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Notacanthus elongatus, a new deep-sea spiny eel (Notacanthiformes: Notacanthidae) from the Arabian Sea, southwest coast of India

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Abstract

Information on spiny eels of the family Notacanthidae from Indian waters remains limited. Examination of deep-sea trawl bycatch obtained from shrimp fisheries and exploratory surveys in the Arabian Sea revealed the presence of an undescribed species of *Notacanthus*. The new species differs from its congeners in possessing 13 or 14 dorsal-fin spines, 28–32 anal-fin spines, 38–66 anal-fin soft rays, and a relatively slender, laterally compressed body with a long dorsal-fin base (71.5–78.0% of gnathoproctal length). Molecular analysis based on the mitochondrial cytochrome c oxidase subunit I (COI) gene further supports its distinctiveness, showing a genetic divergence of 4.8%–16.4% from other species of *Notacanthus*. Phylogenetic analyses indicate that *Notacanthus elongatus* n. sp. is most closely related to *Notacanthus indicus*, although it differs from that species in several key morphological characters. The discovery increases the number of valid species of *Notacanthus* to 8 and represents a significant step forward in deep-sea research in the Indian Ocean, while also highlighting the potential of trawl bycatch as a valuable resource for species discoveries when logistical constraints limit targeted deep-sea sampling.

Key words: ichthyology, taxonomy, DNA barcoding, Indian Ocean, phylogenetics, deep-sea fishes

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Introduction

The spiny eels of the family Notacanthidae comprise a group of small to medium-sized eel-like fishes characterized by numerous short dorsal-fin spines and an elongated body form. Members of this family possess ventral and anal fins with spines in their anterior portions and are typically adapted to deep-sea environments (McDowell 1973). The family Notacanthidae comprises 12 valid species distributed among three genera: *Notacanthus* Bloch, 1788; Polyacanthonotus Bleeker, 1874; and Lipogenys Goode & Bean, 1895 (Fricke et al. 2026). Species of *Notacanthus* can be distinguished from closely related genera by the presence of numerous isolated dorsal-fin spines, an elongated laterally compressed body, and distinctive dentition, with the premaxillary teeth differing markedly from those of the dentary (Sulak 1986).

Notacanthids are benthopelagic or benthic deep-sea fishes occurring primarily along continental slopes and seamounts (Bañón et al. 2024). They are typically found at depths ranging from about 125 to more than 3500 m, although most species occur between 450 and 2500 m (Nelson et al. 2016). Despite their wide distribution in tropical to subpolar oceans, notacanthids remain poorly represented in museum collections due to the difficulty of sampling deep-sea habitats. Consequently, several species are known from only a few specimens, and their taxonomy remains incompletely understood.

The genus *Notacanthus* currently comprises seven recognised species: *Notacanthus abbotti* Fowler, 1934; *Notacanthus bonaparte* Risso, 1840; *Notacanthus chemnitzii* Bloch, 1788; *Notacanthus indicus* Lloyd, 1909; *Notacanthus sexspinis* Richardson, 1846; *Notacanthus spinosus* Garman, 1899; and the recently described *Notacanthus arrontei* Bañón, Barros-García, Baldó, Cojan & Carlos, 2024. Among these, *N. indicus* is the only species previously reported from the Indian region. It was originally described by Lloyd (1909) based on specimens collected off Mumbai in the northeastern Arabian Sea. Although the occurrence of *N. sexspinis* in Indian waters has been mentioned in earlier faunal lists (Venu 2009, Hashim 2012), these records remain doubtful because detailed descriptions or voucher specimens were not provided.

Deep-sea biodiversity in the Indian Ocean remains poorly explored, and new species continue to be discovered through trawl bycatch and research surveys (Rajeeshkumar et al. 2017, 2022). During recent investigations of the deep-sea fish fauna of Indian waters, morphologically distinct specimens of *Notacanthus* were obtained from the deep-sea trawl bycatch at Wadge Bank in the Arabian Sea, southwest coast of India. Detailed examination revealed a diagnostic combination of morphological characters that clearly distinguishes these specimens from all previously described congeners. The aim of the present study is therefore to describe this taxon as a new species of *Notacanthus*. The description is based on detailed morphological examination and a comparison with known species of the genus, supported by molecular evidence derived from the mitochondrial cytochrome c oxidase subunit I (COI) gene. The results provide further insights into the diversity and taxonomy of deep-sea notacanthid fishes from the Indian Ocean.

Materials and Methods

Specimens of the new species were obtained from deep-sea trawl landings along the Indian coast, comprising one holotype and two paratypes collected from the southwest coast of India (Fig. 1). Each specimen was photographed using a Nikon D3500 digital camera and approximately 100 mg of muscle tissue was sampled and preserved in 95% ethanol for molecular analyses. The holotype and one paratype were deposited in the National Zoological Collections (NZC) of the Marine Biology Regional Centre, Zoological Survey of India (ZSI), Chennai, and the remaining paratype was deposited in the Andaman and Nicobar Regional Centre (ANRC), Zoological Survey of India, Port Blair.

Morphometric measurements followed the standard methods of Hubbs & Lagler (1970). Measurements were taken to the nearest 0.1 mm using digital vernier calipers, except for total length (TL) and standard length (SL), which were measured to the nearest millimeter using a measuring tape. Gnathoproctal length (GPL) was measured as the straight-line distance from the tip of the lower jaw to the anal opening (McDowell 1973). Premaxillary tooth counts were taken only from the left side of the fish (Bañón et al. 2024).

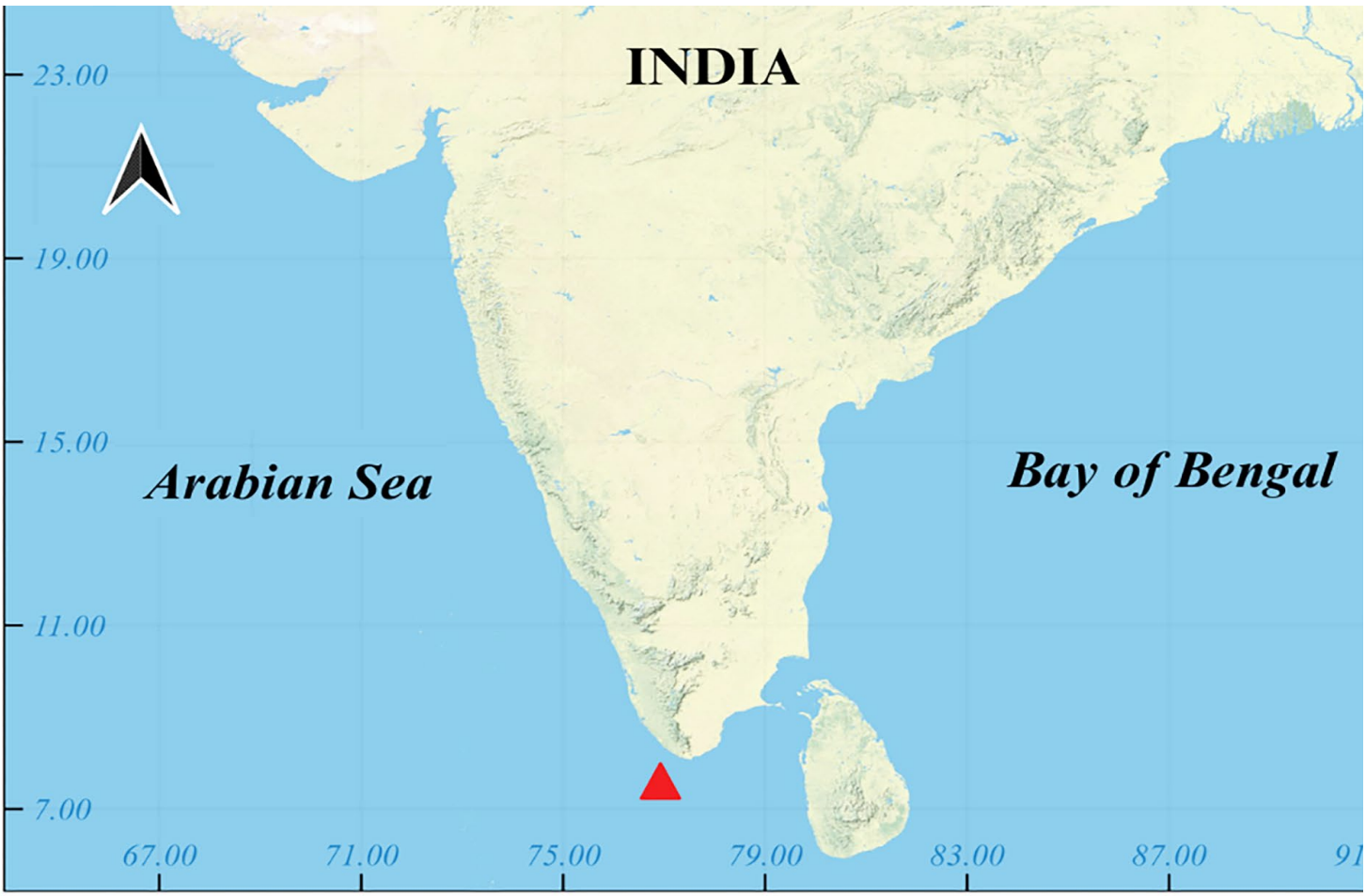


Figure 1. Map showing the type locality of *Notacanthus elongatus* n. sp., at Wadge Bank, Arabian Sea, southwest coast of India (red triangle).

Genomic DNA was extracted from the preserved muscle tissue using the QIAGEN DNeasy Blood and Tissue Kit following the manufacturer's protocol. A partial fragment of the mitochondrial cytochrome c oxidase subunit I (COI) gene was amplified using the universal primers FishF1 (5′–TCA ACC AAC CAC AAA GAG ATT GGC AC–3′) and FishR1 (5′–TAG ACT TCT GGG TGG CCA AAG AAT CA–3′) (Ward et al. 2005). PCR amplification was performed in a 25 µL reaction volume under standard conditions. The thermal cycling profile consisted of an initial denaturation at 94°C for 5 min, followed by 35 cycles of denaturation at 94°C for 30 s, annealing at 50°C for 30 s and extension at 72°C for 1 min, with a final extension at 72°C for 10 min. PCR products were visualized on a 1% agarose gel and purified using the QIAGEN PCR Purification Kit. Sequencing was performed on an ABI 3730 DNA sequencer. The sequences generated for the new species are accessioned in GenBank as KR105803, KR105804, and PZ148116.

The mitochondrial cytochrome c oxidase subunit I (COI) sequences were aligned using BioEdit v7.0.5.2 (Hall 1999). The sequences were checked and edited manually in both forward and reverse directions in BioEdit. Reference sequences of congeners were downloaded from GenBank for comparative analyses. Pairwise genetic distances were calculated using the Kimura two-parameter (K2P) model with uniform rates among sites in MEGA v12 (Kumar et al. 2024). Phylogenetic relationships were inferred using the neighbor-joining (NJ) method under the Kimura two-parameter (K2P) model in MEGA v12. Nodal support for the resulting topology was assessed using 1000 bootstrap replicates. The phylogenetic tree was visualized and edited using FigTree v1.4.4 (Rambaut 2018).



Figure 2. *Notacanthus elongatus* n. sp., fresh holotype, ZSI/MBRC/F3578, 412 mm TL, Wadge Bank, Arabian Sea, southwest coast of India (K.K. Bineesh).

Notacanthus elongatus, n. sp. Kasinath & Bineesh

Elongate Spiny Eel

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Figures 2–5, Tables 1 & 2

Holotype. ZSI/MBRC/F3578, 412 mm TL, from Wadge Bank, Arabian Sea, southwest coast of India, 7.4506°, 76.8132°, fishing ground, 350–450 m, landed at Sakthikulangara Fishing Harbour, 8.9332°, 76.5414°, deep-sea trawl catch, K.K. Bineesh, 23 December 2024.

Paratypes. ZSI/ANRC/M-25110, 385 mm TL, same collection data as holotype, 22 January 2014; ZSI/MBRC/F3579, 365 mm TL, same collection data as holotype, 23 December 2024.

Diagnosis. A species of *Notacanthus* distinguished from congeners by a combination of characters: dorsal fin with 13 or 14 spines; dorsal-fin base 71.5–78.0% GPL; anal fin with 28–32 spines and 38–66 soft rays; spinous anal-fin base 78.4–85.7% GPL; body slender and compressed with a tapering tail; mouth inferior; snout obtusely pointed; branchiostegal membranes united; scales small and cycloid; lateral line faint and porous; body depth 7.5–8.5 times in SL; eye diameter 15.6–17.7% GPL and 1.2–1.4 times preorbital snout length; dorsal-fin origin anterior to vent and almost in line with pelvic-fin origin.

Description. Body elongated and slender; maximum body depth less than head length, body depth 1.4–1.6 times in head length and 3.02–3.07 times in gnathoproctal length. Eye round, horizontal eye diameter 1.2–1.4 times in preorbital snout length. Interorbital distance less than eye diameter, interorbital width 7.3–7.6% head



Figure 3. *Notacanthus elongatus* n. sp., fresh paratype, ZSI/MBRC/F3579, 365 mm TL, Wadge Bank, Arabian Sea, southwest coast of India (K.K. Bineesh).

length. Snout short and obtusely pointed; preorbital snout length 21.9–23.0% head length; snout length 4.3–4.5 times in head length. Mouth inferior, extending to posterior half of eye. Nostrils situated high on snout, in line with mid-eye; prenarial length 12.7–16.6% head length. Dorsal fin with 13 or 14 spines, first spine originating behind pelvic-fin base; dorsal-fin base slightly shorter than spinous anal-fin base, dorsal-fin base 1.0–1.1 times in anal spinous-fin base and 1.2–1.3 times in gnathoproctal length. Anal fin with 28–32 spines and 38–66 soft rays; spinous anal-fin base 78.4–85.7% gnathoproctal length and 1.1–1.2 times in gnathoproctal length. Pelvic fin with 2–4 spines and 6–7 rays; pelvic-fin length 2.5–3.0 times in head length. Pectoral fin with 11–14 rays; pectoral-fin length 2.1–2.8 times in head length; pectoral fin positioned closer to gill opening than pelvic-fin origin. Caudal fin minute. Teeth small, slender and sharply pointed in both jaws; premaxillary teeth arranged in two rows, outer

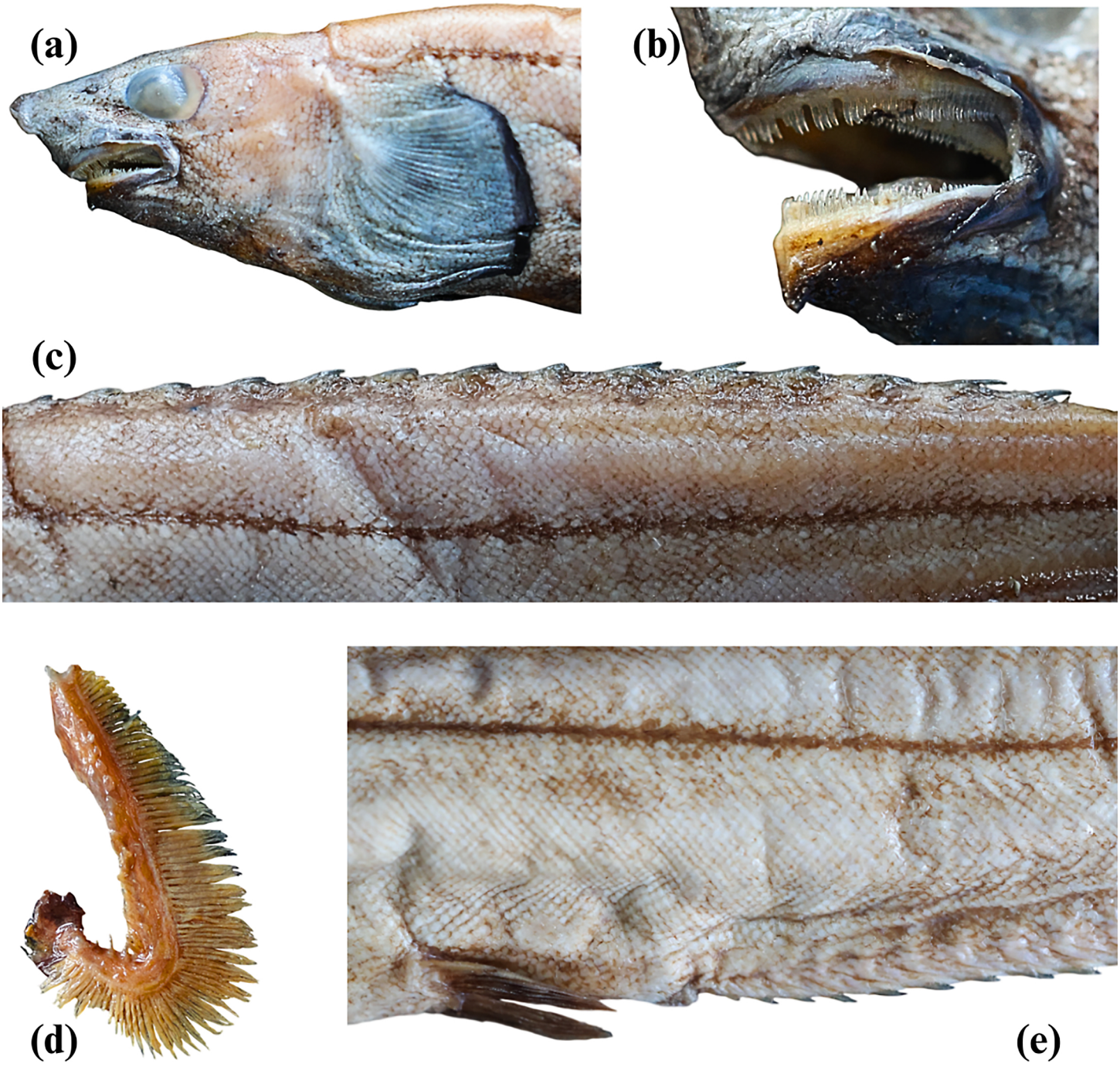


Figure 4. *Notacanthus elongatus* n. sp., holotype, ZSI/MBRC/F3578, 412 mm TL, a) head, (b) lateral view of mouth and teeth, (c) dorsal fin, (d) first gill raker on the left side, (e) ventral part showing pelvic fin, anus, and anal-fin spines (A. Kasinath (a-d) & P. Rozario (e)).

TABLE 1

Morphometrics (as percent of GPL and percent of HL) and meristic values of type specimens of *Notacanthus elongatus* n. sp.

	holotype	paratypes range		holotype	paratypes range
Total length	412	365–385	Interorbital width	7.3	7.4–7.6
Standard length (mm)	405	350.0–375.0	Upper jaw length	22.5	22.0–22.5
Gnathoproctal length (GPL) in mm	145.1	142.4–146.2	Preoral length	9.7	9.1
% GPL			Pectoral-fin length	47.4	35.0–44.9
Snout-vent length	108.2	107.2–110.5	Pelvic-fin length	39.3	32.6–33.8
Head length (HL)	48.9	52.5–52.6	Longest dorsal-fin spine	13.7	11.1–11.9
Pre-dorsal-fin length	95.5	101.0–108.5	Longest anal-fin spine	16.2	15.8–17.2
Pre-anal-fin length	111.8	111.4–114.9	**Meristic counts**		
Pre-pectoral-fin length	52.4	52.2–56.7	Dorsal-fin spines	14	13
Pre-pelvic-fin length	85.9	85.0–92.0	Anal-fin spines	30	28–32
Dorsal-fin base	78	71.5–74.2	Anal-fin rays	66	38–56
Spinous anal-fin base	78.4	83.3–85.7	Pectoral-fin rays	11	11–14
Body depth (maximum)	32.4	32.4–33.1	Pelvic-fin rays	4+6	2–3 + 6–7
% HL			Gill rakers	3+13	3+12–13
Pre-narine length	16.6	12.7–15.5	Total gill rakers	16	15–16
Preorbital length	23	21.9–22.2	Premaxillary teeth	38	38–39
Postorbital length	64.9	64.8–65.0	Branchiostegal rays	10	8–10
Eye diameter	15.9	15.6–17.7			

row slightly larger and more widely spaced, inner row composed of smaller, closely packed teeth; maxillary teeth minute, forming a narrow band along upper jaw; dentary teeth densely packed and slightly recurved posteriorly. Total vertebrae 170 in holotype and 151 in one paratype (tail regenerated); vertebrae to origin of anal-fin spine 45–46 (n= 2).

Color. (Figs. 2–4) Fresh color uniformly off-white with a slightly brownish dorsal profile; lateral line faint. Pectoral, pelvic, and caudal fins darker. Opercular region distinctly darker, dark grey to blackish, contrasting with lighter surrounding head; opercular membrane dusky.

Etymology. The specific epithet *elongatus* (Latin: "elongate") refers to the species' slender, laterally compressed body, which tapers gradually posteriorly. The epithet is treated as a masculine singular adjective.

Distribution, habitat & size. The new species is currently known only from the southwestern coast of India in the Arabian Sea, where it occurs at depths of 350–450 m. Maximum recorded size is 412 mm TL (holotype); while the two paratypes are 365 and 385 mm TL.

Comparisons. *Notacanthus elongatus* differs from all currently recognized congeners in possessing a unique combination of meristic and morphometric characters, including 13 or 14 dorsal-fin spines, 28–32 anal-fin spines, 38–66 anal-fin soft rays, a relatively long dorsal-fin base (71.5–78.0% of gnathoproctal length), and a slender, laterally compressed body (body depth 7.5–8.5 in SL). Dorsal-fin spine counts represent an important diagnostic character among species of *Notacanthus*. Reported counts for other species include: *N. indicus* (9–10), *N. sexspinis* (5–10), *N. bonaparte* (6–9), *N. abbotti* (12–15), *N. chemnitzii* (8–12), *N. spinosus* (8–9), and *N. arrontei* (10 or 11) (Bañón et al. 2024).

TABLE 2

Comparative meristic characters of *Notacanthus* species, including *Notacanthus elongatus* n. sp.

Meristic comparative data from Bañón et al. (2024)

Species	Geographic range	Dorsal-fin spines	Anal-fin spines	Anal-fin rays	Pectoral-fin rays	Pelvic-fin formula	Gill rakers	Premaxillary teeth	Branchiostegal rays
N. elongatus n. sp.	Southwest Coast of India	13 or 14	28–32	38–66	11–14	II–IV, 6–7	15 or 16	38 or 39	8–10
N. chemnitzii	Circumglobal?	8–12	20–25	110+	10–17	II–IV, 6–9	12–17	19–37	7–11
N. bonaparte	Northeast Atlantic Ocean	6–9	10–17	117–153	12–16	III–IV, 5–7	13–16	14–23	6
N. arrontei	Iberian Peninsula	10 or 11	13–18	100–125	13–15	III–IV, 6–8	14–17	17–26	9
N. sexspinis	Southern Hemisphere	5–10	13–17	150–160	9–15	I–IV, 6–9	12–16	19–31	6–12
N. abbotti	E. Indian Ocean (off Thailand) & Western & Central Pacific	12–15	12–22	106–131	17–22	III–IV, 6–7	12–15		9 or 10
N. spinosus	Eastern Pacific Ocean	8 or 9	17–20	106–112	14		12	25–30	12 or 13
N. indicus	Indian Ocean	9 or 10	13–16	105	12	III, 7		25–37	12–14

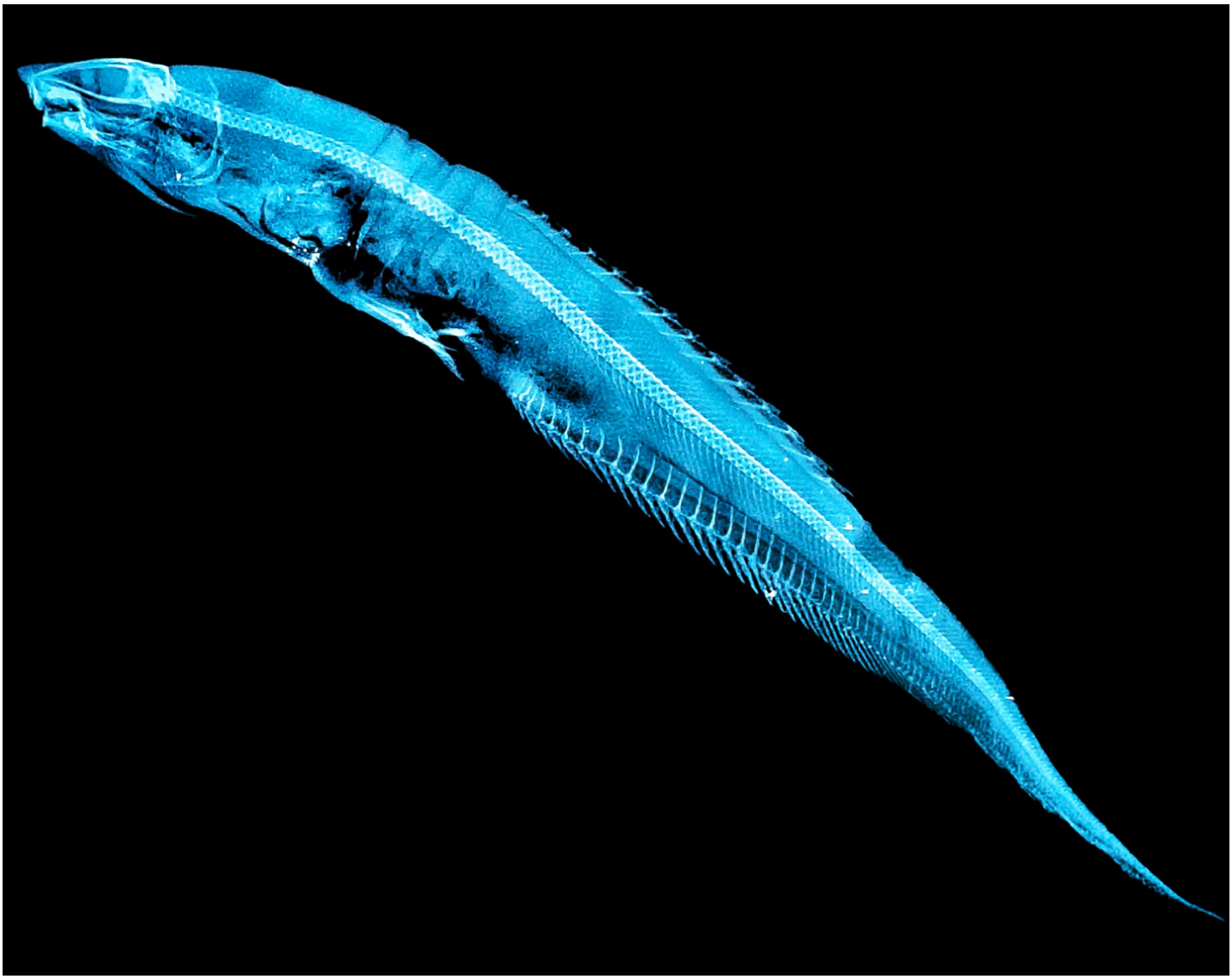


Figure 5. *Notacanthus elongatus* n. sp., x-ray of holotype, ZSI/MBRC/F3578, 412 mm TL, Wadge Bank, Arabian Sea, southwest coast of India (A. Kasinath).

The new species differs from *N. indicus*, the only previously confirmed species reported from Indian waters, in possessing more dorsal-fin spines (13 or 14 vs. 9 or 10), fewer anal-fin soft rays (38–66 vs. 105), a relatively smaller head (head length 4.6–5.7 in SL vs. approximately 4.2 in SL), and slightly smaller eyes relative to head length (5.6–6.4 in HL vs. about 6.5 in HL). In both species, the vent is located beneath the third dorsal-fin spine and the first anal-fin spine originates immediately posterior to the vent, a characteristic feature of notacanthids.

Notacanthus elongatus also differs markedly from the recently described *N. arrontei* in several meristic characters: *N. arrontei* possesses fewer dorsal-fin spines (10–11 vs. 13 or 14) and substantially fewer anal-fin spines (13–18 vs. 28–32), but considerably more anal-fin soft rays (100–125 vs. 38–66). In addition, the dorsal-fin base in *N. arrontei* is shorter (54.3–72% of GPL) than that observed in *N. elongatus* (71.5–78.0% of GPL). The new species further differs from *N. abbotti* and *N. chemnitzii* in possessing a higher number of anal-fin spines (28–32 vs. 12–22 and 20–25, respectively) but markedly fewer anal-fin soft rays (38–66 vs. 106–131 and more than 110, respectively). It can also be distinguished from *N. spinosus*, *N. sexspinis*, and *N. bonaparte* by the combination of higher dorsal and anal-fin spine counts, substantially fewer anal-fin soft rays, and a more slender body form. The new species also differs from the characters originally described for *Notacanthus laccadiviensis* Idreesbabu, Bineesh, Raghavan & Sureshkumar, 2023 (Konhamkakkada et al. 2023), which was reported to possess fewer dorsal-fin spines (12), fewer pectoral-fin rays (10 or 11), and more numerous anal-fin rays (92–94). In contrast, *N. elongatus* possesses 13 or 14 dorsal-fin spines, 11–14 pectoral-fin rays, and 38–66 anal-fin soft rays.

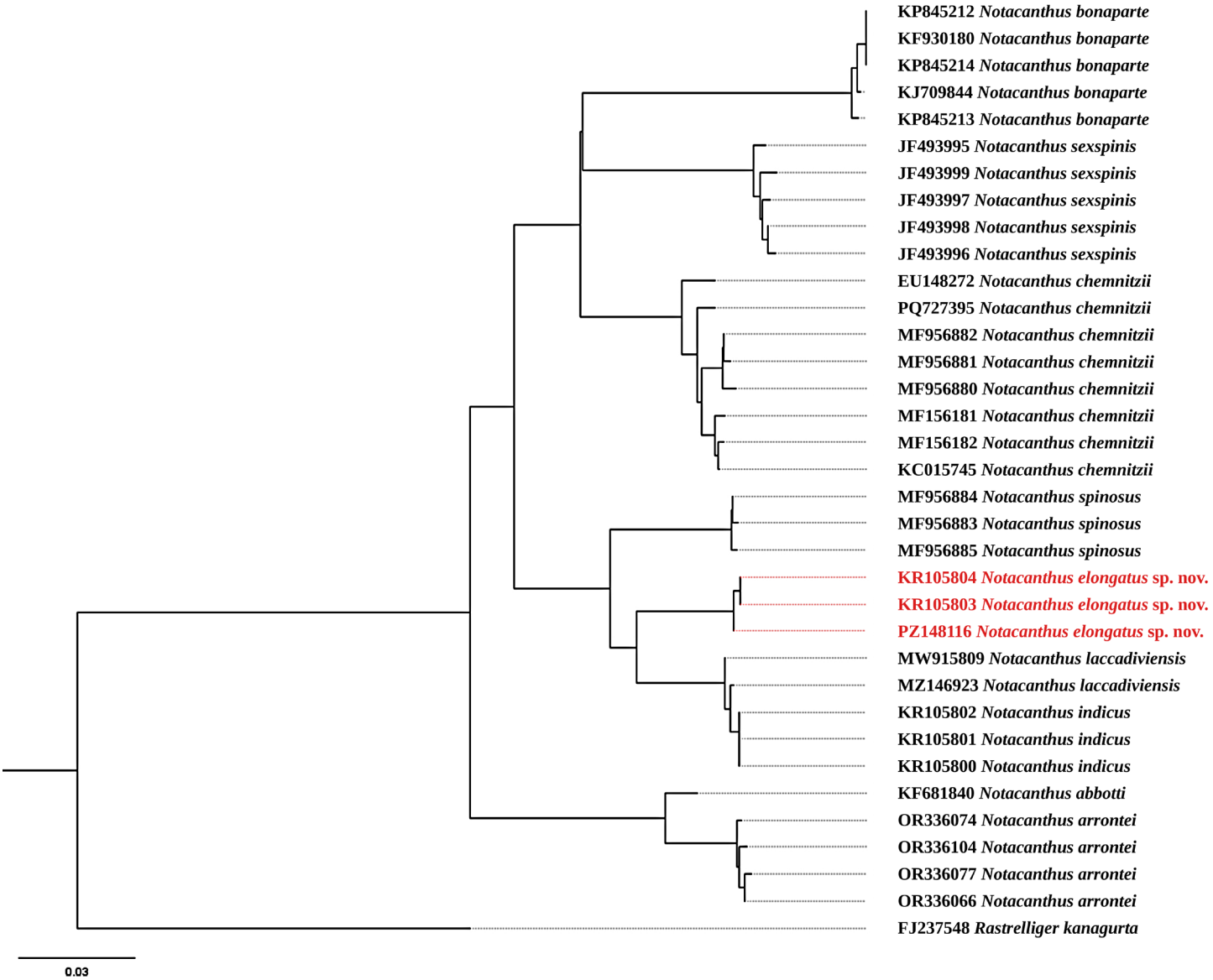


Figure 6. Neighbor-Joining phylogenetic tree of *Notacanthus* species based on mitochondrial COI DNA sequences using the Kimura 2-parameter (K2P) model. *Notacanthus elongatus* n. sp. is highlighted in red. *Rastrelliger kanagurta* was used as the outgroup.

Discussion. The genus *Notacanthus* currently includes 7 recognized species distributed in deep waters of the Atlantic, Indian, and Pacific oceans (Fricke et al. 2026). Deep-sea biodiversity in the Indian Ocean remains poorly explored, and new species continue to be discovered through fisheries bycatch and research surveys. The discovery of *N. elongatus* from the southwest coast of India highlights the limited knowledge of deep-sea fish diversity in this region. *Notacanthus indicus* is the only previously confirmed species of the genus reported from Indian waters. It was originally described by Lloyd (1909) based on a specimen collected from the Arabian Sea off Mumbai. Another species, *N. laccadiviensis*, has been described from the Arabian Sea; however, recent taxonomic work suggested that this species likely represents a junior synonym of *N. indicus* (Bañón et al. 2024). Our molecular results further support this interpretation, as sequences attributed to *N. laccadiviensis* cluster with *N. indicus* in the phylogenetic analysis.

Among recognized species of the genus, *N. chemnitzii* has an almost circumglobal distribution, although it is generally absent from tropical waters (Bañón et al. 2024), whereas the remaining species have more restricted geographic ranges. *Notacanthus bonaparte* occurs in the northeastern Atlantic Ocean and the Mediterranean Sea, *N. arrontei* has been reported from the northeastern Atlantic Ocean around the Iberian Peninsula, *N. sexspinis* is restricted to the Southern Hemisphere, and *N. spinosus* occurs in the eastern Pacific Ocean. *Notacanthus abbotti* is distributed in the eastern Indian Ocean and the western and central Pacific Ocean, whereas *N. indicus* occurs in the Indian Ocean (Bañón et al. 2024). In contrast, *N. elongatus* is currently known only from the southwest coast of India in the Arabian Sea and appears to be geographically isolated from other recognized congeners.

Molecular analyses based on the mitochondrial COI gene further support the distinctiveness of the new species (Fig. 6). Phylogenetic reconstruction using the neighbor-joining method recovered *N. elongatus* as a distinct clade. Genetic distances from the new species calculated with the Kimura two-parameter model range from 4.8–5.3% to *N. indicus*, 5.3–5.7% to *N. spinosus*, 10.0–11.7% to *N. chemnitzii*, 12.1–12.3% to *N. abbotti*, 12.5–12.9% to *N. sexspinis*, 13.4–13.8% to *N. arrontei*, and 15.7–16.4% to *N. bonaparte*. These molecular results, together with the diagnostic morphological characters, clearly support the recognition of *N. elongatus* as a valid species within the genus.

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References

Bañón, R., Barros-García, D., Baldó, F., Cojan, M. & de Carlos, A. (2024) Unveiling taxonomic diversity in the deep-sea fish genus *Notacanthus* (Notacanthiformes: Notacanthidae) with description of *Notacanthus arrontei* n. sp. *Journal of Fish Biology*, 104, 1910–1923. https://doi.org/10.1111/jfb.15734

Bleeker, P. (1874) Typi nonnuli generici piscium neglecti. *Verslagen en Mededeelingen der Koninklijke Akademie van Wetenschappen, Afdeeling Natuurkunde (Serie 2)*, 8, 367–371.

Bloch, M.E. (1788) Ueber zwey merkwürdige Fischarten. *Abhandlungen der Böhmischen Gesellschaft der Wissenschaften*, 3, 278–282, 2 pls.

Fowler, H.W. (1934) Descriptions of new fishes obtained 1907–1910, chiefly in the Philippine Islands and adjacent seas. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 85, 233–367.

Fricke, R., Eschmeyer, W.N. & Van der Laan, R. (Eds.) (2026) *Eschmeyer's catalog of fishes: genera, species, references*. Available at: http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp (accessed 9 March 2026)

Garman, S. (1899) The fishes. Reports on an exploration off the west coasts of Mexico, Central and South America, and off the Galápagos Islands by the U.S. Fish Commission steamer "Albatross" during 1891 (No. XXVI). *Memoirs of the Museum of Comparative Zoology*, 24, 1–431, pls. 1–85 + A–N.

Goode, G.B. & Bean, T.H. (1895) A revision of the order Heteromi, deep-sea fishes, with a description of the new generic types *Macdonaldia* and *Lipogenys*. *Proceedings of the United States National Museum*, 17 (1013), 455–470, pl. 18.

Goodrich, E.S. (1909) Vertebrata Craniata (first fascicle: cyclostomes and fishes) *In*: R. Lankester (Ed.), *A treatise on zoology (Pt. 9, pp. i–xvii + 1–518)*, A. & C. Black, London, UK.

Hall, T.A. (1999) BioEdit: a user-friendly biological sequence alignment editor and analysis program for Windows 95/98/NT. *Nucleic Acids Symposium Series*, 41, 95–98.

Hashim, M. (2012) *Distribution, diversity and biology of deep-sea fishes in the Indian EEZ*. PhD thesis, Cochin University of Science and Technology, Kochi, India.

Hubbs, C.L. & Lagler, K.F. (1970) *Fishes of the Great Lakes region (2nd edition)*. University of Michigan Press, Ann Arbor, MI, USA, 332 pp.

Konhamkakkada, I., Kinattumkara, B., Raghavan, R. & Sivanpillai, S. (2023) A new species of spiny eel of the genus *Notacanthus* Bloch 1788 (Notacanthiformes: Notacanthidae) from the Indian Ocean. *Journal of Fish Biology*, 103, 113–117. https://doi.org/10.1111/jfb.15408

Kumar, S., Stecher, G., Suleski, M., Sanderford, M., Sharma, S. & Tamura, K. (2024) MEGA12: Molecular Evolutionary Genetics Analysis version 12 for adaptive and green computing. *Molecular Biology and Evolution*, 41, msae263. https://doi.org/10.1093/molbev/msae263

Lloyd, R.E. (1909) A description of the deep-sea fish caught by the R.I.M.S. ship Investigator since the year 1900, with supposed evidence of mutation in *Malthopsis*. *Memoirs of the Indian Museum*, 2, 139–180.

McDowell, S.B. (1973) Order Heteromi (Notacanthiformes) Suborder Notacanthoidei, family Notacanthidae; suborder Notacanthoidei, family Lipogenyidae. *In*: Cohen, D.M., Atz, J.W., Berry, F.H., Böhlke, J.E., Gibbs Jr., R.H., Lachner, E.A., Mead, G.W. & Merriman, D. (Eds.), *Fishes of the western North Atlantic.* Sears Foundation for Marine Research, New Haven, CT, USA, pp. 124–228

Nelson, J.S., Grande, T.C. & Wilson, M.V.H. (2016) *Fishes of the World (5th edition)*. John Wiley & Sons, Hoboken, NJ, USA, 752 pp.

Rajeeshkumar, M.P., Meera, K.M. & Hashim, M. (2017) A new species of the deep-sea ceratioid anglerfish genus *Oneirodes* (Lophiiformes: Oneirodidae) from the western Indian Ocean. *Copeia*, 105, 82–84. https://doi.org/10.1643/CI-16-467

Rajeeshkumar, M., Pietsch, T.W. & Saravanane, N. (2022) A new species of deep-sea anglerfish, genus *Himantolophus* (Lophiiformes: Himantolophidae) from the Andaman Sea, India. *Zootaxa*, 5178, 589–594. https://doi.org/10.11646/zootaxa.5178.6.6

Rambaut, A. (2018) *FigTree v1.4.4*. Available at: http://tree.bio.ed.ac.uk/software/figtree/ (accessed 10 March 2026)

Richardson, J. (1846) Ichthyology of the voyage of H.M.S. Erebus & Terror. *The zoology of the voyage of H.M.S. Erebus & Terror during the years 1839–1843*, (2), 54, pl. 32 (figs. 4–11), E. W. Janson, London, UK,

Risso, A. (1840) Observations sur quelques poissons de la mer de Nice. *Archiv für Naturgeschichte*, 6 (1), 376–393, pl. 10.

Sulak, K.J. (1986) Notacanthidae. *In*: Whitehead, P.J.P. Bauchot, M.L., Hureau, J.C., Nielsen, J. & Tortonese, E. (Eds.), *Fishes of the northeastern Atlantic and the Mediterranean (Vol. 2)*, UNESCO, Paris, France, pp. 599–603.

Venu, S. (2009) *Systematics, distribution and bionomics of deep-sea fishes beyond 200 m depth along the southwest coast of India*. PhD thesis, Cochin University of Science and Technology, Kochi, India.

Ward, R.D., Zemlak, T.S., Innes, B.H., Last, P.R. & Hebert, P.D.N. (2005) DNA barcoding Australia's fish species. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 360 (1462), 1847–1857. https://doi.org/10.1098/rstb.2005.1716