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Sphyraena arabiansis a new species of barracuda (Family: Sphyraenidae) from the south-west coast of India

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ABSTRACT

A new species of barracuda *Sphyraena arabiansis* is described based on specimens collected from the eastern Arabian Sea off Kerala coast, India. The new species is morphologically similar to *Sphyraena barracuda* and both were so far considered as one species. Characters such as more and relatively small cycloid scales, 118-122 along lateral line, 11 along vertical axis above lateral line at first dorsal and 13 below the lateral line at anal origin; broad, round spoon shaped maxilla ending vertically below, before the anterior margin of the eye, narrow inter orbital area (4.2-5.13 in head length) and more prominent pointed paired central lobes of caudal fin make *Sphyraena arabiansis* sp. nov. clearly distinct from *S. barracuda*. Other distinguishing characters are prominent curve of the lateral line before the origin of first dorsal fin, absence of black spots on the body, white branchiostegal membrane, broad, thick and inwardly curved otoliths with round, blunt posterior end and an elongated, pointed anterior upper lobe. The mitochondrial Cytochrome oxidase C subunit 1 (COI) gene sequence studies revealed that the new species has distinct genetic divergence from *S. barracuda* and other species of the family occurring in the area.

Keywords: Arabian barracuda, Arabian Sea, COI barcode, *Sphyraena arabiansis*, *Sphyraena barracuda*

Introduction

The barracudas (Sphyraenidae: Perciformes) are marine pelagic predatory fishes, distributed in tropical and subtropical oceans (Williams, 1959; Blaber, 1982) and they occupy an important position in the marine food web as apex predators (de Sylva, 1963; 1973; Friedlander and de Martini, 2002). Twenty nine valid species represent the family globally (Eschmeyer and Fong, 2013) and only nine species have been reported from Indian waters *viz*., *Sphyraena acutipinnis* Day 1876, *S. barracuda* (Edwards 1771), *S. jello* Cuvier 1829, *S. putnamae* Jordan and Seale 1905*, S. qenie* Klunzinger 1870, *S. forsteri* Cuvier 1829*, S. obtusata* Cuvier 1829*, S. flavicauda* Ruppell 1838, *S. chrysotaenia* Klunzinger 1884 and *S. helleri* (Jenkins, 1901). The present paper describes a new species of barracuda, *Sphyraena arabiansis* sp. nov. from the Arabian Sea off Lakshadweep Islands.

Materials and methods

Specimens of *Sphyraena arabiansis* sp. nov. were collected from commercial fish landings at Cochin Fisheries Harbour Kerala situated along the south-west coast of India, during 2012-2013. The species was caught by hooks and line fishing units operating in Lakshadweep waters and associated seamount. Morphometric measurements were made using digital vernier caliper to the nearest millimeter following Hubbs and Lagler (1958). A total of 34 specimens of *S. arabiansis* sp. nov. ranging in size between 385 and 1420 mm standard length (SL) and 27 of *S. barracuda* of size range 589 and 1288 mm SL were analysed. Results of detailed examination of the holotype and paratypes are presented in this paper. All measurements and colour descriptions were made using fresh specimens. The holotype and paratype specimens were deposited in the Marine Biodiversity Referral Museum of Central Marine Fisheries Research Institute, Kochi, India.

Genetic variation between species were assessed for confirmation following standard protocols (Miller *et al.,* 1988; Ward *et al.,* 2005). Tissue samples were collected and preserved in 99.5% ethanol at ambient temperature, total DNA was extracted and mitochondrial Cytochrome oxidase C subunit 1 (COI) barcode was generated. The sequence data so generated were submitted to the NCBI Gene bank.

Results

Sphyraena arabiansis sp. nov. Abdussamad and Retheesh

Fig. 1-6 and Table 1-2 *Holotype***:** CMFRI GB 31.143.2.1, 850 mm SL, collected Lakshadweep Islands, south-eastern Arabian Sea, India, 28 December 2012 (Fig. 1). Gene Bank Accession number RA18 KF590625.

Fig. 1. Lacteral view of *Sphyraena arabiansis* sp. nov. CMFRI GB 31.143.2.1, 850 mm SL

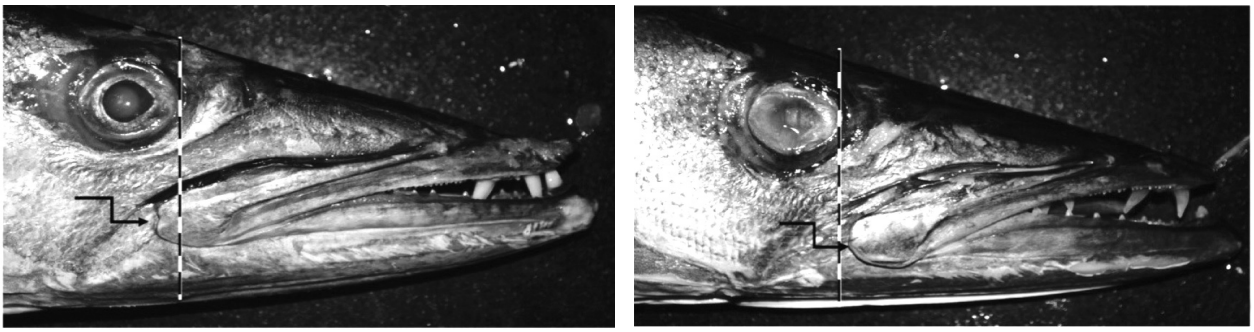
Paratypes: CMFRI GB 31.143.2.1.1, 812 mm SL; collected Lakshadweep Islands, India, south-eastern Arabian Sea, 28 December 2012. Gene Bank Accession number RA5 KF590626; CMFRI GB 31.143.2.1.2, 857 mm SL; collected Lakshadweep Islands, India, south-eastern Arabian Sea, 28 December 2012.

Diagnosis: A large sized barracuda, with following distinguishing characters. Numerous, small cycloid scales all along body, Lateral line scales 118-122; broad, rounded maxilla ending vertically below before the anterior margin of the eye; narrow inter orbital area (4.20-5.13 in head length); paired central lobes of caudal fin prominently pointed. Lateral line curved before the origin of first dorsal fin. Branchiostegal membrane in the opercular region white. No black spots on the body.

Description: First dorsal fin V; second dorsalfin I, 10; pectoral-fin I, 14; pelvic fin I, 5; anal fin I, 9; lateral line scales 118 - 122; Gillrakers absent. Branchiostegal rays 7; 11 scales above the lateral line to first dorsal origin; 13 scales below lateral line to anal fin origin (Table 1). Body fusiform, elongated, sub-cylindrical and pike like in appearance; body depth 7.22-7.66 in SL; head long, HL 2.03-2.11 times body depth at dorsal origin. Long and pointed snout, snout length 3.46-4.35 times orbit length; mouth large. Jaws elongate, lower jaw projecting beyond the upper when closed, upper jaw length 2.29-2.33 in HL. Teeth prominent, fang like, sharp and of varying size, arranged in sockets of lower jaw and roof of the upper jaw. Two canine teeth on upper jaw and one at the tip of the lower jaw. Maxilla broad, rounded and spoon shaped posteriorly, reaching to anterior margin of the eye in vertical or slightly before (Fig. 2). Eye large, eyes 8.14-9.35 in HL; narrow inter orbital area (4.20-5.13 in head length); caudal peduncle depth 4.25-5.01 in head length; caudal peduncle length 1.41-1.73 in head length. Two widely separated dorsal fins, first dorsal fin origin posterior to pectoral fin insertion, first dorsal fin base length 6.34-8.18% SL; pectoral fins below the level of eyes. Lateral line very prominent and curved before the origin of first dorsal fin. Body covered with relatively small cycloid scales; Body depth at second dorsal fin origin 12.45-13.38% SL (Table 2). Anal fin height 4.25-4.67% SL; pelvic fin relatively short,

Table 1. Meristic counts of holotype and paratype specimens of *Sphyraena arabiansis* sp. nov.

Meristic characters	Holotype CMFRI GB 31.143.2.1.	Paratype CMFRI GB 31.143.2.1.1	Paratype CMFRI GB 31.143.2.1.2	Specimen not retained
1D spines	5	5	5	5
II D spines	1	1	1	1
II D rays	10	10	10	10
Anal spines	1	1	1	1
Anal rays	9	9	9	9
Pectoral spine	1	1	1	1
Pectoral rays	14	14	14	14
Pelvic spines	1	1	1	1
Pelvic rays	5	5	5	5
Vertical scales at 1ID lat. line	11	11	11	11
Vertical scales at anal lat. line	13	13	13	13
Branchiostegal rays	7	7	7	7
Lateral line scales	120	120	122	118



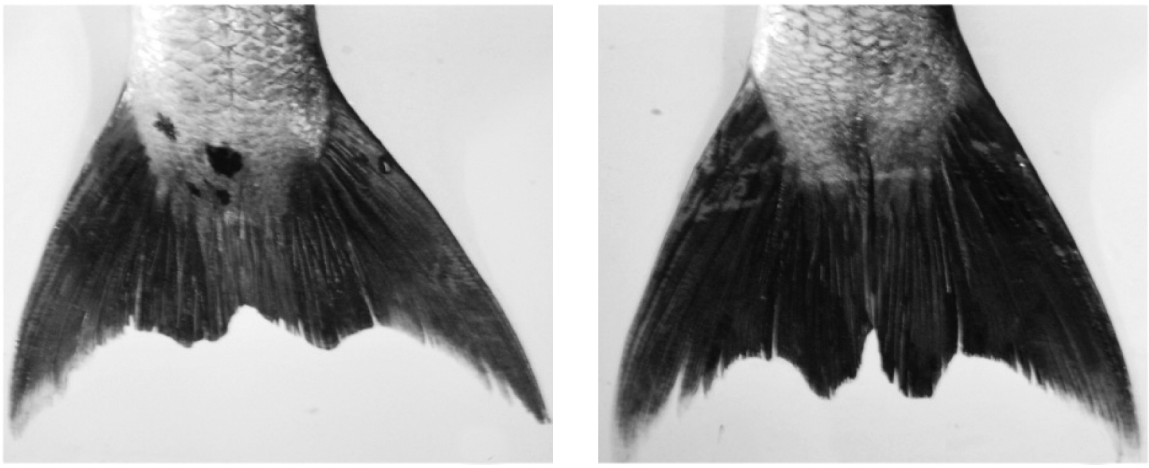
(a) (b)

Fig. 2. Maxillary position and shape of (a) *S. barracuda;* (b) *S. arabiansis*

3.32-3.56 in HL. Caudal fin tetra-lobed with prominently pointed central lobes (Fig. 3). Otolith broad and thick, lower and upper margins curved inward to form a central channel (Fig. 4). Upper half elongated anteriorly to a pointed lobe and with two prominent teeth ventrally, posterior margin round and blunt.

Colour (when fresh): Dark bluish dorsally, silvery below; 20-22 distended forward arrow shaped dark bars on the body crossing the lateral line. First dorsal fin membrane black. Second dorsal and anal fin black with white tips for first and last rays. Pelvic fin membrane black with white rays. Caudal fin dark with lobe tips white. Branchiostegal membrane white (Fig. 5).

rounded and spoon shaped posteriorly, ending vertically below, before the anterior margin of the eye, compared to bilobed posterior end, ending vertically below the eye in line with anterior margin of the pupil in *S. barracuda*. Narrow inter orbital area 0.159 of head length (HL) in the new species compared to 0.246 in *S. barracuda*. Paired central lobes of caudal fin relatively more pointed in *S. arabiansis*. Otolith broad and curved with blunt posterior margin in new species, where as

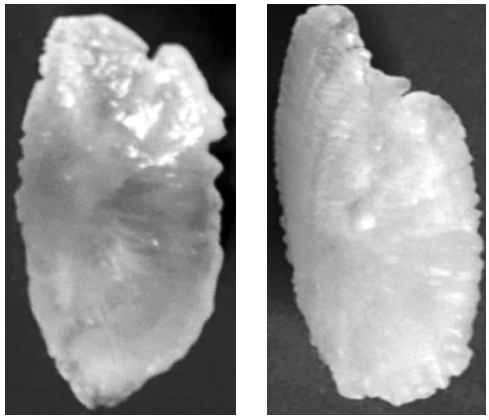


(a) (b)

Fig. 3. Caudal fin of (a) *S. barracuda;* (b) *S. arabiansis*

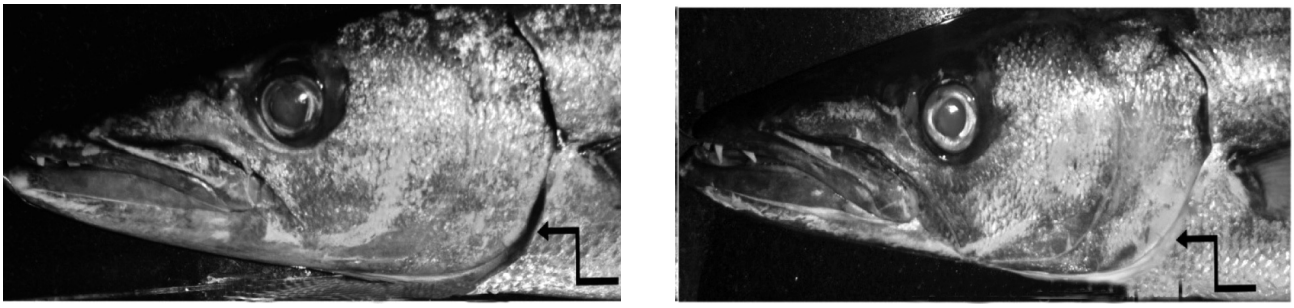
Comparison

Sphyraena arabiansis sp. nov. exhibit close morphological resemblance with *S. barracuda.* More numerous and relatively smaller lateral line scales (118-122) in the former clearly distinguishes it from the latter (Table 3 and 4). Vertical scales are also more numerous in the new species, between lateral line and first dorsal origin and lateral line and anal origin. Maxilla broad,



(a) (b)

Fig. 4. Otolith of (a) *S. barracuda;* (b) *S. arabiansis*



(a) (b)

Fig. 5. Colour pattern of branchiostegal membrane of (a) *S. barracuda* - black; (b) S. *arabiansis* - white

Table 2. Morphometric measurements of holotype and paratype specimens of *Sphyraena arabiansis* sp.nov.

Morphometric characters	Holotype CMFRI GB 31.143.2.1.	Paratype CMFRI GB 31.143.2.1.1	Paratype CMFRI GB 31.143.2.1.2	Specimen not retained	Min	Max
Total length (mm)	1000	935	1006	916		
Fork length (mm)	950	880	934	854		
Standard length, SL (mm)	850	812	857	800		
Head length (%SL)	27.53	28.90	27.70	28.50	27.53	28.90
Snout length (%SL)	13.29	12.48	12.16	12.13	12.13	13.29
Eye diameter (%SL)	3.06	3.35	2.96	3.50	2.96	3.50
Inter orbital width (%SL)	5.36	6.87	6.31	6.79	5.36	6.87
Distance from snout to first dorsal (%SL)	41.18	40.15	37.57	38.50	37.57	41.18
Distance from snout to second dorsal (%SL)	69.41	67.36	67.79	67.63	67.36	69.41
Distance from snout to pectoral (%SL)	28.24	27.96	27.04	26.88	26.88	28.24
Distance from snout to pelvic (%SL)	35.41	33.89	33.61	33.75	33.61	35.41
Distance from snout to anal (%SL)	70.59	70.69	69.66	71.25	69.66	71.25
Depth at first dorsal origin (%SL)	13.05	13.88	13.62	13.63	13.05	13.88
Depth at second dorsal (%SL)	12.66	12.45	12.96	13.38	12.45	13.38
First dorsal fin height (%SL)	7.75	7.75	7.15	7.75	7.15	7.75
Body width at first dorsal origin (%SL)	9.06	9.25	9.30	9.38	9.06	9.38
Body width at second dorsal (%SL)	7.98	8.26	8.05	8.25	7.98	8.26
Post orbital length (%SL)	11.53	11.58	11.67	11.50	11.50	11.67
Head depth (%SL)	11.06	8.71	7.86	8.50	7.86	11.06
Upper jaw length (%SL)	12.00	12.48	11.90	12.38	11.90	12.48
First dorsal fin base length (%SL)	6.34	7.27	8.18	8.00	6.34	8.18
Second dorsal fin height (%SL)	10.59	9.78	9.92	9.63	9.63	10.59
Second dorsal fin base length (%SL)	8.99	8.62	8.75	8.63	8.62	8.99
Distance from pelvic to anal (%SL)	36.47	37.19	36.17	36.88	36.17	37.19
Anal fin base length (%SL)	8.13	8.18	7.78	7.75	7.75	8.18
Pectoral length (%SL)	10.94	11.17	11.35	10.63	10.63	11.35
Second dorsal height (%SL)	5.06	4.88	4.70	5.50	4.70	5.50
Anal fin lobe height (%SL)	4.59	4.25	4.67	4.38	4.25	4.67
Pelvic fin length (%SL)	8.29	8.26	8.23	8.00	8.00	8.29
Caudal peduncle depth (%SL)	6.06	5.76	6.51	6.50	5.76	6.51
Caudal peduncle width (%SL)	3.61	3.04	3.56	3.38	3.04	3.61
Caudal peduncle length (%SL)	19.53	16.75	17.15	16.49	16.49	19.53
Snout to anus length (%SL)	67.06	67.12	66.74	68.13	66.74	68.13

it is flat and straight with pointed posterior margin in *S. barracuda.*

Molecular results

The molecular genetic distance of intraspecies ranged between 0.000 and 0.007, while it was between 0.111 and 0.273 for interspecies. Two specimens of *S. arabiansis* clustered, but well separated from (D11.1%), the three specimens of similar species, *S. barracuda.* The COI sequences of species. *S.barracuda* and *S. arabiansis,* exhibited clear barcode split (11.1% divergence) congruent with their morphological differences. The neighbour joining trees revealed very distinct species clusters (Fig. 6). The average interspecies distance among the seven collected species of barracuda was 15.4%.

Distribution and habitat

S. arabiansis is presently known only from the oceanic waters off south-west coast of India, in the Arabian Sea around the Lakshadweep Islands and adjacent seamounts.

Table 3. Distinguishing characters of *Sphyraena arabiansis* and *Sphyraena barracuda*

Sphyraena arabiansis sp. nov.	*Sphyraena barracuda*
➢ Body covered with relatively small cycloid scales, lateral line scales 118-122; vertical scales above lateral line to first dorsal origin 11; below lateral line to anal origin 13	➢ Scales relatively large and less numerous, 80-87 along lateral line; vertical scales above lateral line to I D origin and below lateral line to anal origin 10 each.
➢ Maxilla broad, rounded and spoon shaped posteriorly, ending vertically below, at, or before the anterior margin of the eye	➢ Posterior margin of maxilla with a notch giving bilobed appearance, with both lobes rounded, ending vertically below the eye before the anterior margin of the pupil.
➢ Inter-orbital area relatively narrow 4.20-5.13 in head length (HL)	➢ Inter orbital area relatively broad, 0.246 of head length (HL).
➢ Paired central lobes of caudal fin relatively more pointed	➢ Paired central lobes of caudal fin blunt and less pointed
➢ Otolith broad and thick, lower and upper margin curved inwards to form a central channel. Upper half elongated anteriorly to a pointed lobe and with two prominent teeth ventrally. Posterior end round and blunt	➢ Otolith broad and thick, surface flat with straight lower and upper margins. Anterior part bilobed with broad and blunt upper lobe projecting beyond small, rounded lower lobe.Posterior margin nearly pointed.
➢ Posterior margin of branchiostegal membrane white	➢ Posterior margin of branchiostegal membrane black
➢ No black blotches on the body	➢ 3-5 irregular black blotches on the lower side towards the posterior half of the body
➢ 20-22 distended forward arrow shaped dark bars on the body crossing the lateral line	➢ Diagonal dark bars 17-19, not crossing the lateral line

Table 4. Meristic counts and extent of variation between the new species, *S. arabiansis* and the morphologically similar species *S. barracuda*

Meristic parameters	*S. arabiansis* (A)	*S. barracuda* (B)	Variation (D = A-B)
1D spines	5	5	0
2 ID spines	1	1	0
2 ID rays	10	10	0
Anal spines	1	1	0
Anal rays	9	9	0
Pectoral spine	1	1	0
Pectoral rays	14	14	0
Pelvic spines	1	1	0
Pelvic rays	5	5	0
Vertical scales at I D origin to lateral line	11	10	1
Vertical scales at anal origin to lateral line	13	10	3
Branchiostegal rays	7	7	0
Lateral line scales	118-122	80-87	35-38

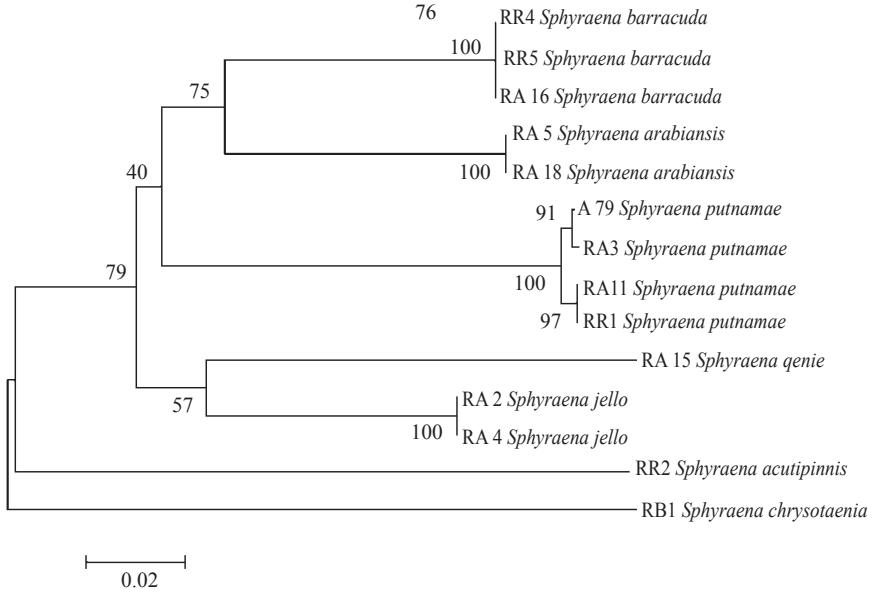


Fig. 6. K2P distance neighbour-joining tree of mitochondrial COI sequences from the species under genus *Sphyraena* from southern Arabian Sea

They were caught in hook and line and gillnets, along with the great barracuda (*S. barracuda),* dolphin fishes and rainbow runners.

Etymology

The new species is named *S. arabiansis* with reference to the collection area Arabian Sea. Proposed common name is *Arabian barracuda* and vernacular name *Neelan seelav.*

Remarks

Earlier reports indicated the presence of only ten species of barracuda around the Indian peninsula. De Silva (1973) reviewed the taxonomy of barracuda species in the Indian Ocean and adjacent seas and reported 11 species. The newly described species, *S. arabiansis* was earlier misidentified as *S. barracuda,* because of its morphological similarities.

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