

Cocotropus izuensis, a New Species of Velvetfish (Teleostei: Aploactinidae) from Japan

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Abstract A new species of aploactinid, *Cocotropus izuensis*, is described based on 8 specimens (25.2–47.3 mm in standard length) collected from the Izu Peninsula, Shizuoka Prefecture, and Chiba Prefecture, Japan. The new species differs from 13 valid species of *Cocotropus* in having the following combination of characters: 12 dorsal-fin spines, 7 segmented lower caudal-fin rays, 26 vertebrae, 5 preopercular spines, upper jaw length equal to or a little shorter than the lachrymal length, no distinct fleshy papillae on posterior portion of upper jaw, no vomerine teeth, first lower jaw sensory pores on both sides fused, anterior position of isthmus well beyond fifth lower jaw sensory pore, 4 dorsal spines anterior to third neural spine, and interneural space between seventh and eighth neural spines without dorsal-fin spine proximal pterygiophores.

Key words: Aploactinidae, Velvetfishes, New species, *Cocotropus*, Japan.

Cocotropus masudai was originally described by Matsubara (1943) based on a single specimen collected from Hachijo-jima Island, Izu Islands, Japan. Senou (1990) subsequently reported the species from the Izu Peninsula, southern Japan, as the second record of the species. Nakabo (1993, 2000, 2002) in his pictorial key of the Aploactinidae used the specimen of *C. masudai* figured by Senou (1990) (H. Senou and T. Nakabo, pers. comm.). Masuda and Kobayashi (1994) also showed 2 aquarium photographs of the species, one being identical with the photograph shown by Senou (1990) and the other also being from the Izu Peninsula. However, after detailed examination of the voucher specimens of Senou (1990) [followed by Nakabo (1993, 2000, 2002)] and Masuda and Kobayashi (1994), and comparison with the holotype of *C. masudai*, it

was revealed that the specimens from the Izu Peninsula are not *C. masudai*, but belong to an undescribed species of *Cocotropus* Kaup, 1858 (see Imamura and Shinohara, 2003, 2004, 2008 for the diagnosis of the genus). In this study, we describe the new species of *Cocotropus* based on 8 specimens from the Izu Peninsula, Shizuoka Prefecture, and the Boso Peninsula, Chiba Prefecture, Japan.

Materials and Methods

Methods for making counts and measurements follow Imamura and Shinohara (2003). Counts of unpaired fin rays and vertebrae were based on radiographs. Standard and head lengths are abbreviated as SL and HL, respectively. Specimens of *Cocotropus* used for comparison in this study are

listed in Imamura and Shinohara (2003, 2004, 2008). Institutional acronyms are as follows: CMNH (Coastal Branch of Natural History Museum and Institute, Chiba, Katsuura), HUMZ (Hokkaido University Museum, Hakodate), IOP (Izu Oceanic Park, Ito), KPM (Kanagawa Prefectural Museum of Natural History, Odawara) and NSMT (National Museum of Nature and Science, Tokyo).

Cocotropus izuensis sp. nov.

[New Japanese name: Izu-okoze]

(Figs. 1–6)

Cocotropus masudai (not Matsubara, 1943): Senou, 1990: 1, one unnumbered fig. (Izu Peninsula); Nakabo, 1993: 523 (in part, Izu Peninsula); Masuda and Kobayashi, 1994: 89, figs. 1–2 (Izu Peninsula); Nakabo, 2000: 601 (in part, Izu Peninsula); Nakabo, 2002: 601 (in part, Izu Peninsula).

Holotype. KPM-NI 22797 [ex. IOP 3306, voucher of *Cocotropus masudai* (misidentified) in Masuda and Kobayashi, 1994: 89, fig. 2], 40.2 mm SL, Izu Oceanic Park, Jogasaki, east coast of Izu Peninsula, Shizuoka Prefecture, Japan (34°53'01"N, 139°07'59"E), 17 m depth, 4 Apr. 1993.

Paratypes. 7 specimens. CMNH-ZF 4692, 36.7 mm SL, Isomura, Kamogawa, Boso Peninsula, Chiba Prefec-

ture, Japan (35°05'225"N, 140°07'17"E), 18 Dec. 2002; HUMZ 204489 (ex. KPM-NI 22796, originally registered as IOP 3053), 26.7 mm SL, Izu Oceanic Park, Jogasaki, east coast of Izu Peninsula, Shizuoka Prefecture, Japan (34°52'59"N, 139°07'59"E), 15 m depth, 27 Oct. 1991; KPM-NI 22794 (ex. IOP 2307), 25.2 mm SL, Izu Oceanic Park, Jogasaki, east coast of Izu Peninsula, Shizuoka Prefecture, Japan (34°52'59"N, 139°07'59"E), 25 m depth, 23 May 1991; KPM-NI 22798 (ex. IOP 3307), 40.3 mm SL, Kurosaki, west coast of Izu Peninsula, Shizuoka Prefecture, Japan (34°44'12"N, 138°44'59"E), 12 m depth, 4 Apr. 1993; KPM-NI 22799 (ex. IOP 3316), 47.3 mm SL, Izu Oceanic Park, Jogasaki, east coast of Izu Peninsula, Shizuoka Prefecture, Japan (34°52'59"N, 139°07'59"E), 15 m depth, 23 Apr. 1993; KPM-NI 22800 [ex. IOP 1540, voucher of *Cocotropus masudai* (misidentified) in Senou, 1990 and Nakabo, 1993, 2000, 2002 (Senou and Nakabo, pers. comm.)], 29.2 mm SL, Izu Oceanic Park, Jogasaki, Shizuoka Prefecture, east coast of Izu Peninsula, Japan (34°52'55"N, 139°07'59"E), 8 m depth, 15 Aug. 1991; NSMT-P 93093 (ex. KPM-NI 22795, originally registered as IOP 2983), 29.1 mm SL, Izu Oceanic Park, Jogasaki, east coast of Izu Peninsula, Shizuoka Prefecture, Japan (34°53'08"N, 139°08'05"E), 26 Aug. 1991.

Diagnosis. A new species of *Cocotropus* with 12 dorsal-fin spines, 7 segmented lower caudal-fin rays, 26 vertebrae, 5 preopercular spines, upper jaw length equal to or a little shorter than lachrymal length, no distinct fleshy papillae on posterior portion of upper jaw, no vomerine teeth,



Fig. 1. *Cocotropus izuensis* sp. nov., KPM-NI 22797, holotype, 40.2 mm SL, east coast of Izu Peninsula, Japan (ethanol preserved condition) (photo by H. Imamura).

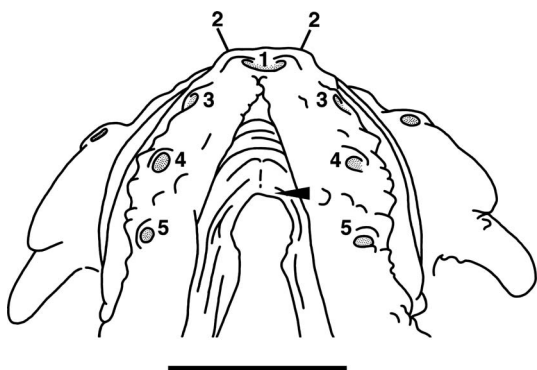


Fig. 2. Ventral view of head of *Cocotropus izuensis* sp. nov., KPM-NI 22797, holotype, 40.2 mm SL, east coast of Izu Peninsula, Japan. Arrow head and numbers indicate anterior tip of isthmus and sensory openings of lower jaw, respectively. Most papillae underlain by a tiny buried scale are not shown. Scale indicates 3 mm.

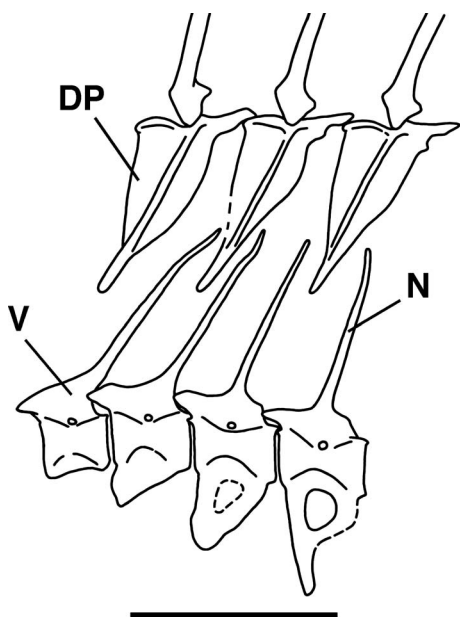


Fig. 3. Illustration from radiograph showing sixth to eighth dorsal-fin spine proximal pterygiophores (DP), and sixth to ninth vertebrae (V) and associated neural spine (N), in *Cocotropus izuensis* sp. nov., KPM-NI 22797, holotype, 40.2 mm SL, east coast of Izu Peninsula, Japan. Scale indicates 3 mm.

first lower jaw sensory pores on both sides fused, anterior position of isthmus well beyond fifth lower jaw sensory pore, 4 dorsal-fin spines anterior to third neural spine, and interneural space between seventh and eighth neural spines without dorsal-fin spine proximal pterygiophores.

Description. Data for the holotype are presented first, followed by the data of the paratypes, in parentheses: dorsal-fin rays XII, 9 with ultimate pterygiophore supporting 2 rays (XI–XIII, 8–10 with ultimate pterygiophore supporting 2 rays); anal-fin rays II, 8 with ultimate pterygiophore supporting 1 ray (II, 6–7, 6 in 1 paratype and 7 in 6 paratypes, with ultimate pterygiophore supporting 2 rays); pectoral-fin rays 13 on both sides (12–13, 12 in 2 and 13 in 5); pelvic-fin rays I, 3; segmented caudal-fin rays 7 (upper)+7 (lower); bony sensory tubes on lateral line 10 on both sides (8–10 on left, 8–13 on right); gill rakers $1+9=10$ (0–3+4–9=4–10); vertebrae 26. Proportions as % SL: HL 37.1 (34.5–38.5); snout length 9.7 (9.1–10.3); orbital diameter 9.2 (8.9–11.1); lachrymal length 15.7 (14.4–16.1); upper jaw length 15.4 (14.2–15.9); lower jaw length 16.9 (15.6–17.9); interorbital width 8.7 (7.4–9.3); predorsal length 14.4 (14.6–16.3); pre-anal length 65.9 (63.5–68.4); length of dorsal-fin base 80.6 (79.4–85.7); length of anal-fin base 25.6 (24.5–29.0); length of caudal peduncle 13.7 (10.4–16.9); depth of caudal peduncle 11.4 (10.1–13.1); pectoral-fin length 31.3 (27.4–34.7); pelvic-fin length 16.2 (14.7–17.5); length of first dorsal-fin spine 21.6 (19.6–24.3); length of second dorsal-fin spine 23.1 (22.1–25.5); length of third dorsal-fin spine 21.1 (20.3–23.7); length of fourth dorsal-fin spine 15.7 (14.0–18.6); length of fifth dorsal-fin spine 13.7 (11.8–13.4); length of first anal-fin spine 8.2 (5.6–7.9); length of second anal-fin spine 10.7 (8.9–11.7). Proportions as % HL: snout length 26.2 (24.7–27.5); orbital diameter 24.8 (24.8–28.9); lachrymal length 42.3 (41.2–43.9); upper jaw length 41.6 (39.4–41.4); lower jaw length 45.6 (44.0–47.7); interorbital width 23.5 (20.7–25.2).

Body and head moderately compressed, covered by small pointed papillae, each underlain by

tiny buried scales. Anterodorsal profile of head mostly straight (or weakly rounded in paratypes less than 30 mm SL). Snout short; its length 3.8 (3.6–4.0) in HL. Eye moderate; its diameter 4.0 (3.5–4.0) in HL, shorter than snout length. Small papillae surrounding pupil. Interorbital ridges on both sides running in parallel, ending posteriorly in a pointed papillae. Supraorbital ridge ending in a spine. Single spine present on parietal, pterotic, posttemporal and supracleithrum. Two blunt suborbital spines ventral to eye. Two lachrymal, 5 preopercular and 2 opercular spines present. Mouth weakly oblique. Upper jaw length 2.4 (2.4–2.5) in HL, a little shorter than lachrymal length (or upper jaw length equal to lachrymal length in a paratype in 25.2 mm SL). Posterior part of upper jaw with several small papillae, each underlain by a tiny buried scale, without distinct fleshy papillae. Lower and upper jaws subequal in length when mouth closed. Upper and lower jaws with villiform teeth. Palatines and vomer lacking teeth. Several fleshy papillae present on ventral surface of lower jaw (Fig. 2). Five sensory pores present on lower jaw; first pores fused on both sides (Fig. 2). Gill membranes free from isthmus. Isthmus tip well beyond fifth sensory pores of lower jaw (Fig. 2). Lateral line well arched anteriorly; remaining part of lateral line mostly straight. Sensory canals of supracleithrum and of the all bony tubes separated from each other. Ultimate bony tube situated on caudal-fin base (tubes absent on the left side of caudal-fin base in 1 paratype). Anus slightly before anal-fin origin. Small papillae scattered on dorsal fin. First dorsal-fin spine slightly shorter than second spine. Four dorsal-fin spines anterior to third neural spine. Interneural space between seventh and eighth neural spines without dorsal-fin spine proximal pterygiophores (Fig. 3). Anal fin with several papillae basally. Pectoral fin mostly covered with papillae except for lower and posterior margins; its length 3.2 (2.9–3.7) in SL. Posterior tip of pectoral fin just reaching origin of anal fin. Pelvic fin short; its length 6.5 (5.7–7.0) in SL. Caudal fin rounded posteriorly; basal portion of caudal fin with papillae. All soft fin rays un-

branched.

Color of holotype in alcohol (Fig. 1). Dorsal and lateral portions of head and body brown; lower side of head and body pale brown. Anterior and dorsal margins of dorsal fin pale brown; middle and posterior portions of dorsal fin with irregular pale brown bands and spots; remaining portions of dorsal fin darker brown. Pectoral fin brown, except for pale brown posterior and ventral margins. Pelvic fin brown, except for pale brown outer margin. Anal fin with a single darker brown band ventrally; basal portion and ventral margin of anal fin pale brown. Caudal fin darker brown, except for pale brown posterior and ventral margins, and basal portion. Head, body and dorsal fin with many small darker spots. Anterior and posterior portions of body near base of dorsal fin with single pale brown spot, respectively.

Color when alive. In holotype (based on aquarium photograph, used as misidentified *Cocotropus masudai* by Masuda and Kobayashi, 1994: fig. 2 on page 89) (Fig. 4), dorsal portion of head and body dark brown, becoming paler and ventrally yellowish. Anterior and dorsal margins of dorsal fin orange; middle and posterior portions of dorsal fin with irregular orange bands and spots; remaining portions of dorsal fin dark brown. Pectoral fin brown, except for pale brown posterior and ventral margins. Anal fin with a single dark brown band ventrally; basal portion and ventral margin of anal fin yellowish pale brown. Caudal fin dark brown ventrally and posteriorly, except for yellowish brown posterior and ventral margins, and orange dorsal margin and basal portion. Anterior and posterior portions of body near base of dorsal fin with single orange spot, respectively.

In 1 paratype [KPM-NI 22800, based on aquarium photograph, used as misidentified *Cocotropus masudai* by Senou (1990)] (Fig. 5), head, body and dorsal fin mottled red, pink and brown; abdomen pale brown. Dorsal margin of dorsal fin brownish. Pectoral fin brown except for pale brown margin. Caudal fin reddish dark brown except for red dorsal margin, pale ventral and posterior margins, and brownish basal area.



Fig. 4. *Cocotropus izuensis* sp. nov., KPM-NI 22797, holotype, 40.2 mm SL, east coast of Izu Peninsula, Japan (aquarium photo by H. Masuda).

Color when fresh. In another paratype (CMNH-ZF 4692, based on color photograph) (Fig. 6), head, body, and dorsal, anal, pectoral and pelvic fins yellowish brown with many dark spots. Dorsal fin anteriorly with a dark area, and posteriorly with a marginal band. Pectoral fin base reddish. Anal fin with a single ventral dark band. Caudal fin posteriorly dark brown, except for the pale yellowish brown upper and lower posterior margins; caudal-fin base yellowish brown.

Distribution. Known only from the Izu Peninsula, Shizuoka Prefecture, and the Boso Peninsula, Chiba Prefecture, Japan.

Etymology. Named for the Izu Peninsula, where most of the examined specimens were collected.

Remarks. The new species, *Cocotropus izuensis*, has been erroneously identified as *C. masudai*. The 2 species, as well as *Cocotropus roseomaculatus* Imamura and Shinohara, 2004 and *Cocotropus steinitzi* Eshmeier and Dor, 1978, have 12 or fewer dorsal-fin spines in common, no distinct fleshy papillae on the posterior portion of the upper jaw, the first lower jaw sensory pores

on both sides fused (Fig. 2), and the absence of vomerine teeth. Other species of *Cocotropus* lack this combination of characters (Eshmeier and Dor, 1978; Imamura and Shinohara, 2003, 2004, 2008; Fricke, 2004). However, *C. izuensis* differs from *C. masudai* and *C. roseomaculatus* in having the anterior position of the isthmus well beyond the fifth lower jaw sensory pore (Fig. 2) (vs. the tip mostly or just reaching to the pore in *C. masudai* and *C. roseomaculatus*). *Cocotropus izuensis* is also distinguished from *C. masudai* in having 5 preopercular spines (vs. 4 in *C. masudai*), and from *C. roseomaculatus* and *C. steinitzi* in having 7 segmented lower caudal-fin rays (vs. 6 in *C. roseomaculatus* and *C. steinitzi*), and the upper jaw length equal to or a little shorter than lachrymal length (vs. upper jaw length longer than lachrymal length). *Cocotropus izuensis* can also be distinguished from *C. steinitzi* in its 26 vertebrae (vs. 25 in *C. steinitzi*) and 4 dorsal-fin spines anterior to the third neural spine (vs. 5). In addition, *C. izuensis* differs from *C. steinitzi* in lacking dorsal-fin spine proximal pterygiophores in the interneural space between the seventh and eighth neural spines (Fig. 3) (vs.



Fig. 5. *Cocotropus izuensis* sp. nov., KPM-NI 22800, paratype, 29.2 mm SL, east coast of Izu Peninsula, Japan (aquarium photo by H. Masuda).



Fig. 6. *Cocotropus izuensis* sp. nov., CMNH-ZF 4692, paratype, 36.7 mm, Boso Peninsula, Japan (photo by M. Aizawa).

space between sixth and seventh neural spines without pterygiophores in *C. steinitzi*). The characters of the 4 species discussed here are compared in Table 1.

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Table 1. Comparison of characters found in *Cocotropus izuensis* sp. nov. and 3 species of *Cocotropus*.

	<i>C. izuensis</i>	<i>C. masudai</i>	<i>C. roseomaculatus</i>	<i>C. steinitzi</i>
Segmented lower caudal-fin rays	7	Damaged	6	6
Vertebrae (total)	26	26	26	25
Number of preopercular spines	5	4	5	5
Relationship of lengths of upper jaw (U) and lachrymal (L)	U≤L	U<L	U>L	U>L
Position of anterior tip of isthmus relative to fifth lower jaw sensory pore (SP)	Well beyond SP	Mostly reaching to SP	Reaching to SP	Well beyond SP
Number of dorsal fin spines anterior to third neural spine	4	4	5	4
Interneural space lacking dorsal-fin spine pterygiophores	Between 7th and 8th neural spines (NS)	Between 7th and 8th NS	Between 7th and 8th NS	Between 6th and 7th NS

All data from this study

ically reading a draft manuscript and providing important comments. We are grateful to T. Nakabo (the Kyoto University Museum) and H. Senou (KPM) for giving us information on the specimens of the new species. We are deeply indebted to D. Catania (CAS) for providing literature and A. Masuda (Masuda Marine Productions) for sending 2 aquarium photographs taken by the late H. Masuda (Masuda Marine Productions) to the first author (HI). Finally, we sincerely thank K. Matsuura (NSMT) for providing us with an opportunity to publish this new species. This study was partly supported by a grant awarded to HI by Ito Grant for Ichthyology, Fujiwara Natural History Foundation, and that to the third author (GS) by Japan Society for the Promotion of Science (18570098).

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