



Taxonomic note on *Halieutaea indica* Annandale and Jenkins, 1910 (Lophiiformes: Ogcocephalidae) from Indian waters

M. P. Rajeehkumar*, R. Rajeev, K. V. Aneesh, M. Hashim and N. Saravanane

Centre for Marine Living Resources and Ecology (CMLRE), Ministry of Earth Sciences (MoES), Government of India, LNG Road, Puthu Vypin South, Ochanthuruthu PO, Kochi- 682 508, Kerala, India.

*Correspondence e-mail: rajeeshmeppura@gmail.com

Received: 10 May 2020 Accepted: 28 July 2020 Published: 30 July 2020

Original Article

Abstract

The present paper discusses the new occurrence report and taxonomic note of a deep-sea anglerfish *Halieutaea indica* Annandale and Jenkins, 1910 collected by Fishery Oceanographic Research Vessel *Sagar Sampada* from the South-eastern Arabian Sea at a depth ranging from 200-300 m. This species was originally described by Annandale and Jenkins in 1910 from Bay of Bengal at a depth of 180 m. Along with a short description, key diagnostic characters distinguishing *H. indica* from its congeners with previous distributional records from the Indian Exclusive Economic Zone are also discussed.

Keywords: *Distributional record, Halieutaea indica, South-eastern Arabian Sea, misidentification*

Introduction

The Order Lophiiformes contains diverse groups of species that inhabit both shallow and deep-water environments. Commonly referred to as anglerfishes, the group is characterized by the structure of the first dorsal-fin spine (known as illicium), typically placed out on the tip of the snout and modified to serve as a

luring apparatus. Anglerfishes show amazing morphological variations in their body shapes, from globose to almost spherical, elongate, laterally compressed or extremely dorso-ventrally depressed (Pietsch, 2009)

The Order contains approximately 348 living species, under 71 genera and 18 families. These 18 families are distributed among five suborders (Pietsch, 2009), namely the Lophioidei, comprising a single family, four genera, and 28 valid species of relatively shallow-water dorso-ventrally flattened forms, commonly referred to as the goosefishes or monkfishes (Caruso, 1981, 1983); the Antennarioidei, with four families, 20 genera, and about 65 species (Pietsch, 2009; Arnold, 2013) that are nearly laterally compressed, shallow- to moderately deep-water and benthic forms, with a host of common names such as frogfishes, sea-mice, sea-toads, warty anglerfishes and hand fishes; the Chaunacoidei or coffin fishes, represented by one family and two genera and 25 nominal species (Ho *et al.*, 2013; Ho and Ma, 2016) of more or less globose, deep-water benthic forms; the Ogcocephaloidei or batfishes comprising of a single family and ten genera and some 75 species of dorso-ventrally flattened, deep-water benthic forms (Derouen *et al.*, 2015) and the Ceratioidei, the deep-sea anglerfishes, containing 11 families, 35 genera and 166 species (Pietsch, 2009)

Deep-sea exploratory surveys in India were carried out by the Royal Indian Marine Steamer *R.I.M.S. Investigator* during 1884-1914. Lt. Col. A. W. Alcock, through his publication "A Descriptive Catalogue of the Indian deep-sea fishes in the Indian museum" (1889, 1898 and 1899), described many new deep-sea fishes. This catalogue is the first detailed document of Indian deep-sea fishes. Later, Lloyd (1909) and Annandale and Jenkins (1910) described few more species of lophiiformes from Indian waters. Subsequently many scientific groups (Tholasilingam *et al.*, 1964, 1968; Sudarsan *et al.*, 1988; Sivakami, 1989; Ninan *et al.*, 1992; Jayapraksh *et al.*, 2006; Somvanshi *et al.*, 2009; Sajeevan *et al.*, 2009; Venu, 2013) attempted to explore the deep-sea resources from Indian waters. However, not much attention was paid on systematics or distribution of the Lophiiformes except redescription of *Lophiodes triradiatus* (Lloyd, 1909) from Arabian Sea (Ho *et al.*, 2014).

Previously, Lophiiformes fishes from Indian EEZ comprising Arabian Sea, Bay of Bengal and Andaman waters were represented

by 7 families, 13 genera and 21 species. Recent studies of Rajeeshkumar *et al.*, 2013, 2016, 2019; and Rajeeshkumar, 2019 updated the checklist with 8 families, 17 genera and 36 species including 8 new species and 7 new records.

Material and methods

The specimen was collected during cruise 288 FORV *Sagar Sampada* conducted by the Centre for Marine Living Resources and Ecology (CMLRE), Ministry of Earth Sciences, India along the south-west coast of India. The specimen was preserved in 5% buffered formaldehyde solution and deposited at the CMLRE Referral Centre, Kochi, India (Accession number IO/SS/FIS/00614) and was subsequently identified as *Halieutaea indica* following the original descriptions of Annandale and Jenkins (1910) and Ho and Shao (2008). Morphometric and meristic counts were taken from the preserved specimen (Table 1). The methods and definitions followed Bradbury (1980, 1988). Terminology used in describing angling apparatus follows Bradbury (1967).

Table 1. Morphometric and meristic data of *H. indica* compared with previous records

Morphometric	IO/SS/FIS/00614 (Present specimen)	Mahapatro <i>et al.</i> , 2018 (2)	Silambarasan <i>et al.</i> , 2016	Dash <i>et al.</i> , 2013	Annandale and Jenkins, 1910 (Holotype)
TL (mm)		75-83		83	
SL (mm)	74	% SL	72		
Head length	24	32.4			
Head width	14	18.9			
Eye diameter	5.0	6.8	5.0-7.0	5.0	5.0
Interorbital space	7.0	9.5	4.0-7.0	0.9	5.0
Intersphenotic length	19	25.7			
Rostrum length	7.0	9.5			
Disc margin length	38	51.4	41-45	56	42
Illicial cavity length	5.0	6.8	6.0-16		
Mouth width	24	32.4	14-22	21	23
Upper jaw length	14	18.9			
Lower jaw length	13	17.6			
Pre-dorsal	55	74.3			
Pre-anal	60	81.1			
Lower lip to anus	47	63.5			
Post anal	5.0	6.8			
Anus opening to origin of anal fin	10	13.5			
Anus to caudal peduncle	25	33.8	34-41	21	41
Pectoral fin length	21	28.4	19-26	17	16
Caudal fin length	24	32.4	11-19	7	20
Caudal peduncle depth	6.0	8.1			
Gill opening length	6.0	8.1	5.0-3.0		
Meristic					
Dorsal fin rays	4	4	4	4	4
Pectoral fin rays	14	8	7	8	13
Anal fin rays	4	4	3	4	4
Caudal fin rays	9	8	8	6	9
Lateral line					
Pre-opercular	4				
Sub-opercular	7;8				
Tail series	5;6				

All measurements were expressed in mm and also in terms of percentage of standard length (SL). Previous distributional records from world Ocean are also provided in Fig. 2.

Material examined : IO/SS/FIS/00614, 74 mm SL, Arabian Sea, 11.99° N, 74.42° E, 200-300 m., High Speed Demersal Trawl-Crustacean Version (HSDT- CV) August 2011.

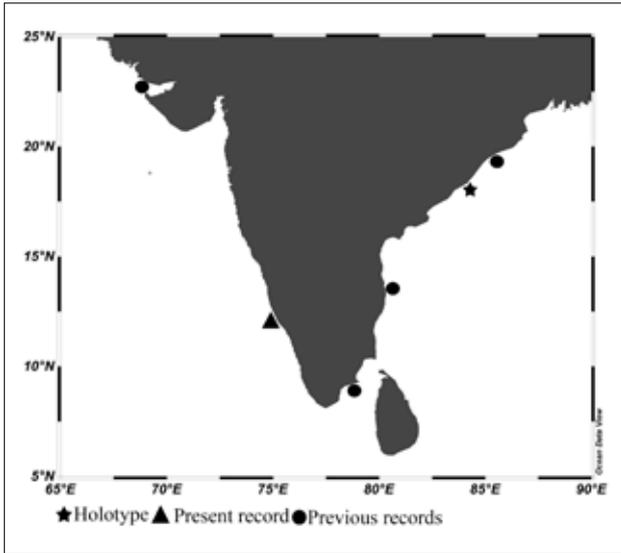


Fig. 2. Map showing geographical distribution of *H. indica*.

Results

Systematics

Halieutaea indica Annandale and Jenkins, 1910

Indian hand fish

Order :Lophiiformes Garman, 1899

Family :Ogcocephalidae Gill, 1893

Genus :*Halieutaea* Valenciennes, 1837

Fig.1. A, B & C

Synonyms: *Lophius muricatus* Shaw, 1804; *Lophius faujas* Lacepède, 1798; *Halieutaea spicata* Smith, 1965; *Halieutaea spicata* Smith, 1965; *Halieutaea sinica* Tchang and Chang, 1964; *Astrocanthus stellatus* Swainson, 1839.

Diagnosis: Dorsal fin rays 4; pectoral fin rays 14; anal fin rays 4; caudal fin rays 9; rostrum projects over the margin of the disk, esca invisible from dorsal view; relatively long spines on the dorsal surface, most of them are bifid; peritoneum white; caudal fin length almost equal to tail length.

Description: Head compressed, strongly depressed body disc, disc margin is rounded in dorsal view, angling apparatus (illicium)

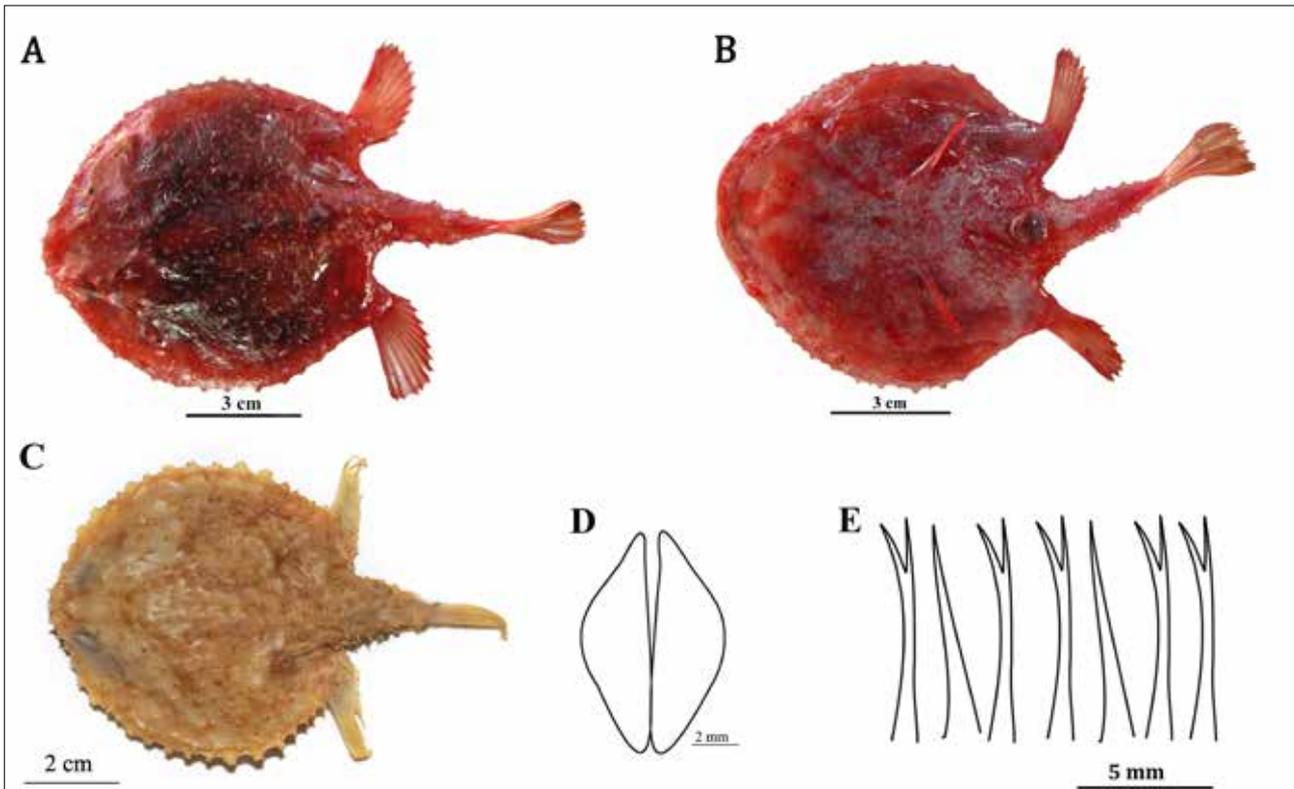


Fig. 1. *H. indica* (IO/SS/FIS/00614; 74 mm SL) A: dorsal view; B: ventral view; C: Holotype (ZSI- F 4145/1); D: teeth pattern; E: principal tubercles

placed within a cavity just above the mouth; trilobed fleshy esca bulb present at tip of the illicium; rostrum projects over front of disc so that esca invisible or hardly visible from dorsal view; mouth sub-terminal in front of disc, teeth on tongue forming two large, long patches, rather than broad, each has a pointed tip on both ends (Fig. 1. D), both jaws having minute villiform teeth. Dorsal surface covers with sharp and slender principal tubercles, no spinules (naked area) in between the principal tubercles; most of the principal tubercles are bifid with star shaped bases (Fig. 1. E); ventral surface with minute scattered spines. Mostly trifid spines are present along the edges of the disc and lateral line system. Pectoral fins are leg like, attached to the latero-posterior edges of the disc; pelvic fins are present on the ventral surface of the disc; tail is slender and tapering; caudal fin length is almost equal to tail length.

Colour: In fresh, dorsal surface having reddish to pink colour with minute black spots which together form lines and reticulate patterns. In preserved specimen, uniform creamy colour on both dorsal and ventral surfaces, dorsal surface retains some black spots.

Remarks: Number of previous reports came from the east coast of India, Visakhapattanam coast (Krishnan and Mishra, 1993), Odisha coast (Barman *et al.*, 2007, check list); Mahapatro *et al.*, 2018), Gulf of Mannar coast (Murugan *et al.*, 2011, check list), Chennai coast (Silambarasan *et al.*, 2016), Off Gujarat coast (Dash *et al.*, 2013) and from Kerala coast (Bijukumar and Raghavan, 2015, check list). Key diagnostic features mentioned in the holotype description were unattended by previous authors "the extremity- of the roof of the tentacular cavity extends at least as far forwards as the edge of the disk, so that the illicial cavity is concealed from above; dorsal surface covered with numerous strong subequal spines, many of which are bifid". Also the caudal fin length is occasionally equal or higher than the tail length. On this character, there are much variations in previously reported specimens of the above works vs original description, viz. (caudal fin length vs. tail length (in mm), 20 vs. 41 (Dash *et al.*, 2013); 7.0 vs. 21 (Silambarasan *et al.*, 2016); (2 specimens) 19 vs. 41, 11 vs. 34 (Mahapatro *et al.*, 2018); 24.0 vs. 25.0 (present study). Also, the previously reported specimens showed much variation in pectoral fin ray count (7-8 (earlier reports) vs. 14). Due to the variation of these two key characters, it is possible that earlier reports of this species could be erroneous or might be an undescribed species.

Existing studies on batfishes (Ogcocephalidae) reveals that rather than obvious adaptations for piscivory, their large ventrally directed mouth, enable them to catch small demersal prey such as gastropods, crustaceans and polychaete worms (Nagareda and Shenker, 2008). Pectoral fins are highly modified and leg-like which enable them to walk on the bottom. Rajeeshkumar (2019)

performed dietary studies of congener species (*H. coccinea*, n=129) from Andaman Sea, which revealed that crustaceans contribute 45% of the diet followed by fish (16%) and gastropods (11%). Mahapatro *et al.*, 2018 observed macrobenthic fauna from the gut contents of *H. indica* from Chilika Lagoon, Odisha. Luring apparatus (illicium and esca) plays an important role in feeding as well as in reproduction. It is believed that esca secretes chemically active compounds which may attract prey or opposite sex. However, the complete process is still unknown (Bradbury, 2003; Pietsch, 2009).

Distribution: East and West coast of India. Also known from South Africa, Madagascar, Australia, the Philippines, Indonesia, Taiwan, China and Japan (70 -300 m)

Discussion

Halieutaea indica mainly differs from its congeners *H. stellata* (Vahl, 1797); *H. coccinea* Alcock, 1889; *H. fumosa* Alcock, 1894 and *H. nigra* Alcock, 1891) in the following characters -rostrum projects over the margin of the disk; relatively long spines on the dorsal surface, most of them are bifid; naked area between principal tubercles; white peritoneum.

In all the species *H. stellata*, *H. coccinea* and *H. fumosa*, rostrum not projecting over front of disc, esca visible from dorsal view, black peritoneum and teeth on tongue forming two large patches with outer pointed prolongation. *Halieutae stellata* can be distinguished from *H. coccinea* having a velvet skin appearance between the major tubercles due to the tiny spinules vs. star shaped spinules and, widely placed spines on ventral surface vs. thickly packed stellate spines. *Halieutaea fumosa* can easily distinguish from other two species having peculiar dorsal colour pattern and a totally naked area on the ventral surface. *Halieutaea nigra* is unique in its colouration, blue black with jet black vermicular line on dorsal surface. However, the taxonomic status of *H. nigra* and *H. fumosa* from Indian water remains uncertain. This can be clarified based on additional specimens.

Acknowledgements

The study was undertaken as part of the Deep-Sea and Distant Water Fishery (DS & DWF) project under the Marine Living Resource Programme (MLR Programme) of CMLRE, funded by MoES, India. Authors are greatly indebted to Secretary, MoES for supporting the work and for providing the facilities onboard FORV *Sagar Sampada*. We deeply express our sincere thanks to all the scientific and crew members of cruise 288 and our colleagues in CMLRE for their continuing support. Special thanks to Dr. K.K. Bineesh for sharing holotype photo and Dr. N. Rajendran for his diligent proofreading of this paper. This is CMLRE contribution number 121.

References

- Alcock, A. W. 1889. Natural history notes from H.M. Indian marine survey steamer 'Investigator', Commander Alfred Carpenter, R. N., D. S. O., commanding.-No. 13. On the bathybial fishes of the Bay of Bengal and neighbouring waters, obtained during the seasons 1885-1889. *Ann. Mag. Nat. Hist.*, (Ser. 6) 4 (24): 450-461.
- Alcock, A. W. 1898. Illustrations of the zoology of the Royal Indian marine surveying steamer Investigator, Fishes. Calcutta. Illustrations of the zoology of the Royal Indian marine surveying steamer Investigator, Fishes. Part 5: 249p.
- Alcock, A. W. 1899. A descriptive catalogue of the Indian deep-sea fishes in the Indian Museum. Being a revised account of the deep sea fishes collected by the Royal Indian marine survey ship Investigator. Calcutta. *A descriptive catalogue of the Indian deep sea fishes in the Indian Museum*, i-iii + 1-211 + I viii.
- Annandale, N. and J. T. Jenkins. 1910. Report on the fishes taken by the Bengal Fisheries Steamer - Golden Crown. Part III. Plectognathi and Pediculati. *Mem. Indian Mus.*, 3(1): 7-21.
- Arnold, R. J. 2013. A new species of frogfish of the genus *Kuiterichthys* (Lophiiformes: Antennariidae: Histiophryninae) from New South Wales, Australia. *Zootaxa*, 3718 (5): 496 - 499.
- Barman, R. P., S. S. Mishra, S. Kar, P. Mukherjee and S. C. Saren. 2007. Marine and Estuarine Fish Fauna of Orissa. *Rec. Zool. Surv. India. Occ. Paper No 260*: 1-186
- Bijukumar, A. and R. Raghavan. 2015. A checklist of fishes of Kerala, India. *J. Threatened Taxa*, 7(13): 8036-8080.
- Bradbury, M. G. 1967. The genera of batfishes (family Ogcocephalidae). *Copeia*, 399 - 422 p.
- Bradbury, M. G. 1980. A revision of the fish genus *Ogcocephalus*, with descriptions of new species from the Western North Atlantic Ocean (Ogcocephalidae; Lophiiformes). *Proc. California Acad. Sci.*, 42:229 - 285.
- Bradbury, M. G. 1988. Rare fishes of the deep-sea genus *Halieutopsis*: a review with descriptions of four new species (Lophiiformes: Ogcocephalidae). *Fieldiana Zoology*, (new series) 44:1 - 22.
- Bradbury, M. G. 2003. Family Ogcocephalidae Jordan 1895-Batfishes. California Academy of Sciences Annotated Checklists of Fishes, 17: 1 - 17.
- Caruso, J. H. 1981. The systematics and distribution of the lophiid anglerfishes: I. A revision of the genus *Lophiodes*, with the description of two new species. *Copeia* (3): 522-549.
- Caruso, J. H. 1983. The systematics and distribution of the lophiid anglerfishes: II. Revisions of the genera *Lophiomus* and *Lophius*. *Copeia* (1): 11-30.
- Dash, S. S., G. Dash, M. K. Koya, K. R. Sreenath, P. Pradeep and R. Kamaliya Kiran. 2013. First record of Indian hand fish *Halieutaea indica* Annandale & Jenkins, 1910 from Gujarat. *Mar. Fish. Infor. Serv. T&E Ser.*, No. 216.
- Derouen, V., W. B. Ludt, H. C. Ho and P. Chakrabarty. 2015. Examining evolutionary relationships and shifts in depth preferences in batfishes (Lophiiformes: Ogcocephalidae). *Mol. Phylogene. Evolut.*, 84: 27-33.
- Ho, H. C. and K. T. Shao. 2008. The batfishes (Lophiiformes: Ogcocephalidae) of Taiwan, with description of eight new records. *J. Fish. Soc. Taiwan*, 35: 289 - 313.
- Ho, H. C. and W. C. Ma. 2016. Revision of southern African species of the anglerfish genus *Chaunax* (Lophiiformes: Chaunacidae), with descriptions of three new species. *Zootaxa*, 4144 (2): 175 194.
- Ho, H. C., C. D. Roberts and A. L. Stewart. 2013. A review of the anglerfish genus *Chaunax* (Lophiiformes: Chaunacidae) from New Zealand and adjacent waters, with descriptions of four new species. *Zootaxa*, 3620 (1): 89 - 111.
- Ho, H. C., K. K. Bineesh and K. V. Akhilesh. 2014. Rediscovery of *Lophiodes triradiatus* (Lloyd, 1909), a senior synonym of *L. infrabrunneus* Smith and Radcliffe (Lophiiformes: Lophiidae). *Zootaxa*, 587-592 p.
- Jayaprakash, A. A., B. M. Kurup, U. Sreedhar, S. Venu, D. Thankappan, H. Manjebraayakath, V. A. Pachu, P. Thampy and S. Sudhakar. 2006. Distribution, diversity, lengthweight relationship and recruitment pattern of deep-sea finfishes and shellfishes in the shelf-break area off southwest Indian EEZ. *J. Mar. Biol. Assoc. India*, 48(1): 56-67.
- Krishnan, S. and S. S. Mishra. 1993. On a collection of fish from Kakinada-Gopalpur sector of the east coast of India. *Rec. Zool. Surv. India*, 93 (1-2): 201 - 240
- 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*. *Mem. Indian Mus.*, 2 (1909-10).
- Mahapatro, D., R. C. Panigrahy, P. Sudarsan, K. K. Subodh, R. K. Mishra, S. S. Mishra and S. K. Mohanty. 2018. New distributional record of *Halieutaea Indica* (Lophiiformes: Ogcocephalidae) from Chilika lagoon, India. *Indian J. Geo Mar. Sci.*, 47(08): 1594-1600.
- Murugan, A., S. Dhanya, A. B. Sarcar, V. Naganathan, S. Rajagopal and T. Balasubramanian. 2011. Fishery biology, demography of three spotted seahorse, *Hippocampus trimaculatus* inhabiting Gulf of Mannar region, Southeast coast of India. *Indian J. Geo Mar. Sci.*, 40(3): 411-423.
- Nagareda, B. H. and J. M. Shenker. 2008. Dietary analysis of batfishes (Lophiiformes: Ogcocephalidae) in the Gulf of Mexico. *Gulf Mex. Sci.*, (1): 28-35.
- Ninan, T. V., V. Sivaji, N. Jagannadh and L. Ramalingam. 1992. Observations on demersal resources survey between lat 7 N and 11 N along south-west coast, Wadge Bank and Gulf of Mannar during 1988-1990. *Bull. Fish. Surv. India*, 24: 14-40.
- Pietsch, T. W. 2009. Oceanic Anglerfishes: Extraordinary Diversity in the Deep Sea, University of California Press. ISBN: 9780520942554
- Rajeeshkumar, M. P. 2019. Dee-sea Anglerfishes (Pisces-Lophiiformes) of the Indian EEZ-Systematics, Distribution and Biology. PhD thesis submitted to Cochin University of Science and Technology.
- Rajeeshkumar, M. P., J. Vinu, K. S. Sumod, V. N. Sanjeevan and M. Hashim. 2016. Three new records of rare deep-sea Anglerfishes (Lophiiformes: Ceratioidei) from the Northern Indian Ocean. *Mar. Biod., Springer*, 46:923 - 928.
- Rajeeshkumar, M. P., J. Vinu, S. S. Cubelio, K. J. Jayalakshmi and V. N. Sanjeevan. 2013. First record of the batfish, *Halieutopsis stellifera* (Lophiiformes: Ogcocephalidae) from the eastern Indian Ocean. *Mar. Biod. Rec.*, Marine Biological Association of the United Kingdom, 6: e84.
- Rajeeshkumar, M. P., K. K. Bineesh, M. Hashim, S. S. Cubelio and M. Sudhakar. 2019. New Geographical Record of *Chaunax penicillatus* McCulloch, 1915 (Chaunacoidei: Chaunacidae) from the Eastern Indian Ocean. *Thalassas: Int. J. Mar. Sci.*, 36: 225-229.
- Sajeewan, M. K., V. S. Somvanshi and J. Nair Rajasekharan. 2009. Deep sea teleostean species diversity off the south-west coast of India (7° N-10° N lat.). *Asian Fish. Sci.*, 22: 617-629.
- Silambarasan, K., K. Sujatha, A. Sundaramanickam, E. Rajalakshmi and P. Senthilkumar. 2016. First Record of Indian Hand Fish *Halieutaea indica* Annandale & Jenkins, 1910 From Chennai Coast, Tamil Nadu, India, *Indian J. Geo Mar. Sci.*, 45(07): 882-884
- Sivakami, S. 1989. Observations on the demersal fishery resources of the coastal and deep sea areas of the exclusive economic zone of India. *Proc. Symp. Living Resources of the Seas around India*, CMFRI: 527- 538.
- Somvanshi, V. S., S. Varghese, D. K. Gulati and P. V. Sijo. 2009. Resource assessment and biology of deep sea fishes along the continental slope of Indian EEZ. Project Report submitted to Research & Development Grant-in-aid Marine Research on Living Resources Programme Department of Ocean Development, Government of India. 581pp
- Sudarsan, D. T. E. Sivaprakasam, V. S. Somvanshi, M. E. John and K. N. V. Nair. 1988. An appraisal of the marine fishery resources of the Indian Exclusive Economic Zone. Agriculture Information Service FAO.
- Tholasingam, T., G. Venkataraman and K. N. Kartha. 1964. On some bathypelagic fishes taken from the continental slope off the south west coast of India. *J. Mar. Biol. Assoc. India*, 6(2): 268-284.
- Tholasingam, T., K. C. George, M. G. Dayanandan, P. K. Nair, and K. Nandakumaran. 1968. Exploratory trawl fishing and ground fish resources along the Kerala coast and adjacent waters. Abstracts of papers presented at the Symposium on the living resources of the seas around India, Cochin, 7- 10 December 1968, Central Marine Fisheries Research Institute, Mandapam Campus: 9-10.
- Venu, S. 2013. Deep-sea fish distribution along the south-west region of Indian EEZ. In Ecology and Conservation of Tropical Marine Faunal Communities: 261-281.