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Cite this article: Roul SK, Jeena NS, Ghosh S, Rohit P (2020). Redescription and molecular characterization of *Crenidens macracanthus* Günther, 1874 (Pisces: Sparidae), and first record of *C. indicus* Day, 1873 in the eastern Indian Ocean. *Journal of the Marine Biological Association of the United Kingdom* **100**, 1147–1153. <https://doi.org/10.1017/S0025315420000880>

Received: 12 May 2020

Revised: 11 September 2020

Accepted: 14 September 2020

First published online: 28 October 2020

Key words:



Crenidens macracanthus; *C. indicus*; Sparidae; redescription; COI barcode; Indian Ocean

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Redescription and molecular characterization of *Crenidens macracanthus* Günther, 1874 (Pisces: Sparidae), and first record of *C. indicus* Day, 1873 in the eastern Indian Ocean

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Abstract

Crenidens macracanthus was originally described in 1874 based on a single specimen collected from Chennai (Madras), south-east coast of India. In 1875, the species was synonymized with *C. indicus* without citing any valid reason. Since then, no taxonomic studies have been attempted for the genus *Crenidens*, except in 2013 the species was resurrected from synonymy and redescribed as a valid species based on the holotype and non-type specimen. In view of the fact that *C. macracanthus* is a poorly known species, it is redescribed based on examination of 30 additional specimens of 105.8–162.2 mm SL, collected from Puri, Odisha, north-east coast of India (Bay of Bengal) from 2017–2019, using morphological and molecular examinations. Our study provides a detailed morphological description, first colour photographs and phylogenetic analysis using COI barcodes of the species. The study has expanded the range in several morpho-meristic characters in comparison with the type and non-type specimens described earlier. The species in fresh condition can be easily distinguished from its two congeners (*C. crenidens* and *C. indicus*) by the yellowish tip of the lower caudal-fin lobe. Our study has also extended the distribution range of *C. indicus* (previously known only from the north-eastern Arabian Sea) to the eastern Indian Ocean, based on examination of a preserved specimen collected from Tuticorin, Tamil Nadu.

Introduction

Crenidens Valenciennes in Cuvier & Valenciennes, 1830 is a small group of commercially important sparid fishes distributed in the coastal waters of the Indian Ocean (Bogorodsky *et al.*, 2017). These omnivorous fishes are characterized in having both incisor-like and molariform teeth, and they feed mostly on benthic algae and associated invertebrates with the algal turf (Iwatsuki & Maclaine, 2013; Bogorodsky *et al.*, 2017). Historically, the genus was considered as monotypic with two recognized subspecies: *Crenidens crenidens crenidens* (Forsskål, 1775) and *Crenidens crenidens indicus* Day, 1873 (Bauchot & Smith, 1984; Manilo & Bogorodsky, 2003; Randall, 1995). Recently, Iwatsuki & Maclaine (2013) redescribed *Crenidens macracanthus* Günther, 1874 from the south-east coast of India as a valid species resurrecting it from the synonymy of *C. indicus*, placed by Day (1873), and raised *C. crenidens* and *C. indicus* to the species level from the subspecies level.

Despite the occurrence of commercially important *Crenidens* spp. in part of the Indian Ocean, only a few studies have been conducted in detail (Iwatsuki & Maclaine, 2013; Bogorodsky *et al.*, 2017) and hence, the information on these species is limited but is still available from Indian waters. For a long period, it was believed that a single species: *Crenidens indicus* was found to occur along the Indian coast (Bauchot & Smith, 1984). The distribution (record) of *C. indicus* from Indian waters was raised to a questionable status by Iwatsuki & Maclaine (2013, p. 247) stating that the species is either not distributed along the Indian coast or is extremely rare in occurrence. Later, Bogorodsky *et al.* (2017) confirmed the occurrence of *C. indicus* from the Indian waters (west coast of India) based on morphological examination of a specimen from Mumbai (Bombay) and COI sequence analysis of one from Gujarat (sequence unpublished). However, a preserved specimen of *C. indicus* from Tuticorin, Tamil Nadu, was examined in the present study and can be considered as the first confirmed record of the species from the eastern Indian Ocean.

During the ichthyofaunal survey along Odisha coast (north-western part of the Bay of Bengal) in the period 2017–2019, 30 fresh specimens of *C. macracanthus* were collected by the first author from the Astaranga Fishing Harbour, Puri, Odisha (north-east coast of India). With this study, molecular data were generated for this species and phylogenetic analyses performed, including all the available sequences from allied *C. indicus* and *C. crenidens* to



assess the interspecific relationships among the three species. *Crenidens macracanthus* was originally described based on the holotype only (BMNH 1868.10.27.28) and additional material collected by Francis Day (BMNH 1975.9.30.18). Hence, this study provides a redescription of *C. macracanthus* based on new fresh material examined and colour photographs. This study explores several morpho-meristic variations in comparison with the type specimen along with colour description in its fresh condition. An updated key to the species of *Crenidens* from Indian waters is provided.

Materials and methods

Thirty specimens of *Crenidens macracanthus* were collected between 2017–2019 from landings at Astaranga fishing harbour (19°58'27.1344"N 86°20'20.9976"E), Puri, Odisha. The fishes were caught in the shallow turbid waters of Devi river mouth (estuary) area by bottom set gill nets (mesh size: 36 mm). The freshly collected specimens were preserved in crushed ice and brought to the laboratory of Puri Field Centre of ICAR-Central Marine Fisheries Research Institute (CMFRI) for detailed taxonomic investigation. In addition, one preserved specimen (accession number GB.31.142.12.1) from the Marine Biodiversity Referral Museum of ICAR-Central Marine Fisheries Research Institute (CMFRI), Cochin, Kerala, India labelled as *C. crenidens* (identified here as *C. indicus*) was studied based on the morpho-meristic characters. The specimen was collected from Tuticorin, Tamil Nadu, India (8.79°N 78.16°E) by the staff of Tuticorin Research Centre of ICAR-CMFRI on 5 January 2005.

Morphological analysis

Meristic and morphometric measurements were recorded according to Hubbs & Lagler (1958), Iwatsuki *et al.* (2007), Iwatsuki & Heemstra (2010, 2011) and Bogorodsky *et al.* (2017). The morphometric characters were measured using a digital Vernier calliper, with 0.1 mm accuracy. Standard length, second and third anal-fin spines are abbreviated as SL, 2AS and 3AS, respectively (Iwatsuki & Maclaine, 2013). Morphometric data presented are given as ratio to standard length in the text and percentages of standard length in Table 1 for easier comparison with published data (Iwatsuki & Maclaine, 2013; Bogorodsky *et al.*, 2017).

Molecular analysis

Genomic DNA was isolated from the muscle tissue preserved in 95% ethanol using phenol/chloroform method (Sambrook & Russell, 2001). Amplification of partial sequences of mitochondrial COI gene was carried out using the primer pair FishF2/FishR2 (Ward *et al.*, 2005) under optimized thermal regime. The amplicons were sequenced bi-directionally and aligned in MEGA7 (Kumar *et al.*, 2016). Five individuals of *C. macracanthus* were barcoded and two representative haplotypes were deposited in NCBI GenBank (accession nos. MT179595–MT179596). The sequences were aligned with available sequences of *C. crenidens* and *C. indicus* from different geographic locations. Phylogenetic trees were inferred using Maximum likelihood method under the best fitting models excluding and including the comparatively shorter COI sequences (239 bp) of *C. indicus* from GenBank. The evolutionary divergence between aligned sequences (625 bp) of *C. macracanthus* and *C. crenidens* were calculated using the Kimura 2-parameter model (Kimura, 1980).

Results

Systematics

Order PERCIFORMES Bleeker, 1863

Family SPARIDAE Rafinesque, 1818

Genus *Crenidens* Valenciennes in Cuvier & Valenciennes, 1830

***Crenidens macracanthus* Günther, 1874**

Günther's karanteen (Figure 1A–C, Figure 2, Figure 3A–C, Table 1)

Type and Non-type material

Crenidens macracanthus Günther 1874: 368 (type locality: Madras (Chennai), India).

Holotype: BMNH 1868.10.27.28, 126 mm SL (X-ray), Chennai (as Madras originally), India, Bay of Bengal.

Non-type specimen: BMNH 1975.9.30.18, a dried right-hand side skin specimen collected by Francis Day, 150 mm SL, no locality information, but considered likely to be Chennai, India (see Iwatsuki & Maclaine, 2013).

Material examined for comparison

Crenidens macracanthus (N = 30): GB.31.142.12.2, 105.8–162.2 mm SL; Astaranga fishing harbour, Puri, Odisha, India, Bay of Bengal, north-eastern Indian Ocean; 19°58'27.1344"N 86°20'20.9976"E; depth 6–12 m; collected by Subal Kumar Roul on 31 October 2019.

Crenidens indicus (N = 1): GB.31.142.12.1, 197.4 mm SL; Tuticorin (8.79°N 78.16°E), Tamil Nadu, India, Bay of Bengal, south-eastern Indian Ocean; collected by Tuticorin Research Centre Staff on 5 January 2005 (Figure 1D).

Diagnosis. A species of *Crenidens* with the following combination of characters: dorsal-fin rays XII, 10–11, usually XII, 10; anal-fin rays III, 9–11, usually III, 10; pectoral-fin rays 14–15, usually 14; pored lateral-line scales 47–50; scale rows above lateral line 5.5, below 11.5; scale rows between fifth dorsal-fin spine and lateral line 5.5; gill rakers 6–7 + 9–11 = 15–18; 2AS much larger than 3AS, the length of 3AS 1.3–1.5 in 2AS; scales on top of head extending to a vertical through the centre of the eye; body deep, the depth 2.0–2.4 in SL; caudal peduncle depth 7.6–8.6 in SL and 1.0–1.3 in its length; pelvic-fin length 3.5–4.2 in SL; pectoral fin with a large blackish spot dorsally in axil (see Figure 2A); caudal fin blackish distally, tip of lower lobe yellowish (see Figure 2D); lips smooth without cirri; incisor-like teeth with five points, all points sub-equal in size, forming a flat cutting edge (see Figure 3A–C).

Description. Counts and proportional measurements of *Crenidens macracanthus* are given in Table 1.

Body somewhat oval, compressed, and deep, the maximum depth 2.0–2.4 in SL (see Figure 1A, B); dorsal profile of the head slightly convex with a broad-based, slight convexity just in front of upper edge of eye; ventral profile nearly straight; anterior nostril small and rounded, posterior nostril larger, narrowly oval, with flap; orbit diameter sub-equal to interorbital width; mouth horizontal and moderate, maxilla not reaching to below anterior margin of eye, maxilla naked, its hind margin concealed by sub-orbital; lips without any tiny prickle-like cirri; jaws with three series of incisor-like teeth (third series very weak); outer series of larger incisor-like teeth, each with five points, all points sub-equal in size, forming a flat cutting edge (see Figure 3A–C); outer teeth movable; several rows of small molars inside from the incisor-like teeth in the posterior part of the jaws; hind margin of preopercle generally rounded and weakly serrated; predorsal length less than body depth, and dorsal-fin base length; caudal peduncle moderately deep, the depth 7.6–8.6 in SL and 1.0–1.3 in its length; pectoral-fin base scaly and rounded posterior, the fin tip reaching slightly beyond vertical at anus but not reaching anal-fin origin,

Table 1. Morphometric and meristic data for *Crenidens macracanthus* and *C. indicus*

Specimen	<i>Crenidens macracanthus</i> Holotype BMNH 1868.10.27.28, Madras (Chennai)	<i>Crenidens macracanthus</i> GB.31.142.12.2, Puri (N = 30)	Mean	<i>Crenidens indicus</i> GB.31.142.12.1, Tuticorin (N = 1)
Standard length (mm)	126	105.8–162.2	131.8	197.4
Body depth (at pelvic-fin origin)	45	42.4–50.0	45.3	48.8
Body depth (at anal-fin origin)	39	36.7–43.6	39.1	39.3
Head length	27	25.7–28.4	27.1	27.3
Body width	15	14.9–17.4	16.4	14.6
Snout length	10	11.0–14.5	13.3	10.6
Orbit diameter	10	8.2–10.9	9.5	8.4
Dermal eye opening	8	7.4–9.1	8.1	7.3
Inter orbital width, bony	8	8.0–9.6	8.8	9.8
Inter orbital width, with membrane	9	9.8–12.9	11.6	11.5
Upper-jaw length	6	6.9–8.2	7.6	7.6
Caudal peduncle depth	13	11.7–13.2	12.4	12.6
Caudal peduncle length	15	8.4–12.7	11.1	11.3
Predorsal-fin length	43	27.1–33.7	31.3	33.7
Preanal-fin length	71	70.8–76.6	73.9	72.0
Prepelvic-fin length	37	32.7–37.6	35.1	37.6
Dorsal-fin base length	58	60.9–65.7	63.2	58.5
Anal-fin base length	20	21.5–24.5	22.5	19.5
Caudal-fin length	18	26.5–31.9	29.6	-(broken)
Pelvic-fin spine length	17	16.7–19.7	17.8	15.7
First pelvic-fin ray length	24	23.7–28.6	26.8	23.3
Pectoral-fin length	39	39.9–45.1	42.5	34.2
First dorsal-fin spine length	6	5.8–9.4	7.4	3.1
Second dorsal-fin spine length	9	10.3–13.8	12.5	8.1
Third dorsal-fin spine length	14	16.4–19.8	18.0	13.3
Fourth dorsal-fin spine length	20	18.8–22.4	20.5	15.5
Fifth dorsal-fin spine length	19	17.9–22.0	20.1	14.7
Sixth dorsal-fin spine length	19	16.7–20.8	19.0	13.6
Last dorsal-fin spine length	14	11.7–14.8	13.1	9.6
First dorsal-fin ray length	14	13.3–16.6	15.3	10.6
First anal-fin spine length	6	5.3–8.0	6.2	4.7
Second anal-fin spine length	21	18.9–22.8	20.5	12.8
Third anal-fin spine length	16	13.2–16.9	15.5	11.9
First anal-fin ray length	14	12.6–15.6	14.5	-(broken)
Least suborbital depth	7	5.1–6.3	5.8	4.8
Posterior-most jaw length	–	2.2–3.1	2.8	2.9
<i>Meristics</i>				
Dorsal-fin rays	XII,10	XII,10–11	XII,10	XI,11
Anal-fin rays	III,10	III, 9–11	III,10	III,10
Pelvic-fin rays	I,5	I,5	I,5	I,5
Pectoral-fin rays	14	14–15	14	14
Pored lateral-line scales	47	47–50	49	50
Scale rows above and below lateral line	5.5/11.5	5.5/11.5	5.5/11.5	6.5/13.5
Scales rows between fifth dorsal-fin spine and lateral line	5.5	5.5	5.5	6.5
Scale rows between tenth dorsal-fin spine and lateral line	4.5	4.5	4.5	6.5

(Continued)

Table 1. (Continued.)

Specimen	<i>Crenidens macracanthus</i> Holotype BMNH 1868.10.27.28, Madras (Chennai)	<i>Crenidens macracanthus</i> GB.31.142.12.2, Puri (N = 30)	Mean	<i>Crenidens indicus</i> GB.31.142.12.1, Tuticorin (N = 1)
Rows of scales on cheek	–	3–5	4	4
Rows of scales on opercle	–	4–5	4	4
Gill rakers including rudiments	6 + 1 + 12 = 19	6–7 + 9–11 = 15–18	6 + 10 = 16	6 + 10 = 16

Standard length is expressed in millimetres; all other measurements are expressed as percentage of standard length.

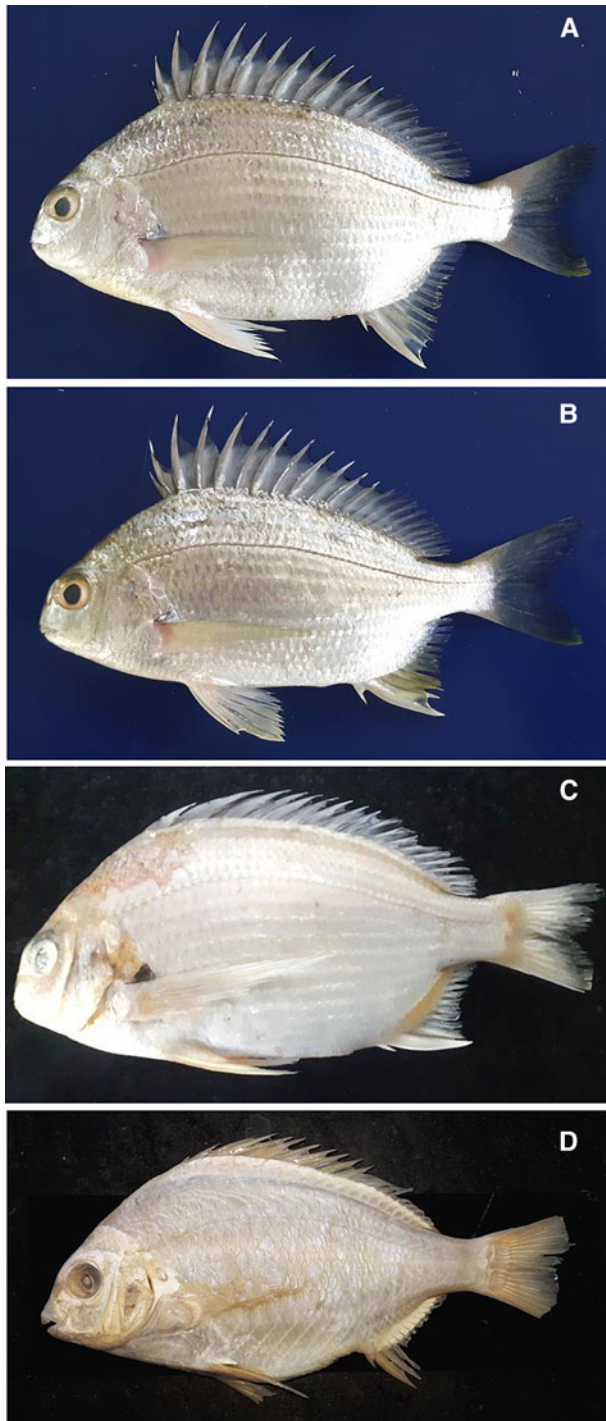


Fig. 1. *Crenidens macracanthus*. (a) GB.31.142.12.2, 162.2 mm SL, fresh, Puri, Odisha, India; (b) 105.8 mm SL, fresh, Puri, Odisha, India; (c) GB.31.142.12.2, 162.2 mm SL, formalin preserved, Puri, Odisha, India; *C. indicus*. (d) GB.31.142.12.1, 197.4 mm SL, formalin preserved, Tuticorin, Tamil Nadu, India.

its length greater than head length; pelvic fin longer than the longest dorsal-fin spine, fin tip not reaching anus or vertical through the tip of pectoral fin, the length 3.5–4.2 in SL; first to fourth dorsal-fin spines progressively longer, fourth dorsal-fin spine longest and much greater than snout length; anal fin origin below second dorsal-fin soft ray, 2AS and 3AS strong, 2AS much larger and longer than 3AS, the length of 3AS 1.3–1.5 in 2AS; caudal fin weakly forked, each lobe with rounded posterior margin and somewhat pointed tip; scales ctenoid, suborbital and interorbital without scales; lower cheek with 3–5 rows of scales, opercle with 4–5 rows of scales; lateral line with 47–50 pored scales, gently curved, sub-parallel to curved dorsal profile from nape to caudal peduncle; scale rows between fifth dorsal-fin spine and lateral line, and 10th dorsal-fin spine and lateral line 5.5; scales on top of head extending almost to a point vertical above the centre of the eye; no scaly sheath on spinous dorsal and anal-fin rays; soft portions of dorsal and anal fins with no scales but with weak and moderate scaly sheaths; gill rakers, including rudiments, 6–7 + 9–11 = 15–18.

Colour of fresh specimens. Body light silvery yellowish with poorly defined dusky spot in scale centre, resulting in a faint striped effect, more obvious ventrally (see Figure 1A, B); pectoral fins with a large blackish spot dorsally in axil (see Figure 2A); pelvic fins whitish, sometimes light yellowish; dorsal fin with pale grey spines and rays and grey membranes, margin of spinous portion of dorsal fin narrowly black (see Figure 2B); anal fin light yellowish, occasionally with a black pigmentation basally (see Figure 2C); caudal fin dusky basally shading to blackish distally, tip of lower lobe of caudal fin yellowish (see Figure 2D); denticulations of incisiform teeth brown (see Figure 3A, B); iris light yellow, sometimes with dark mark dorsally.

Colour of formalin preserved specimens. Head and body yellowish tan, lower part of head and abdomen whitish-yellow; all fins pale except blackish shading of distal part of caudal fin, grey spines, rays and membranes of dorsal fin, and blackish margin of spinous portion of dorsal fin; anal-fin base, caudal-fin base and area above pectoral fin light yellow; jaws with brown edges; yellow colour on tip of lower lobe on caudal fin disappeared; black spot well visible in axil of pectoral fin (see Figure 1C).

Distribution and habitat. Iwatsuki & Maclaine (2013) reported that *C. macracanthus* is endemic to Chennai (Madras), south-east coast of India, after extensive searching of specimens in museums and field exploration in India. Recently, Psomadakis *et al.* (2020) has mentioned the occurrence of this species in the 'Field identification guide to the living marine resources of Myanmar' without any detailed information (the description seems to be taken from Iwatsuki & Maclaine (2013)). In the present study specimens (N = 30) from the east coast of India (Puri, Odisha) were examined and included in the phylogenetic analysis, thus confirming the occurrence of the species in broader geographic ranges in the Eastern Indian Ocean (see Figure 4). Inhabits coastal shallow and turbid estuarine area; specimens collected during the study were caught in the depth ranges from 6–12 m; usually found in



Fig. 2. *Crenidens macracanthus*. (a) large blackish spot dorsally in axil of pectoral fin; (b) dorsal fin with pale grey spines and rays and grey membranes, margin of spinous portion of dorsal fin narrowly black; (c) light yellowish pelvic and anal-fins; and (d) yellowish tip of caudal fin lower lobe.

small groups and caught along with *Rhabdosargu sarba* and *Acanthopagrus berda* in bottom set gillnets; gut content analysis revealed that it feeds on benthic algae and a variety of small invertebrates associated with algal turf. *Crenidens macracanthus* is one of the commercially important sparid fishes in its range, and marketed mostly fresh at ₹150–200 kg⁻¹ along with *R. sarba* in local

markets due to their similar appearance to consumers. However, future study is essential to have detailed information on fishery, food and feeding habits, reproductive biology and population parameters of this species.

Remarks. *Crenidens macracanthus*, a very rare species which closely resembles its congener *C. indicus*, so far known only

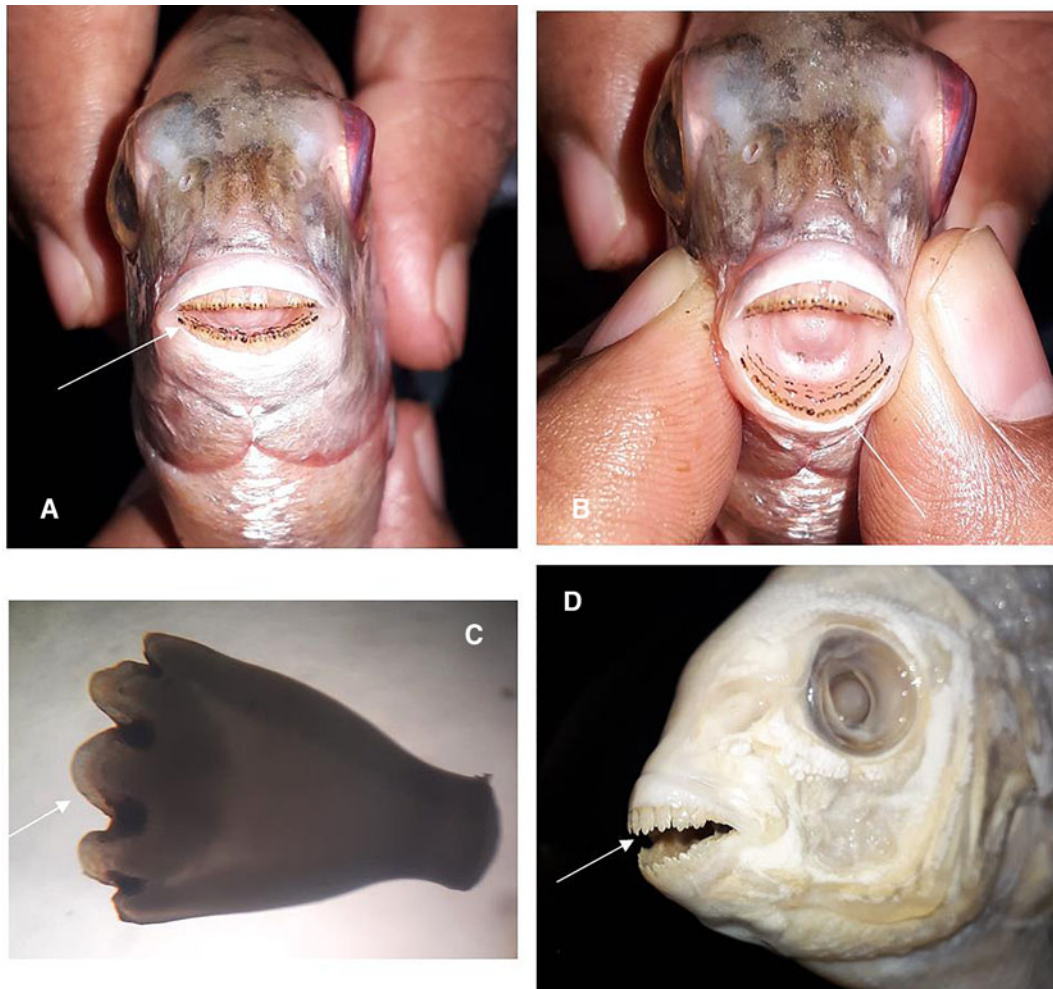


Fig. 3. *Crenidens macracanthus*. (a) incisor-like teeth; (b) rows of teeth; (c) close-up of incisor-like tooth with five subequal points; *C. indicus*. (d) incisor-like teeth with three median points much larger than outer point on each side.

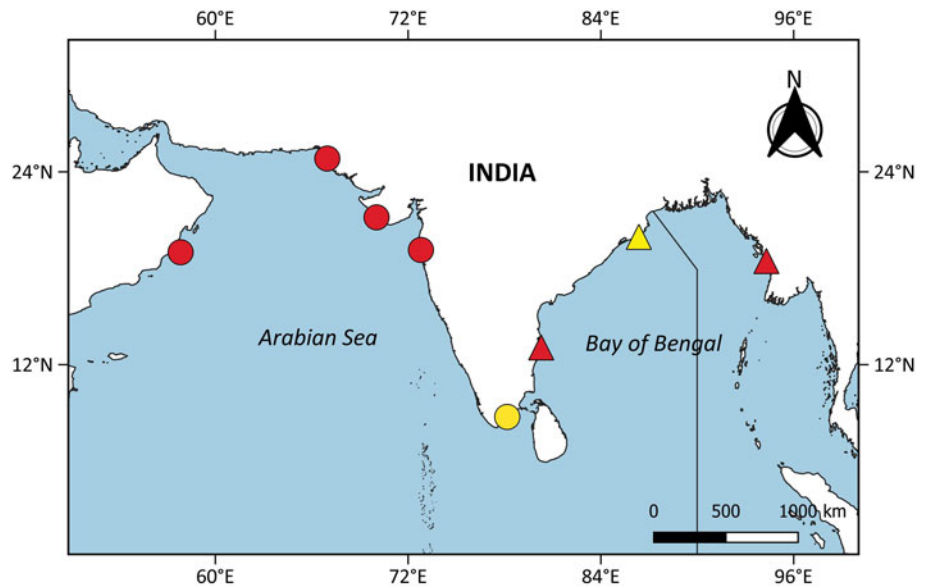


Fig. 4. Distribution of *Crenidens macracanthus* (triangle) and *C. indicus* (dot) from the Indian Ocean. Red symbols indicate previous record and yellow indicate present record.

from Chennai, east coast of India (Iwatsuki & Maclaine, 2013) but appears to be abundant in certain locations along the Indian coast (Puri, Odisha: present study). This study highlights several new characters in addition to those described by Iwatsuki & Maclaine (2013) to be useful for identification of *C. macracanthus* (see Table 1, key). Based on the present study, *C. macracanthus* differs from *C. indicus* in having dorsal-fin rays XII,10–11, usually XII,10 (vs XI–XII,10–11, usually XI,11); scale rows between fifth dorsal-fin spine and lateral line 5.5 (vs 6–6.5 rows); 2AS much larger than 3AS, the length of 3AS 1.3–1.5 in 2AS (vs second anal-fin spine sub-equal to or only slightly larger than third, the length of 3AS 1.0–1.3 in 2AS); incisor-like teeth with five points, all points sub-equal in size (vs three median points much larger than outer point on each side); caudal fin blackish distally, tip of the lower lobe yellowish (vs tip of the lower caudal-fin lobe not yellowish); anal fin light yellowish (vs anal fin with grey spines, and blackish rays and membranes).

Phylogenetic analysis. The Maximum likelihood (ML) analysis of the partial sequences (625 bp) of COI gene resulted in placement of the *C. macracanthus* and *C. crenidens* in two major clades with high

bootstrap support (see Figure 5). Two major lineages/sub-clades were noted in the latter species. The group-wise genetic distance between the two species was 13.5–14%. Analysis with the three extant species resulted in three distinct major clades with high bootstrap support. *Crenidens crenidens* and *C. indicus* clustered together as two sub-clades in the first major clade while *C. macracanthus* formed a separate clade (see Supplementary material).

Discussion

Iwatsuki & Maclaine (2013) recognized *Crenidens macracanthus* Günther, 1874 as a third valid species in the genus *Crenidens* known from the south-east coast of India and raised *C. crenidens* and *C. indicus* to species level status from the subspecies level based on comparative morphology only. Bogorodsky et al. (2017) confirmed both *C. crenidens* and *C. indicus* as valid species based on both morphological and molecular data (phylogenetic analysis of the COI bar coding region). However, no molecular data from the third congener, *C. macracanthus* were available by previous authors to assess the interspecific phylogenetic



Fig. 5. Maximum likelihood analysis of COI sequences based on HKY + G model. The values at nodes indicate bootstrap support from 1000 replicates.

0.050

relationships and genetic relatedness among the three species. The present study is the first integrated taxonomic report on *C. macracanthus*, the third congener of the genus *Crenidens*, including the detailed analysis of morphological characters and molecular data. The study provided several additional distinctive features including the colour pattern of fresh specimens of *C. macracanthus* which will be helpful for easy identification of this species (see remarks for details, key). The results provided confirmation of the species status, i.e. the same as suggested by Iwatsuki & Maclaine (2013). The phylogenetic tree (see Figure 5) in our study also supports the existence of two evolutionary units in *C. crenidens* (Bogorodsky *et al.*, 2017). The shorter read (239 bp) of COI gene of *C. indicus* limits the interpretation of genetic divergence data in the genus when the three species were aligned (see Supplementary material).

In the present study one preserved specimen (GB.31.142.12.1, 250 mm SL) from Marine Biodiversity Referral Museum of ICAR-Central Marine Fisheries Research Institute (CMFRI), Cochin, Kerala, India labelled as *C. crenidens* was also re-examined and identified as *C. indicus* based on relatively deeper body (2.1 in SL); 6.5 scale rows between dorsal fin and lateral line; incisor-like teeth with five points, three median points much larger in size than one outside point on each side; and other morpho-meristic characters (see Table 1, Figures 1D and 3D). The specimen was collected from Tuticorin, Tamil Nadu from the east coast of India, thus confirming the first record of this species in the eastern Indian Ocean. The first author, students and other staff visited Tuticorin several times during 2017–2019 but failed to notice or collect any more specimens of *C. indicus* which suggests the rarity of the species in that area.

Revised key to the species of Crenidens from Indian waters based on present study and Bogorodsky et al. (2017)

1a. Dorsal-fin rays XII,10–11 (usually XII,10); scale rows between fifth dorsal-fin spine and lateral line 5.5; 2AS much larger than 3AS, the length of 3AS 1.3–1.5 in 2AS; incisor-like teeth with five points, all points sub-equal in size; caudal fin blackish distally, tip of lower lobe yellowish; anal fin light yellowish.....*C. macracanthus*

1b. Dorsal-fin rays XI–XII,10–11 (usually XI,11); scale rows between fifth dorsal-fin spine and lateral line 6–6.5; 2AS sub-equal to or only slightly larger than 3AS, the length of 3AS 1.0–1.3 in 2AS; incisor-like teeth with five points, three median points much larger than outer point on each side; caudal fin blackish distally, tip of lower caudal-fin lobe not yellowish; anal fin with dark grey or black spines, rays and membranes.....*C. indicus*

Supplementary material. The supplementary material for this article can be found at <https://doi.org/10.1017/S0025315420000880>

Acknowledgements. We thank Dr A. Gopalakrishnan, Director of ICAR-CMFRI, for providing all necessary facilities and support during the study period. We thank Dr K.K. Joshi (Head Marine Biodiversity Division, ICAR-CMFRI) for permission to examine the Museum specimen. We also

thank the staff of Puri Field Centre of ICAR-CMFRI for their help both in the field and laboratory.

Author contributions. Subal Kumar Roul collected and analysed morpho-meristic data and wrote the manuscript. Jeena N.S. analysed molecular data. Shubhadeep Ghosh, Prathibha Rohit and Jeena N.S. corrected and improved the language of the manuscript.

Conflict of interest. The authors declare that they have no conflict of interest.

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