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Range extension of two deep-sea peristediid fishes (Scorpaenoidei: Peristediidae) to the Arabian Sea, Northern Indian Ocean

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The present communication is based on the report of two peristediid fishes of the family Peristediidae from the southeastern Arabian Sea. Both specimens were collected as by catch from deep-sea shrimp trawlers operating at Sakthikulangara fishing harbour, Kollam, Kerala, India, at depths ranging from 200 to 420 m. The specimens were identified as *Scalicus orientalis* (Fowler, 1938) and *Peristedion riversandersoni* Alcock, 1894. Notably, the present study documents the first occurrence of these peristediid fishes in the Arabian Sea. This paper presents and discusses the detailed morphometric and meristic characteristics of these species, along with previous distributional records.

[**Keywords**: Armored searobins, Bycatch, Indian Ocean, New record, Scorpaenoidei]

Introduction

The scorpaenoid fishes represent one of the largest and most morphologically diverse groups of teleosts, comprising over 1,400 species found in both shallow waters and mid to great depths[1-3]. These fishes exhibit tremendous diversity in both morphology and habitat in which they reside[4], making them one of the most challenging groups for the taxonomists due to their taxonomic ambiguities and collection difficulties[5]. Among them, fishes belonging to the family Peristediidae, commonly known as armoured gurnards or searobins, are moderately sized demersal marine fishes that inhabit the continental shelf and slope at depths ranging from 30 – 1324 m[6-9]. Currently, the family consist of six valid genera: *Gargariscus* Smith 1917, *Peristedion* Lacepède 1801, *Satyrichthys* Kaup 1873, *Scalicus* Jordan 1923, *Heminodus* Smith 1917 and *Paraheminodus* Kamohara 1957[(refs. 6,10)]. *Peristedion* is the most speciose genus in its family, with 25 valid species identified to date. Of these, twelve species are known from the western Atlantic[11,12] *viz*., *Peristedion miniatum* Goode, 1880; *P. brevirostre* (Günther, 1860); *P. altipinne* Regan, 1903; *P. antillarum* Teague, 1961; *P. ecuadorense* Teague, 1961; *P. longispatha* Goode & Bean, 1886; *P. greyae* Miller, 1967; *P. gracile* Goode & Bean, 1896; *P. imberbe* Poey, 1861; *P. truncatum* (Günther, 1880); *P. unicuspis* Miller, 1967; and *P. thompsoni* Fowler, 1952[(ref. 13)]. Four species comprising *P. crustosum* Garman, 1899; *P. barbiger* Garman, 1899; *P. paucibarbiger* Castro-Aguirre & García-Domínguez, 1984; and *P. nesium* Bussing, 2010; are described from the eastern Pacific, two species *viz*., *P. longicornutum* Fricke, Kawai, Yato & Motomura, 2017 and *P. nierstraszi* Weber, 1913 are described from the western Pacific and a single species *P. cataphractum* (Linnaeus, 1758) from the eastern Atlantic and Mediterranean[11]. Six species *viz*., *P. amblygenys* Fowler, 1938; *P. liorhynchus* (Günther, 1872); *P. orientale* Temminck & Schlegel, 1843; *P. richardsi* Kawai, 2016; *P. riversandersoni* Alcock, 1894; and *P. weberi* Smith, 1934 are described from the Indo-West Pacific[7,8,14]. Besides, the genus *Scalicus* comprises only 6 species *viz*., *Scalicus quadratorostratus* (Fourmanoir & Rivaton, 1979); *S. hians* (Gilbert & Cramer 1897); *S. engyceros* (Günther 1872); *S. orientalis* (Fowler, 1938); *S. serrulatus* (Alcock, 1898); and *S. paucibarbatus* Kawai, 2019 and their distribution is restricted to the Indo-West Pacific[10,15]. The present study contributes valuable insights into the range

extension of two deep-sea demersal scorpaenoid fishes belonging to the family Peristediidae in the Arabian Sea. The deep-sea, the largest habitat on Earth, is under-studied due to logistical and technical constraints, leaving its ecosystem characteristics not fully understood[16]. The biology and distribution of deep-sea resources remain largely mysterious, with limited information available on their stock size in the Indian Exclusive Economic Zone (EEZ)[17,18]. In the above circumstances, findings of the present study underscore the need for more exploratory studies to understand the hidden diversity of scorpaenoid fishes inhabiting the deeper waters of the Indian EEZ.

Materials and Methods

Two specimens, one each of *P. riversandersoni* and *S. orientalis* were collected from Sakthikulangara fish landing centre, Kollam, Kerala, Southwest coast of India (8°35' N – 9°55' N; 75°30' E – 76°15' E) (Fig. 1). The specimens were preserved in 5 % formalin and taken to the fishery laboratory at Centre for Marine Living Resources and Ecology (CMLRE), Kochi for further analysis. Fishes were photographed (Fig. 2) and identified using available taxonomic keys and published literature[7,15,19,20]. Counts, measurements and terminology followed Kawai *et al.*[21] and Kawai[22]. The rostral projection lengths and widths of *S. orientalis* and *P. riversandersoni* were determined following Kawai[10] and Ono & Kawai[14], respectively. The interspace between rostral projections of *P. riversandersoni* was measured according to Kawai[7]. All measurements were taken from specimens preserved in formalin using a digital vernier calliper and are expressed in millimeter (mm). Bony plates of both species were visualized under the stereo zoom microscope (Model: Leica M80), and the magnified images were captured. Comparative data for *P. riversandersoni* were obtained from Alcock[23], Kawai & Hsuan-Ching[20], and for *S. orientalis* from Fowler[24] and Fricke[15]. Both specimens are deposited under the accession numbers IO/OV/FIS/00734 and IO/OV/FIS/00735 at the CMLRE Referral Centre, which functions as the regional node for the Ocean Biodiversity Information System (OBIS) in the Indian Ocean.

Results

Systematic position

Suborder: Scorpaenoidei
Family: Peristediidae Jordan & Gilbert 1883
Genus: *Peristedion* Lacepède, 1801
Peristedion riversandersoni Alcock, 1894

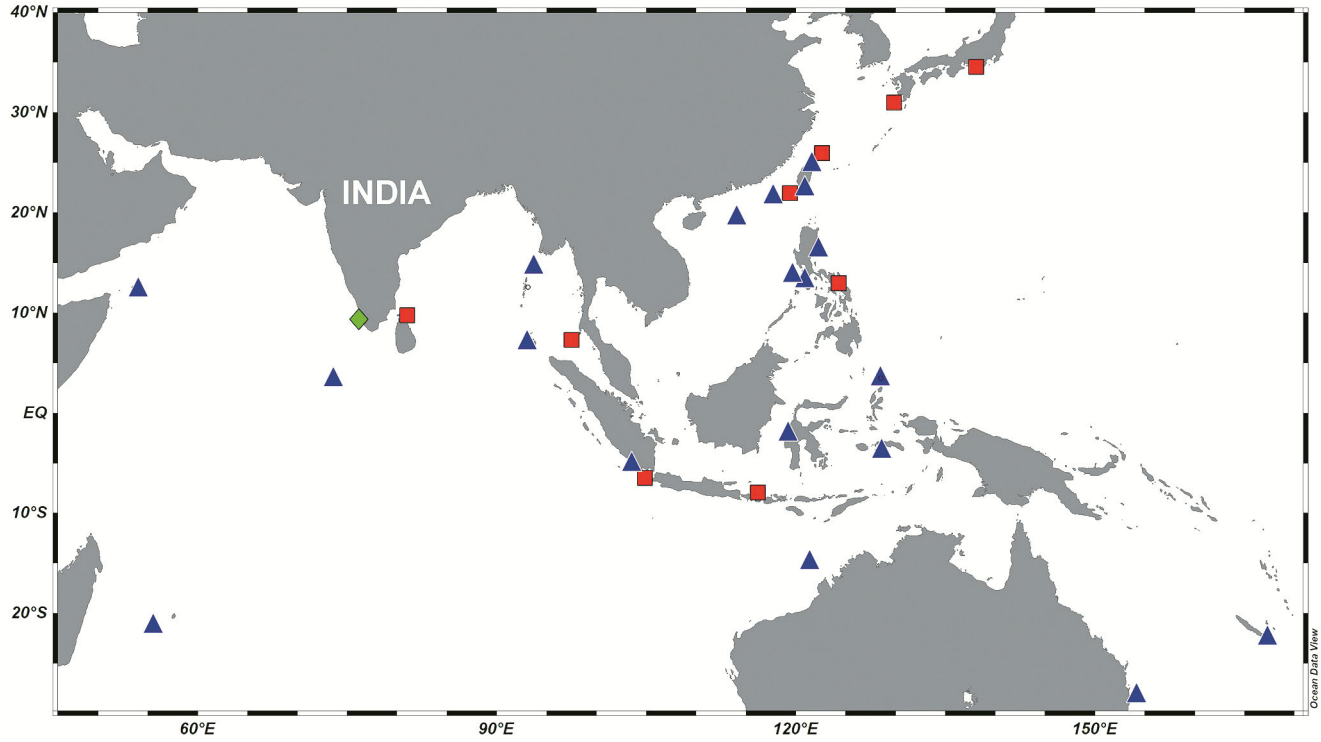

Fig. 1 — Map showing global distribution of *Scalicus orientalis* (blue triangle) and *Peristedion riversandersoni* (red box); present records (green diamond)

Material examined

IO/OV/FIS/00734, 152 mm SL, Sakthikulangara fishing harbour, Kerala, Southeastern Arabian Sea (Lat 8°35' N – 9°55' N; Long 75°30' E – 76°15' E), 200 – 420 m depth, coll. Davood Nihal, May 2022.

Description

Upper jaw lacks teeth, head large and depressed, with a relatively smooth lateral margin; mouth large and positioned inferiorly; rostral projection long and triangular in shape, lower lateral rows of bony plates contralaterally sutured posteriorly along the midline; 21 dorsal fin rays and 21 anal fin rays; anterior edge of 4th sensory pore of rostral projection located on the anterior to anterior edge of premaxilla, prominent perifacial rim and a rounded inner margin at base of rostral projection. Measurements and proportions are given in Table 1.

Fig. 2 — Formalin preserved specimens of *Peristedion riversandersoni* and *Scalicus orientalis* collected from the Arabian Sea

Table 1 — Morphometric and meristic data for *Peristedion riversandersoni* and *Scalicus orientalis* compared with previous study

Morphological characters	*Peristedion riversandersoni*			*Scalicus orientalis*		
	IO/OV/FIS/00734	Holotype ZSI 13469 (Alcock A W 1894)	NMMB-P30869 (Kawai and Hsuan-Ching 2019)	IO/OV/FIS/00735	Holotype USNM 98876 (Fowler 1938)	MHNRUN P-547 (Fricke 2020)
Standard length (mm)	152	68.1	137.8	141	146.1	176.3
Body depth	20.18	15.4	11.8 – 13.7	23.2	20.8	26.4
Body width	19.07	10.3	10.8 – 12.3	19.6	13.2	25.3
Head length	37.97	37	30.8 – 32.1	46.7	39.2	61.5
Distance from snout to dorsal fin	43.08	37.3	31.6 – 32.8	55.3	41	62.8
Distance from snout to anal fin	59.98	No data	44.4 – 48.6	71.3	50.9	80.7
Distance from snout to anus	57.24	41.9	39.6-43	65	45.6	71.9
Snout length	19.23	16.9	14.4-15.2	25.3	20.7	30.4
Rostral projection length	17.13	No data	13.4-16.1	10	7.7	15.2
Rostral projection width	5.67	3.5	2.8-3.3	9.1	5.7	11.4
Filamentous barbel length	15.8	9.8	11.6-14.6	59	44.1	62
Upper jaw length	16.13	14.5	12-12.6	24.8	17.7	26.2
Lower jaw length	14.61	14.4	12-12.8	20.1	15.5	22.8
Orbital diameter	11.22	9.8	8.2-8.3	12	9.7	16.6

(*contd.*)

Table 1 — Morphometric and meristic data for *Peristedion riversandersoni* and *Scalicus orientalis* compared with previous study (*contd.*)

Morphological characters	*Peristedion riversandersoni*			*Scalicus orientalis*		
	IO/OV/FIS/00734	Holotype ZSI 13469 (Alcock A W 1894)	NMMB-P30869 (Kawai and Hsuan-Ching 2019)	IO/OV/FIS/00735	Holotype USNM 98876 (Fowler 1938)	MHNRUN P-547 (Fricke 2020)
Pectoral fin length	23.17	17.2	15.6-17.6	30	19.8	18.6
Length of upper detached pectoral fin rays	29.11	No data	21.3-22.9	27	Damaged	19.7
Length of lower detached pectoral fin rays	23.82	No data	17.3-18.3	23	16	14.5
Pelvic fin length	24.3	No data	17.1-17.6	21.8	17.4	31.9
First dorsal spine length	11	No data	8.5-10.2	11.9	9.2	16.7
Caudal peduncle length	16	9.8	9.3-11.8	16.8	8.4	19.4
Caudal peduncle depth	4	No data	1.9-2	4.2	2.5	5.1
Counts						
Dorsal fin spines	VIII	VIII	VIII	VII	VII	VII
Dorsal fin rays	21	21	20-23	21	21	21
Anal fin rays	21	21	21-23	21	21-22	21
Caudal fin rays	11	No data	11-12	10	No data	No data
Pectoral fin rays including two free rays	15	14	14-15	14	14	16
Pelvic fin rays	I, 5	I, 5	I, 5	I, 5	I, 5	No data
Bony plates in dorsal row	31	31	31-33	25	30	29
Bony plates in lower lateral row	26	26	26-28	24	24-25	27
Bony plates in ventral row	25	24	25-26	25	26	26
Bony plates before anus	2	3	2	2	2-3	No data
Gill rackers (upper+lower)	5+1+19	No data	5+1+18-19=24-25	6+20	5-6+17-22	7+21
Group of barbels (lip+chin)	3+6	3+6	3+6	10+6	12+6	10+6
Branches on filamentous barbels	21	No data	21-25	23+21	No data	25+28
Total chin barbels	21	21	20-23	20	No data	No data

Body fusiform with four rows of bony plates. Snout broad. Long rostral projection, triangular in shape with four sensory pores on its ventral surface. Two spines on the posterior part of lateral line. Inter-orbital space deeply concave. Inferiorly larger mouth. Group of lip and chin barbels 3 + 6. Large and robust head with distinct eyes. Head length 1/4 of SL. Dorsal-fin rays VIII + 21; anal-fin rays 21; pelvic-fin rays I, 5; pectoral fin rays 15. Caudal peduncle depth 1/4 of caudal peduncle length.

Dorsal fin begins at the front end of the second bony plate in the dorsal row and extends to the caudal peduncle. Anal fin originates between the second and third ventral bony plates. Pectoral fin rays are well separated, with upper ray being thicker and longer than the lower one. Pelvic fin rays nearly reach the anus, and the caudal fin is emarginated. Additionally, two large contralateral pairs of bony plates with low ridge are present before the anus.

Colour: In fresh, not documented. In formalin preserved, head and all fins yellowish except for dorsal fin, which has a black margin and whitish detached pectoral fin rays; body pale white; peritoneum dark grey; eyes pale black. Pectoral fin distally with black margin.

Global distribution: Sri Lanka, Flores Sea, Java, Taiwan, Southern Japan and the Philippines in 260 – 732 m depths[7].

Suborder: Scorpaenoidei
Family: Peristediidae Jordan & Gilbert 1883
Genus: *Scalicus* Jordan 1923
Scalicus orientalis (Fowler, 1938)

Material examined

IO/OV/FIS/00735, 140 mm SL, 30 g, Sakthikulangara fishing harbour, Kerala, Southeastern

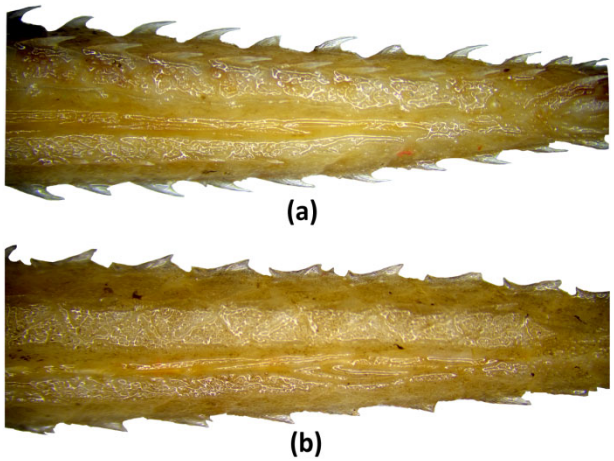

Fig. 3 — Posterior pairs of lower lateral rows of bony plates: (a) Separated in *Scalicus orientalis*, and (b) contralaterally sutured in *Peristedion riversandersoni*

Arabian Sea (Lat 8°35' N – 9°55' N; Long 75°30' E – 76°15' E), 200 – 420 m depth, coll. Davood Nihal, May 2022.

Description

Upper jaw teeth absent; rostral projection long and triangular. Width of rostral projection measures 1.35 times its length; filamentous barbels found on both sides, having 23 branches on the left and 21 branches on right, with a membrane covering each branch's base posteriorly. Additionally, posterior-most chin barbel is simple at its base; notably, absence of antrose spines on posterior bony plates of upper lateral row. Measurements and proportions are given in Table 1.

Body fusiform in shape, distally tapering and covered with bony plates. Enlarge depressed head with large eyes. Head length 1/3 of SL. Inferiorly larger mouth without teeth. Interorbital space concave. Group of lip and chin barbels 10 + 6. Posteriormost chin barbel divides into two branches, while, the posteriormost lip barbel is long and extends beyond the anus.

Small spines present on the nasal, lateral ethmoid, and mesethmoid regions. Dorsal-fin rays VII + 21; anal-fin rays 21; pelvic-fin rays I, 5; pectoral fin rays 14. Dorsal fin begins at the anterior edge of the second dorsal bony plate and extends to the caudal peduncle. Two separated pectoral fin rays thick. Depth of the caudal peduncle is one-quarter of its length. Caudal fin truncate. Bony plates arranged in four horizontal rows, with each plate featuring a single, backwardly directed spine that is well separated from the others. Bony plates before anus and at the dorsal and ventral rows of the caudal peduncle are comparatively large.

Colour: In fresh, not documented. In formalin preserved, head, body and fins pale red with dark margin on tip of the dorsal fin rays; upper and lower detached pectoral fin rays whitish; eyes dark grey; ventral surface pale white.

Global distribution: La Réunion, Maldives, Socotra (Yemen), Andaman Sea, Java, Sumatra, Maluku (Indonesia), Japan, Taiwan, East China Sea, New Caledonia, Philippines and Western Australia in 357 – 510 m depths[10,15]

Discussion

The Arabian Sea is regarded as one of the diversity-rich regions for deep-sea fishery resources. The deep-sea peristediid fishes, being unique in nature due to their armoured body, are very abundant in world oceans. However, their information on distribution from the Arabian Sea (north-eastern Indian Ocean) is poorly studied[12,19,25]. The measurements and counts of present specimens provided fall well within the range described for *P. riversandersoni* by Alcock[23]; Kawai & Hsuan-Ching[20] and for *S. orientalis* by Fowler[24]; Fricke[15]. *Scalicus* and *Peristedion* can be easily differentiated by the structure of bony plates in their posterior part of the lower lateral. In *Scalicus*, these bony plates are spaced apart as opposed to contralaterally sutured in *Peristedion* (Fig. 3). The congeners of the genus *Scalicus* are classified into two groups; the first is a long rostral group having stick-like and long rostral projection represented by four species namely *Scalicus engyceros*, *Scalicus serrulatus*, *Scalicus quadratorostratus* and *Scalicus paucibarbatus*. The second group comprises species with a triangular and short rostral projection *viz*., *Scalicus hians* and *Scalicus orientalis*[15].

Both groups can be distinguished by the presence or absence of antrose spines on the posterior bony plates of the upper lateral row (present in the first group but absent in the second) and by the number of branches on the filamentous barbel (7 – 21 in the first group vs. 22 – 39 in the second). Additionally, *Scalicus hians* differs from *S. orientalis* in having a rostral projection that resembles an equilateral triangle with a depth of 0.79 – 1.25 times the length (compared to the longer, triangular projection of

1.26 – 1.57 times the length), and typically 7 lip barbels (rarely 6 or 8) versus 5 lip barbels (rarely 6). Furthermore, *S. hians* lacks a membrane at the base of each branch of the filamentous barbel, while *S. orientalis* has a membrane present on the posterior part of the filamentous barbel.

Among the species of genus *Peristedion*, *P. riversandersoni* can be easily differentiated from *P. richardsi* and *P. liorhynchus* by the triangular shape of its rostral projections (vs. spatulate shape of rostral projections)[7,12]. Furthermore, *P. riversandersoni* can be distinguished from *P. richardsi* and *P. amblygenys* by the rounded shape of the inner margin at the rostral projection base, as opposed to the straight shape[14]. Moreover, *P. riversandersoni* is distinguishable from *P. liorhynchus* by the position of the anterior edge of the 4th sensory pore of rostral projections located anterior to premaxilla as opposed to posterior to the anterior edge of premaxilla[12,26]. *Peristedion riversandersoni* is morphologically very close to *P. weberi* and *P. orientale.* However, the presence of a prominent perifacial rim differentiates this species from the other two species (*P. weberi* and *P. orientale*)[11]. These present reports of these species represent the first records of *P. riversandersoni* and *S. orientalis* from the Arabian Sea. Previous reports of these two species from Indian waters were confined to the Andaman Sea and Bay of Bengal at a depth range of 260 – 732 m[19,23,27]. Considering the previous report on the distribution of these two species, it is concluded that *S. orientalis* is well represented in the Indian Ocean and western Pacific Ocean[10,15,28] and *P. riversandersoni* is more confined to the western Pacific extending up to the eastern Indian Ocean[11,23,26]. Altogether, the family Peristediidae in the Indian waters comprises of ten species with five genera; *Satyrichthys laticeps* (Schlegel, 1852) from Andaman Sea, Arabian Sea and Bay of Bengal; *Scalicus serrulatus* (Alcock, 1898) from Andaman Sea; *Scalicus investigatoris* Fowler, 1938 from Arabian Sea and Andaman Sea; *Heminodus philippinus* Smith, 1917 from Andaman Sea; *Peristedion amblygenys* Fowler, 1938 from Andaman Sea; *Peristedion liorhynchus* (Günther, 1872) from Arabian Sea; *Gargariscus prionocephalus* (Duméril, 1869) from Arabian Sea; *Satyrichthys milleri* Kawai, 2013 from Andaman Sea; *Scalicus orientalis* (Fowler, 1938) from Arabian Sea (present study) and *Peristedion riversandersoni* Alcock, 1894 from Andaman Sea and Arabian Sea (present study).

Conclusion

The present record of *Scalicus orientalis* and *Peristedion riversandersoni* from the Arabian Sea indicates a significant range extension from their known distributional range, such as the Maldives and the Andaman Sea. The first record of these two peristediid fishes from deeper waters of the Arabian Sea constitutes a valuable addition to the existing marine biodiversity of India.

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Conflict of Interest

The corresponding author, representing all the authors, affirms that there are no conflicts of interest related to this work.

Author Contributions

DN, MPR, KVAK: Collection of fish samples, taxonomic identification, data analysis, writing, review and editing of original draft, map. HM: supervision, writing, review and editing of final draft.

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