



# HOKKAIDO UNIVERSITY

|                  |                                                                                                                                                                                                                                                                         |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Title            | Coelorinchus posteromaculatus (Actinopterygii, Gadiformes, Macrouridae), a new species of grenadier from the eastern Indian Ocean                                                                                                                                       |
| Author(s)        | Nakayama, Naohide; Prokofiev, Artem M.; Kawai, Toshio                                                                                                                                                                                                                   |
| Citation         | Ichthyological research, 67(4), 465-472<br><a href="https://doi.org/10.1007/s10228-020-00741-x">https://doi.org/10.1007/s10228-020-00741-x</a>                                                                                                                          |
| Issue Date       | 2020-11                                                                                                                                                                                                                                                                 |
| Doc URL          | <a href="https://hdl.handle.net/2115/83356">https://hdl.handle.net/2115/83356</a>                                                                                                                                                                                       |
| Rights           | This is a post-peer-review, pre-copyedit version of an article published in Ichthyological Research. The final authenticated version is available online at:<br><a href="http://dx.doi.org/10.1007/s10228-020-00741-x">http://dx.doi.org/10.1007/s10228-020-00741-x</a> |
| Type             | journal article                                                                                                                                                                                                                                                         |
| File Information | manuscript received 2020-05-25.pdf                                                                                                                                                                                                                                      |



***Coelorinchus posteromaculatus* (Actinopterygii, Gadiformes, Macrouridae), a new species of grenadier from the eastern Indian Ocean**

Naohide Nakayama<sup>1</sup> · Artem Prokofiev<sup>2,3</sup> · Toshio Kawai<sup>4</sup>

This article was registered in the *Official Registry of Zoological Nomenclature* (ZooBank) as EAFB041D-5A6A-4404-B43D-130918194A4C.

(Editorial note from the managing editor: please link the above register number to: [http://zoobank.org/urn:lsid:zoobank.org:pub: EAFB041D-5A6A-4404-B43D-130918194A4C](http://zoobank.org/urn:lsid:zoobank.org:pub:EAFB041D-5A6A-4404-B43D-130918194A4C))

✉ Naohide Nakayama  
gadiformes@gmail.com

<sup>1</sup>Department of Marine Biology, School of Marine Science and Technology, Tokai University, 3-20-1 Orido, Shimizu, Shizuoka 424-8610, Japan

<sup>2</sup>A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Leninskii Prospekt 33, Moscow 119071, Russia

<sup>3</sup>P.P. Shirshov Institute of Oceanology, Russian Academy of Sciences, Nakhimovskii Prospekt 36, Moscow 117218, Russia

<sup>4</sup>Faculty of Fisheries Sciences, Hokkaido University, 3-1-1 Minato-cho, Hakodate, Hokkaido 041-8611, Japan

Running head: A new *Coelorinchus* from Indian Ocean

Type of paper: full paper

29    Number of text pages: 16

30    Number of Figures: 2

31    Number of Tables: 1

32    Number of ESM: 0

33

**Abstract** A new species of grenadier, *Coelorinchus posteromaculatus*, is described from nine specimens collected from the tropical eastern Indian Ocean at depths of 100–323 m. This species belongs to the *Coelorinchus argentatus* group (defined here to include 13 species), but differs from other members of that group in its unique body markings consisting of a single, prominent, lateral, dark blotch on the anterior part of the tail, and a slightly diagonal, narrow, dark stripe extending from the upper margin of the gill opening to below the first dorsal-fin midbase or beyond. *Coelorinchus posteromaculatus* is most similar to *C. gaesorhynchus* Iwamoto and Williams 1999 and *C. longissimus* Matsubara 1943, but further differs from the former in its much shorter snout (74–91% of postrostral length vs. 93–100% in *C. gaesorhynchus*), and from the latter in its relatively small mouth (upper-jaw length 38–43% of postrostral length vs. 42–49%).

**Keywords** Taxonomy · Description · Pisces · *Quincuncia* · *Coelorinchus argentatus* group

## Introduction

*Coelorinchus* Giorna 1809 is the largest genus among the order Gadiformes, with about 120 valid species worldwide (Iwamoto and Williams 1999; Iwamoto et al. 2006, 2015; Nakayama and Endo 2017). The species of the genus are typically found on continental shelves and slopes in tropical and temperate waters of the world's oceans (Merrett and Iwamoto 2000; Iwamoto and Graham 2008; Nakayama and Endo 2017). Although its highest diversity lies in Southeast Asia, only a few recent works have attempted to establish the inventory of the deep-sea fish fauna in the region (e.g., Gloerfelt-Tarp and Kailola 1984; White et al. 2013).

In their book on the demersal fishes trawled from eastern Indian Ocean between southern Indonesia and northwestern Australia, Gloerfelt-Tarp and Kailola (1984) provided a color photograph of a unique *Coelorinchus* with a prominent dark blotch on the anterior part of the tail (unnumbered fig. on p. 82), so as to show the general appearance of macrourids (it is most likely to represent their "*Coelorinchus* sp. 3" collected from the south of Lombok Island, Indonesia). Unfortunately, they did not indicate any other information on the species, including the whereabouts of the photographed specimen. While this species appeared to belong to the subgenus *Quincuncia* Gilbert and Hubbs 1920 in having the combination of a long, attenuated snout and silvery reflections on the head and body, no described species of *Quincuncia* had been reported to have such a unique blotch on the tail.

During an ongoing review of *Coelorinchus* by the first author, the specimen illustrated by Gloerfelt-Tarp and Kailola (1984) was rediscovered at the Australian Museum, Sydney (AMS), and eight additional specimens of the same species were also found among several ichthyological collections in the world. A subsequent examination confirmed that they represent a new species, and we provide here a formal description of this species.

## Materials and methods

Methods for counts and measurements follow Iwamoto (1970), Iwamoto and Sazonov (1988), Iwamoto and Williams (1999), Nakayama et al. (2015), and Nakayama and Endo (2017). Head, postrostral, and total lengths are expressed as HL, PRL, and TL respectively. The terminology of the head ridges is that redefined by Nakayama et al. (2015). Occipital scales refer to scales between the parietal ridges. Description of the body scales is based on scales on the dorsum below the interdorsal space, unless otherwise stated. In addition to a standard binocular microscope, a scanning electron microscope (SEM) was used to examine the fine structure of the body scales. Methods for SEM preparation follow Roberts (1993). Institutional codes follow Sabaj (2019). Type specimens of the new species are deposited in ichthyological collections of the Australian Museum, Sydney (AMS), Laboratory of Marine Biology, Faculty of Science and Technology, Kochi University, Kochi (BSKU), Institute of Oceanology, Russian Academy of Science, Moscow (IORAS), and Hokkaido University Museum, Hokkaido University, Hakodate (HUMZ).

***Coelorinchus posteromaculatus* sp. nov.**

(New English name: Tailspotted grenadier)

(Figs. 1, 2; Table 1)

Unidentified macrourid: Gloerfelt-Tarp and Kailola 1984: unnumbered color fig. on p. 82 (second from right top of page) (northwestern Australia and southern Indonesia; AMS I.44527-001).

*Coelorinchus* sp. 3: Gloerfelt-Tarp and Kailola 1984: 85, unnumbered fig. on p. 84 (third from top of page) (2 spec. from south of Lombok Island, NSMT-P22052, missing).

104 **Holotype.** AMS I.44527-001 (66.4 mm HL, 211+ mm TL, mature female), south of Lombok  
105 Island, eastern Indian Ocean, 8.97°S, 116.08°E, 314 m depth, trawl, coll. by T. Gloerfelt-Tarp,  
106 1 Aug. 1981.

107 **Paratypes.** AMS I.44527-002 (2, 57.8–65.3 mm HL, 165+–187+ TL), collected  
108 with holotype; HUMZ 190722 (1, 58.2 mm HL, 197+ mm TL), HUMZ 190723 (61.0 mm  
109 HL, 197+ mm TL), HUMZ 190724 (1, 59.1 mm HL, 192+ mm TL), west of Sumatra  
110 1°07.37'S, 98°27.54'E–1°08.18'S, 98°28.24'E, 100–170 m depth, R/V Baruna Jaya IV, bottom  
111 trawl, coll. by K. Odani, 3 Oct. 2004; IORAS 001-22 (2, 62.3–70.0 mm HL, 203+–220+ mm  
112 TL), Andaman Sea, 11°46'03"N, 96°51'04"E, 315–323 m depth, FRV Akademik Knipovich,  
113 trawl no. 455, 11 Mar. 1966; BSKU 106747 (1, 63.3 mm HL, 196+ mm TL), Thailand, coll.  
114 by T. Senta (no further reliable information).

115 **Diagnosis.** Species of *Coelorinchus* with small, but intense, longitudinally elongate,  
116 lateral, dark blotch on anterior part of tail. Light organ tubular, externally represented by long  
117 black streak covered with scales, extending from immediately in front of anus to chest just  
118 posterior to isthmus. Underside of head completely naked except for overlapping scales  
119 behind lateral nasal ridges; dorsal surface of snout broadly naked along each side of median  
120 rostral ridge. Snout long, sharply pointed, length 74–91% PRL, its dorsal profile gently  
121 concave in lateral view; terminal scute long, spearhead-shaped, dorsoventrally flattened,  
122 length 16–24% PRL when complete. Lateral nasal ridge incompletely supported by nasal  
123 bone. Anus abutting anal-fin origin. Premaxillary teeth small, slender, conical in long,  
124 narrow, tapered band, and none distinctly enlarged; posterior margin of tooth band almost  
125 reaching lateral corner of mouth. Body scales covered with short, erect, slender spinules in  
126 widely divergent rows; spinules in each row completely free from one another, forming  
127 comb-like ridge; buttresses of spinules poorly developed. Second dorsal fin distinctly lower  
128 than anal fin. Upper-jaw length 38–43% PRL; preoral length 65–82% PRL; length of gill slit  
129 21–24% PRL; barbel length 9–14% PRL. Slightly diagonal, narrow, dark stripe extending  
130 from upper margin of gill opening to below first dorsal-fin midbase or beyond; faint,  
131 diagonal, dark stripe extending from pectoral-fin base to above anal-fin origin; median nasal

132 bone blackish; underside of head generally pale, without small, blackish, hair-like papillae;  
133 lips pale to dusky; front of premaxillary ascending process dusky to dark; oral cavity  
134 immaculate; gular and branchiostegal membranes heavily peppered; chest dark; first dorsal  
135 fin dusky to dark, but second spinous ray prominently blackish; pelvic fin dusky; pelvic fin  
136 heavily peppered.

137         **Description.** General features of the fish are shown in Fig. 1. Counts and  
138 measurements are given in Table 1.

139         Body elongate, tapering gradually to long, laterally compressed tail. Trunk shallow  
140 (width over pectoral-fin bases 1.3–1.5 in depth below first dorsal-fin origin in well-preserved  
141 paratypes). Head large, HL about 3.2 (2.9–3.4) in TL. Snout long, sharply pointed, protruding  
142 greatly beyond upper jaw; snout length 2.0 (1.6–2.0) times as long as orbit diameter; when  
143 viewed laterally, dorsal contour of snout gently convex, with slight hump-like rise above  
144 posterior nostril; lateral nasal ridge incompletely supported by nasal bone, slightly convex in  
145 dorsal view. Orbit large, oval, greatest diameter 1.2 (1.1–1.3) in postorbital length.  
146 Interorbital space slightly concave in preserved condition, width 1.1 (1.0–1.2) in orbit  
147 diameter. Mouth moderate in size, inferior, upper-jaw length 1.0 (1.1–1.2) in orbit diameter;  
148 posterior margin of maxilla extending to vertical through midorbit or beyond; lateral corner of  
149 mouth barely restricted by folds of skin; lips thin, not papillose near tooth bands. Suborbital  
150 region divided by longitudinal bony ridge passing from tip of snout to posteroventral angle of  
151 opercle; its upper half almost vertical, lower half sharply inclined mesially. Preopercle large,  
152 posterior margin inclined at about 60° angle, forming moderately angular lobe  
153 posteroventrally. Subopercle prolonged ventrally into short, slender flap; posterior margin  
154 deeply concave. Gill membranes narrowly connected across, and attached mesially to  
155 isthmus, with slight posterior free fold; gill opening extending anteriorly to below posterior  
156 margin of lower jaw. Outer gill slit moderately restricted by folds of skin, length 1.9 (1.9–2.2)  
157 in orbit diameter. Gill rakers small, low, tubercular, armed with short, fine spines; no rakers  
158 on outer side of first arch and inner side of fourth arch; gill filaments moderately long. Chin

159 barbel short, slender, tapering into hairline distal tip; length 3.8 (usually 3.5–4.5; 5.1 in AMS  
160 paratype, 65.3 mm HL) in orbit diameter.

161 Anus abutting anal-fin origin, without scales in their interspace. Light organ long,  
162 tubular, externally represented by long black streak, extending from immediately in front of  
163 anus to chest just behind isthmus; both ends of light organ slightly expanded, teardrop-  
164 shaped.

165 Teeth small, slender, conical, sharp, gently incurved, in long, narrow, tapered bands  
166 in both jaws. In holotype, premaxillary teeth with about 6 tooth rows near symphysis,  
167 posterior margin of tooth band almost reaching lateral corner of mouth; teeth becoming  
168 progressively smaller inwardly, and none distinctly enlarged; mandibular teeth with about 4  
169 tooth rows across widest point near symphysis; posterior end of tooth band extending to  
170 lateral corner of mouth; all teeth uniformly small.

171 Body scales large, deciduous; those on dorsum below interdorsal space covered  
172 with short, erect, slender spinules in widely divergent rows; spinules in each row entirely free  
173 from one another, forming comb-like ridge; middle row not especially high or enlarged  
174 compared with adjacent rows, and every row complete throughout; spinules forming angle of  
175 about 70–80° to scale surface, giving somewhat velvety appearance to body; spinules  
176 increasing in height posteriorly, and tip of last spinule in each row barely reaching or  
177 extending only slightly beyond posterior scale margin; buttresses of spinules poorly  
178 developed; no reticulate structures on unexposed portion of scale surface. Body fully scaled  
179 except for fins.

180 Scales on head ridges modified and thickened; those on median rostral ridge  
181 covered with radiating rows of spinules. Terminal scute long, spearhead-shaped,  
182 dorsoventrally flattened. Three supraoccipital scutes between parietal ridges, but not  
183 especially enlarged; posttemporal scutes absent. Other scales on head (except those on head  
184 ridges) variable in size, generally similar to those on body, but spinules more erect; those on  
185 opercle, preopercle, and postorbital and temporal canals largest. Nasal fossa entirely naked.  
186 Dorsal surface of snout broadly naked along each side of median rostral ridge. Underside of

187 head completely naked, except narrow areas of characteristic overlapping scales immediately  
188 behind lateral nasal ridges.

189 No open pores along cephalic sensory canals. Free neuromasts small, not modified  
190 into prominent flaps or knob-like projections. Anterior nostril small, circular; posterior nostril  
191 large, oval in shape. Grooved lateral line complete, not interrupted (at least in trunk where  
192 scales are well-preserved).

193 Origins of first dorsal, pectoral, and pelvic fins about on same vertical; first dorsal  
194 fin moderately high (its height 2.3–2.7 times as long as its base length in well-preserved  
195 paratypes); second spinous ray not elongated, smooth along leading edge (small rudimentary  
196 denticle present near distal tip in HUMZ 190724); its tip extending posteriorly to base of 2nd–  
197 4th ray of second dorsal fin when laid back. Interdorsal space 1.0 (0.9–1.3) times as long as  
198 first dorsal-fin base length. Origin of second dorsal fin above that of anal fin or slightly  
199 behind. Tip of pelvic fin extending to anal-fin origin or slightly beyond; outer pelvic-fin ray  
200 slightly prolonged, hairline at tip.

201 *Color in alcohol.* Short, prominent, narrow, slightly diagonal, dark stripe of about  
202 1–2 scales deep, extending from upper margin of gill opening to below first dorsal-fin  
203 midbase or beyond; faint, arched, diagonal, dark stripe of about 2 scales deep, extending from  
204 pectoral-fin base to above anal-fin origin; small, but intense, lateral, longitudinally elongate,  
205 dark blotch on anterior part of tail, extending about 3–5 scale rows horizontally, about 2–3  
206 rows vertically; head and body slightly darker dorsally, paler laterally and ventrally; abdomen  
207 dark, with somewhat purplish tinge; breast abruptly dark in front of pelvic-fin bases; median  
208 nasal bone blackish; underside of head generally pale, but mandibular rami and ventral  
209 surfaces of preopercles slightly dusky; short, black, hair-like papillae absent on head surfaces;  
210 cephalic free neuromasts marked with 2 small black dots; lips pale to dusky; front of  
211 premaxillary ascending process dusky to dark; oral cavity immaculate; gill cavity paler  
212 anteriorly, darker posteriorly; gular and branchiostegal membranes heavily peppered; gill  
213 arches, rakers, and filaments pale; first dorsal fin dusky to dark, but second spinous ray  
214 prominently blackish; pelvic fin dusky; pelvic fin heavily peppered; second dorsal and anal

215 fins dark.

216 *Color when fresh.* Based on the color photograph provided by Gloerfelt-Tarp and  
217 Kailola (1984: unnumbered fig. on p. 82; second from the right top of the page): dorsal  
218 surfaces of head and body slightly dark, but lateral and ventral surfaces pale with ivory to  
219 silvery reflections; diagonal stripe on trunk dorsum and blotch on anterior part of tail grayish.

220 **Etymology.** The specific epithet *posteromaculatus* is derived from the Latin  
221 adjectives *posterior*, meaning “further back” or “hinder”, and *maculatus*, meaning “spotted”,  
222 in reference to the species’ characteristic dark blotch on the anterior part of the tail.

223 **Distribution.** Known from the tropical eastern Indian Ocean at depths of 100–323  
224 m.

225 **Remarks.** Data used in the following comparisons are from Iwamoto (1990),  
226 Iwamoto and Merrett (1997), Iwamoto and Williams (1999) and this study. *Coelorinchus*  
227 *posteromaculatus* belongs to a group of species characterized by the following combination of  
228 features: light organ long, extending from anus to chest just posterior to isthmus; no  
229 interspace between anus and anal-fin origin; lateral nasal ridge incompletely supported by  
230 nasal bone; premaxillary teeth in long tapered band, with posterior margin of tooth band  
231 almost reaching lateral corner of mouth; body scales covered with short, erect spinules in  
232 quincunx order or subparallel rows; modified scales on head ridges not prominently  
233 spinulated; dorsal surfaces of snout broadly naked along each side of median rostral ridge;  
234 second dorsal fin poorly developed, its height distinctly lower than that of anal fin; lower half  
235 of body overlain with silvery reflections (often indistinct in preserved specimens); dark spots,  
236 blotches, and vermiculations present dorsally on trunk and tail in some species. Apart from  
237 the new species, this group includes the following 12 valid species: *Coelorinchus argentatus*  
238 Smith and Radcliffe in Radcliffe 1912 from the Philippines, New Caledonia, and northern  
239 Australia; *Coelorinchus denticulatus* Regan 1921 from the western Indian Ocean;  
240 *Coelorinchus formosanus* Okamura 1963, *Coelorinchus kamoharai* Matsubara 1943, and  
241 *Coelorinchus longissimus* Matsubara 1943 from Japan to Taiwan; *Coelorinchus*  
242 *gaesorhynchus* Iwamoto and Williams 1999 from Western Australia; *Coelorinchus mayiae*

243 Iwamoto and Williams 1999 and *Coelorinchus pardus* Iwamoto and Williams 1999 from the  
244 Arafura Sea; *Coelorinchus multispinulosus* Katayama 1942 from Japan to the South China  
245 Sea; *Coelorinchus quincunciatus* Gilbert and Hubbs 1920 and *Coelorinchus thompsoni*  
246 Gilbert and Hubbs 1920 from the Philippines; and *Coelorinchus semaphoreus* Iwamoto and  
247 Merrett 1997 from New Caledonia and Queensland, Australia. This group is called here the  
248 *Coelorinchus argentatus* group.

249       The most important feature characterizing *C. posteromaculatus* is its unique body  
250 markings consisting a single, prominent, lateral, dark blotch on the anterior part of the tail,  
251 combined with a slightly diagonal, narrow, dark stripe extending from the upper margin of the  
252 gill opening to below the first dorsal-fin midbase or beyond. The pattern is quite distinctive  
253 among the group, as the other species have neither such a posterior blotch nor a diagonal  
254 stripe on the trunk dorsum. Namely, *C. formosanus*, *C. gaesorhynchus*, *C. longissimus*, *C.*  
255 *quincunciatus*, *C. semaphoreus*, and *C. thompsoni* lack any prominent body markings; *C.*  
256 *argentatus*, *C. denticulatus*, *C. kamoharai*, *C. mayiae*, and *C. pardus* have only a series of  
257 spots or blotches of irregular shape; and *C. multispinulosus* has many dark spots often  
258 forming fine vermiculations.

259       Despite their pronounced differences in the body markings, *C. posteromaculatus* is  
260 otherwise closely similar to *C. gaesorhynchus* and *C. longissimus*. In fact, the three species  
261 can be distinguished from other members of the *C. argentatus* group by having the following  
262 combination of features: body scales covered with needle-like spinules in subparallel to  
263 widely divergent rows (Fig. 2); underside of head almost completely naked, except for  
264 characteristic overlapping scales immediately behind lateral nasal ridges; smaller mouth  
265 (upper-jaw length 38–43%, 42–44%, 42–49% PRL in *C. posteromaculatus*, *C.*  
266 *gaesorhynchus*, and *C. longissimus* respectively); and shorter barbel (9–14%, 14–15%, 11–  
267 18% PRL respectively) (see also Table 1). However, it further differs from *C. gaesorhynchus*  
268 in its much shorter snout (74–91% PRL vs. 93–100% in *C. gaesorhynchus*), and from *C.*  
269 *longissimus* in its relatively larger mouth (upper-jaw length 38–43% PRL vs. 42–49%).

270       The above definition of the *C. argentatus* group generally agrees with the original

concept of the subgenus *Quincuncia*, within which Gilbert and Hubbs (1920) included only *C. argentatus* (type species), *C. quincunciatus*, and *C. thompsoni*. Currently, this taxon is diagnosed primarily by the combination of a well-developed light organ extending from the anus to the chest just posterior to the isthmus and an incomplete bony support of the lateral nasal ridge (Okamura 1970a, 1970b, 1988). Based on this brief definition, the subgenus comprises not only the species of the *C. argentatus* group, but also *Coelorinchus melanobranchus* Iwamoto and Merrett 1997 known from New Caledonia and those of the *Coelorinchus hubbsi* complex as defined by Okamura (in Okamura and Kitajima 1984) and further refined by Iwamoto et al. (2009) to include the following 10 species: *Coelorinchus brevirostris* Okamura in Okamura and Kitajima 1984, *Coelorinchus fuscigulus* Iwamoto, Ho and Shao 2009, and *Coelorinchus hubbsi* Matsubara 1936 from Japan to Taiwan; *Coelorinchus cingulatus* Gilbert and Hubbs 1920 from Japan to the South China Sea; *Coelorinchus cylindricus* Iwamoto and Merrett 1997 from the Norfolk Ridge and New Zealand; *Coelorinchus gladius* Gilbert and Cramer 1897 from Hawaii; *Coelorinchus matsubarai* Okamura in Okamura et al. 1982 from the Kyushu-Palau Ridge and the Emperor Seamounts; *Coelorinchus melanosagmatus* Iwamoto and Anderson 1999 from the Indian Ocean; *Coelorinchus multifasciatus* Sazonov and Iwamoto 1992 from the Sala-y-Gomez Ridge; and *Coelorinchus spilonotus* Sazonov and Iwamoto 1992 from the Nazca and Sala-y-Gomez ridges and Hawaii. The *C. argentatus* group readily differs from *C. melanobranchus* in having a long attenuated snout tipped with a spear-like terminal scute (vs. short bluntly pointed snout with three tubercular scutes), and also from the *C. hubbsi* complex in having a poorly developed second dorsal fin distinctly lower than (vs. as high as) the anal fin and a pair of broad naked areas along each side of the median rostral ridge (vs. rudimentary or only narrowly developed). It is apparent that *Quincuncia* needs a systematic revision, due to the lack of phylogenetic analysis and the presence of taxonomic problems, both at the subgeneric and species levels.

**Comparative materials examined.** *Coelorinchus gaesorhynchus*—2 specimens from

299 Western Australia: CSIRO H2548-13 (holotype, 75.8 mm HL, 254+ mm TL); west of North  
 300 West Cape, 21°44.7'S, 113°52.3'E, 290–320 m, FRV Southern Surveyor, sta. SS1/91/08  
 301 (H2548), 24 Jan. 1991; SS1/91/08; CSIRO H2548-16 (paratype, 70.0 mm HL, 236+ mm TL),  
 302 collected with holotype. *Coelorinchus longissimus*—29 specimens from Japan: BSKU 19077  
 303 (1, 73.0 mm HL, 256 mm TL), off Satsuma Peninsula, Okinawa Trough, 31.2267°N,  
 304 129.9750°E, 310 m, FRV Soyo-maru, sta. 72d, beam trawl, 12 Feb. 1959; BSKU 106767 (1,  
 305 68.2 mm HL, 240+ mm TL), southeast of Shimokoshiki-jima Island, East China Sea,  
 306 31.5658°N, 129.8915°E, 380 m, F/V Maruko-maru, tr. 1, bottom trawl, coll. N. Nakayama et  
 307 al., 24 Apr. 2012; BSKU 109052 (1, 48.7 mm HL, 185 mm TL), east of Kasayama Bank,  
 308 32.3884°N, 129.0505°E, 304–312 m, T/V Nagasaki-maru, cr. N365, sta. A3, 3-m ORE beam  
 309 trawl, coll. N. Nakayama, 19 Nov. 2012; BSKU 113743 (1, 86.1 mm HL, 313+ mm TL), off  
 310 Katsurahama, Tosa Bay, 230 m, F/V Kosei-maru, bottom trawl, coll. N. Nakayama et al., 9  
 311 Apr. 2014; BSKU 99262 (1, 88.4 mm HL, 314+ mm TL), Mimase fish market, bottom trawl,  
 312 1 Mar. 2006; BSKU 40440 (1, 91.4 mm HL, 327+ mm TL), BSKU 40441 (1, 92.4 mm HL,  
 313 345+ mm TL), BSKU 40442 (1, 92.9 mm HL, 339 mm TL), BSKU 40445 (1, 96.2 mm HL,  
 314 342+ mm TL), BSKU 40447 (1, 92.6 mm HL, 341+ mm TL), BSKU 40448 (1, 95.9 mm HL,  
 315 277+ mm TL), BSKU 40451 (1, 96.6 mm HL, 338+ mm TL), BSKU 40457 (1, 81.0 mm HL,  
 316 304 mm TL), Mimase fish market, bottom trawl, 8 Mar. 1985; BSKU 99346 (1, 93.0 mm HL,  
 317 314+ mm TL), Mimase fish market, bottom trawl, coll. N. Nakayama, 23 Apr. 2008; BSKU  
 318 99235 (1, 81.5 mm HL, 303+ mm TL), BSKU 99237 (1, 58.9 mm HL, 219+ mm TL),  
 319 Mimase fish market, bottom trawl, coll. N. Nakayama, 31 Oct. 2007; BSKU 55 (1, 76.4 mm  
 320 HL, 302 mm TL), Mimase fish market, bottom trawl, coll. T. Kamohara, 5 Mar. 1951; BSKU  
 321 100497 (1, 78.7 mm HL, 287+ mm TL), Mimase fish market, F/V Kosei-maru, bottom trawl,  
 322 15 Oct. 2009; BSKU 108871 (1, 77.5 mm HL, 278+ mm TL), Mimase fish market, F/V  
 323 Kosei-maru, bottom trawl, 22 Oct. 2012; BSKU 94450 (1, 71.6 mm HL, 251+ mm TL),  
 324 Mimase fish market, F/V Kosei-maru, bottom trawl, coll. N. Nakayama, 14 Apr. 2008; BSKU  
 325 93088 (1, 63.4 mm HL, 237 mm TL), BSKU 93090 (1, 89.9 mm HL, 321+ mm TL), Mimase  
 326 fish market, F/V Seiryō-maru, bottom trawl, coll. N. Nakayama, 24 Dec. 2007; BSKU 94387

(1, 51.5 mm HL, 203+ mm TL), Mimase fish market, F/V Seiryō-maru, bottom trawl, coll. N. Nakayama, 4 Apr. 2008; BSKU 69291 (1, 56.1 mm HL, 198+ mm TL), BSKU 69295 (1, 55.7 mm HL, 187+ mm TL), Tosa Bay, 33.1450°N, 133.5150°E, 240–249 m, FRV Kotaka-maru, otter trawl, coll. H. Endo, 20 Aug. 1997; BSKU 112928 (1, 98.7 mm HL, 342+ mm TL), off Okitsu, Tosa Bay, 280–320 m, F/V Kosei-maru, bottom trawl, coll. N. Nakayama et al., 24 Jan. 2014; BSKU 110426 (1, 29.8 mm HL, 113+ mm TL), Suruga Bay, 34.7651°N, 138.4880°E, 200–450 m, F/V Hinode-maru, sta. 4, bottom trawl, coll. N. Nakayama and R. Misawa, 23 Apr. 2013; BSKU 110081 (1, 40.7 mm HL, 154 mm TL), BSKU 110082 (1, 38.3 mm HL, 132+ mm TL), Suruga Bay, 34.7489°N, 138.4664°E, 200–450 m, F/V Hinode-maru, sta. 6, bottom trawl, coll. N. Nakayama and R. Misawa, 23 Apr. 2013.

**Acknowledgements** We thank the following researchers and museum specialists for specimen loans and assistance for this study: M. McGrouther, A. Hay, S. Reader and K. Graham (AMS); H. Endo, T. Yamakawa and T. Naito (BSKU); A. Graham, J. Pogonoski and P. Last (CSIRO); D.A. Astakhov and S.A. Evseenko (IORAS). We are also grateful to members of the Japan Deep Sea Trawlers Association (JDSTA), Overseas Fishery Cooperation Foundation, Japan (OFCF), and Research Institute for Marine Fisheries, Indonesia (RIMF), and to the crew of R/V Baruna Jaya IV, for providing an opportunity to sample in Indonesia. Gordon Yearsley (Hobart, Australia) reviewed an early draft of the manuscript and edited the English text. This study was supported by JSPS KAKENHI Grant Number JP16H06896 and JP18K14509 (to NN) and by a grant (19-14-00026) of the Russian Science Foundation (to AMP).

## References

Gilbert CH, Cramer F (1897) Report on the fishes dredged in deep water near the Hawaiian Islands, with descriptions and figures of twenty-three new species. Proc US Natl Mus

355 19:403–435, pls XXXVI–XLVIII  
 356 Gilbert CH, Hubbs CL (1920) The macrouroid fishes of the Philippine Islands and the East  
 357 Indies. US Natl Mus Bull No 100 1:369–588  
 358 Giorna M (1809) Mémoire sur des poissons d’espèces nouvelles et de genres nouveaux. Plus:  
 359 suite et conclusion du mémoire. Mém Acad Imp Sci Lit Beaux-arts, Turin 9:1–19, 177–  
 360 180, pls I–II  
 361 Gloerfelt-Tarp T, Kailola PJ (1984) Trawled fishes of southern Indonesia and northwestern  
 362 Australia. Australian Development Assistance Bureau, Canberra, Directorate General of  
 363 Fisheries (Indonesia), Jakarta, and German Agency for Technical Cooperation,  
 364 Eschborn  
 365 Iwamoto T (1970) The R/V Pillsbury deep-sea biological expedition to the Gulf of Guinea,  
 366 1964–65. 19. Macrourid fishes of the Gulf of Guinea. Stud Trop Oceanogr 4:316–431  
 367 Iwamoto T (1990) Family Macrouridae. In: Cohen DM, Inada T, Iwamoto T, Scialabba N  
 368 (eds) FAO species catalogue, vol. 10. Gadiform fishes of the world. An annotated and  
 369 illustrated catalogue of cods, hakes, grenadiers and other gadiform fishes known to date.  
 370 FAO, Rome, pp 90–317  
 371 Iwamoto T, Anderson ME (1999) New species of *Caelorinchus* (Macrouridae, Gadiformes,  
 372 Teleostei) from the Indian Ocean. Copeia 1999:1079–1083  
 373 Iwamoto T, Graham KJ (2008) Two new Australian grenadiers of the *Coelorinchus fasciatus*  
 374 species group (Macrouridae: Gadiformes: Teleostei). Proc Calif Acad Sci 59:133–146  
 375 Iwamoto T, Merrett NR (1997) Pisces Gadiformes: taxonomy of grenadiers of the New  
 376 Caledonian region, southwest Pacific. In: Crosnier A (ed) Résultats des Campagnes  
 377 Musorstom, vol 18. Mém Mus Natl Hist Nat 176. Muséum National d’Histoire  
 378 Naturelle, Paris, pp 473–570  
 379 Iwamoto T, Sazonov YI (1988) A review of the southeastern Pacific *Coryphaenoides* (sensu  
 380 lato) (Pisces, Gadiformes, Macrouridae). Proc Calif Acad Sci 45:35–82  
 381 Iwamoto T, Williams A (1999) Grenadiers (Pisces, Gadiformes) from the continental slope of  
 382 western and northwestern Australia. Proc Calif Acad Sci 51:105–243

- 383 Iwamoto T, Golani D, Baranes A, Goren M (2006) Two new grenadiers (Teleostei,  
384 Gadiformes, Macrouridae) from the Seychelles and Mascarene Ridge, western Indian  
385 Ocean. *Proc Calif Acad Sci* 57:433–443
- 386 Iwamoto T, Ho H-C, Shao K-T (2009) Description of a new *Coelorinchus* (Macrouridae,  
387 Gadiformes, Teleostei) from Taiwan, with notable new records of grenadiers from the  
388 South China Sea. *Zootaxa* 2326:39–50
- 389 Iwamoto T, Nakayama N, Shao K-T, Ho H-C (2015) Synopsis of the grenadier fishes  
390 (Gadiformes; Teleostei) of Taiwan. *Proc Calif Acad Sci* 62:31–126
- 391 Katayama M (1942) A new macrouroid fish from the Japan Sea. *Zool Mag Tokyo* 54:332–334
- 392 Matsubara K (1936) On two new species of fishes found in Japan. *Ann Zool Japon* 15:355–  
393 360
- 394 Matsubara K (1943) Ichthyological annotations from the depth of the Sea of Japan. VIII–IX. *J*  
395 *Shigenkagaku Kenkyûsyô* 1:131–152
- 396 Merrett NR, Iwamoto T (2000) Pisces Gadiformes: grenadier fishes of the New Caledonian  
397 region, southwest Pacific Ocean. Taxonomy and distribution, with ecological notes. In:  
398 Crosnier A (ed) *Résultats des Campagnes Musorstom*, vol 21. *Mém Mus Natl Hist Nat*  
399 184. Muséum National d’Histoire Naturelle, Paris, pp 723–781
- 400 Nakayama N, Endo H (2017) A new species of the grenadier genus *Coelorinchus*  
401 (Actinopterygii: Gadiformes: Macrouridae) from the Timor Sea, eastern Indian Ocean.  
402 *Ichthyol Res.* doi.org/10.1007/s10228-017-0585-4 (also appeared in *Ichthyol Res* 65:  
403 12–20)
- 404 Nakayama N, Matsunuma M, Endo H (2015) Redescription of *Coelorinchus tokiensis*  
405 (Steindachner and Döderlein 1887) (Actinopterygii: Gadiformes: Macrouridae), with  
406 comments on its synonymy. *Ichthyol Res.* doi: 10.1007/s10228-015-0493-4 (also  
407 appeared in *Ichthyol Res* 63:247–259)
- 408 Okamura O (1963) A new macrouroid fish found in the adjacent waters of Formosa. *Bull*  
409 *Misaki Mar Biol Inst Kyoto Univ* 4:37–42
- 410 Okamura O (1970a) *Fauna Japonica, Macrourina (Pisces)*. Academic Press of Japan, Tokyo

411 Okamura O (1970b) Studies on the macrouroid fishes of Japan: Morphology, ecology and  
 412 phylogeny. Rep Usa Mar Biol Sta 17:1–179  
 413 Okamura O (1988) Macrouroidei (Macrouroididae and Macrouridae). In: Masuda H, Amaoka  
 414 K, Araga C, Uyeno T, Yoshino T (eds) The fishes of the Japanese Archipelago, second  
 415 edn. Tokai University Press, Tokyo, pp 93–99, 453, pls 79–83, 344–373  
 416 Okamura O, Amaoka K, Mitani F (1982) Fishes of the Kyushu-Palau Ridge and Tosa Bay.  
 417 Japan Fisheries Resource Conservation Association, Tokyo  
 418 Okamura O, Kitajima T (1984) Fishes of the Okinawa Trough and the adjacent waters I. Japan  
 419 Fisheries Resource Conservation Association, Tokyo  
 420 Radcliffe (1912) Description of a new family, two new genera, and twenty-nine new species  
 421 of anacanthine fishes from the Philippine Islands and contiguous waters. Proc US Natl  
 422 Mus 43:105–140, pls 22–31  
 423 Regan CT (1921) New fishes from deep water off the coast of Natal. Ann Mag Nat Hist (ser  
 424 9) 7:412–420  
 425 Roberts CD (1993) Comparative morphology of spined scales and their phylogenetic  
 426 significance in the Teleostei. Bull Mar Sci 52:60–113  
 427 Sabaj MH (2019) Standard symbolic codes for institutional resource collections in  
 428 herpetology and ichthyology: an online reference. Ver 7.1 (21 March 2019), American  
 429 Society of Ichthyologists and Herpetologists, Washington, DC. <http://www.asih.org>.  
 430 Accessed 28 October 2019  
 431 Sazonov YI, Iwamoto T (1992) Grenadiers (Pisces, Gadiformes) of the Nazca and Sala y  
 432 Gomez ridges, southeastern Pacific. Proc Calif Acad Sci 48:27–95  
 433 White WT, Last PR, Dharmadi, Faizah R, Chodrijah U, Prisantoso BI, Pogonoski JJ,  
 434 Puchridge M, Balder SJM (2013) Market fishes of Indonesia. ACIAR Monograph no.  
 435 155. Australian Centre for International Agricultural Research, Canberra  
 436

437 **Figure legends**

438

439 **Fig. 1** *Coelorinchus posteromaculatus* sp. nov. AMS I.44527-001, holotype, 66.4 mm HL,  
440 211+ mm TL, eastern Indian Ocean, 314 m depth. **a** Lateral view; **b** lateral, **c** ventral,  
441 and **d** dorsal views of head and trunk; preserved condition

442

443 **Fig. 2** Scanning electron micrograph showing a scale from the dorsum below the interdorsal  
444 space of *Coelorinchus posteromaculatus* sp. nov. HUMZ 190724, paratype, 59.1 mm  
445 HL, 192+ mm TL

446

**Table 1** Measurements and counts for three species of *Coelorinchus*

| Species                     | <i>C. posteromaculatus</i> |                   | <i>C. gaesorhynchus</i> | <i>C. longissimus</i> |
|-----------------------------|----------------------------|-------------------|-------------------------|-----------------------|
| Type status                 | HT                         | PT                | HT + PT                 | NT                    |
| Number of specimens         | 1                          | 8                 | 2                       | 29                    |
| Measurements (mm)           |                            |                   |                         |                       |
| Total length (TL)           | 211+                       | 165+–220+         | 236+–254+               | 113+–345+             |
| Head length (HL)            | 66.4                       | 57.8–70.0         | 70.0–75.8               | 29.8–98.7             |
| % of HL (% of PRL)          |                            |                   |                         |                       |
| Snout length                | 48 (90)                    | 43–48 (74–91)     | 49–51 (93–100)          | 44–48 (77–90)         |
| Orbit diameter              | 24 (45)                    | 23–27 (43–48)     | 23–24 (46–47)           | 23–29 (43–51)         |
| Postorbital length          | 30 (56)                    | 29–33 (52–56)     | 27–28 (53–54)           | 28–31 (51–58)         |
| Postrostral length (PRL)    | 54 (—)                     | 53–58 (—)         | 51–52 (—)               | 53–57 (—)             |
| Orbit–preopercle distance   | 34 (64)                    | 32–35 (58–64)     | 32–34 (62–65)           | 31–37 (57–68)         |
| Suborbital width            | 11 (21)                    | 10–12 (17–22)     | 11–11 (21–22)           | 10–12 (19–22)         |
| Upper-jaw length            | 23 (43)                    | 21–24 (38–43)     | 21–23 (42–44)           | 23–27 (42–49)         |
| Preoral length              | 41 (77)                    | 38–43 (65–82)     | 44–46 (85–92)           | 38–45 (66–81)         |
| Internasal width            | 18 (34)                    | 18–20 (31–35)     | 19–19 (36–37)           | 17–22 (32–41)         |
| Interorbital width          | 23 (42)                    | 22–23 (38–44)     | 21–23 (42–44)           | 21–24 (38–43)         |
| Body width over P. bases    | 29 (55)                    | 27–34 (50–59)     | 32–33 (62–65)           | 28–44 (50–80)         |
| Body depth at 1D. origin    | — (—)                      | 42–47 (73–86)     | 42–46 (80–91)           | 37–54 (70–99)         |
| Body depth at A. origin     | 34 (64)                    | 30–39 (53–69)     | 38–39 (74–74)           | 32–45 (56–82)         |
| Pre-V. length               | 106 (197)                  | 101–104 (172–194) | 107–112 (211–214)       | 101–115 (183–207)     |
| Pre-anus length             | 138 (258)                  | 128–136 (225–257) | 137–147 (271–282)       | 130–152 (234–275)     |
| Pre-A. length               | 139 (260)                  | 132–141 (231–265) | 139–149 (275–286)       | 133–155 (236–281)     |
| Isthmus–V. distance         | 28 (52)                    | 27–31 (48–53)     | 29–30 (57–58)           | 27–36 (50–65)         |
| Isthmus–anus distance       | 60 (113)                   | 60–63 (109–114)   | 57–66 (112–125)         | 55–71 (99–128)        |
| Isthmus–A. distance         | 62 (115)                   | 63–66 (113–120)   | 60–68 (118–131)         | 56–79 (103–143)       |
| V.–A. distance              | 36 (67)                    | 37–40 (65–75)     | 37–40 (73–76)           | 31–47 (56–88)         |
| Anus–A. distance            | 2 (4)                      | 2–5 (4–10)        | 2–3 (5–5)               | 1–4 (2–8)             |
| V. length                   | 23 (42)                    | 26–36 (46–63)     | 26–28 (50–56)           | 20–32 (36–59)         |
| P. length                   | 38 (71)                    | 31–42 (53–80)     | — (—)                   | 30–34 (55–64)         |
| Pre-1D. length              | 105 (196)                  | 100–109 (175–195) | 105–107 (205–207)       | 103–109 (184–200)     |
| Height of 1D.               | — (—)                      | 35–40 (62–73)     | — (—)                   | 32–37 (58–70)         |
| Length of 1D. base          | 17 (31)                    | 14–17 (25–32)     | 15–18 (30–34)           | 15–19 (28–35)         |
| Interdorsal length          | 16 (30)                    | 16–23 (30–40)     | 15–20 (29–39)           | 15–26 (27–47)         |
| Length of gill slit         | 13 (24)                    | 12–13 (21–24)     | 12–12 (22–23)           | 11–14 (20–25)         |
| Length of posterior nostril | 7 (12)                     | 7–10 (12–18)      | 6–8 (11–15)             | 6–9 (10–16)           |
| Barbel length               | 6 (12)                     | 5–8 (9–14)        | 7–8 (14–15)             | 6–10 (11–18)          |
| Counts                      |                            |                   |                         |                       |
| 1D. rays                    | II,10                      | II,8–10           | II,9                    | II,9–10               |
| P. rays                     | i17                        | i14–i18           | i15–i16                 | i15–i18               |
| V. rays                     | 7                          | 7                 | 7                       | 7                     |
| Outer GR on first arch      | 0                          | 0                 | 0                       | 0                     |
| Inner GR on first arch      | 8                          | 7–9               | 8                       | 7–8                   |
| Outer GR on second arch     | 6                          | 5–6               | 6                       | 5–6                   |
| Inner GR on second arch     | 8                          | 7–8               | 8                       | 7–9                   |
| Lateral line scales         | 45                         | 37–42             | 44–45                   | 36–45                 |
| Scales below 1D. origin     | 6                          | 5–6               | 4.5–5                   | 4.5–7                 |
| Scales below 1D. midbase    | 5                          | 3–4.5             | 4                       | 3.5–5.5               |

|     | Scales below 2D. origin                                                                                                                  | 4.5 | 3.5–4.5 | 4 | 3.5–5.5 |
|-----|------------------------------------------------------------------------------------------------------------------------------------------|-----|---------|---|---------|
| 448 | <i>1D.</i> first dorsal fin, <i>2D.</i> second dorsal fin, <i>A.</i> anal fin, <i>GR</i> gill rakers, <i>HT</i> holotype, <i>NT</i> non- |     |         |   |         |
| 449 | type, <i>P.</i> pectoral fin, <i>PT</i> paratype, <i>V.</i> pelvic fin                                                                   |     |         |   |         |

Fig. 1

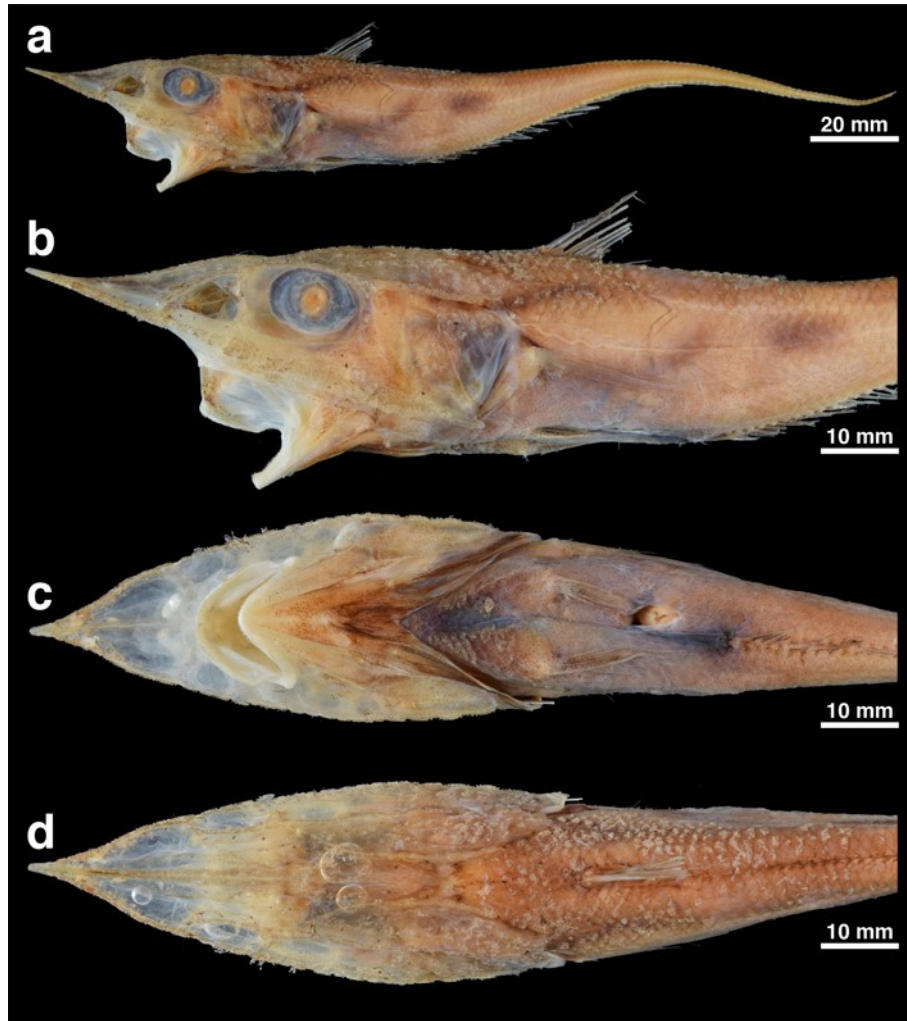


Fig. 2

