

**FIRST RECORD OF THE PINK PIPEFISH, *BRYX ANALICARENS*
(ACTINOPTERYGII: SYNGNATHIFORMES: SYNGNATHIDAE), FROM INDIAN WATERS**

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Abstract. The occurrence of the pink pipefish, *Bryx analicarenis* (Duncker, 1915), is reported for the first time from Indian waters. The geographical distribution of the species extends from east Africa, the Persian Gulf and the Gulf of Oman to Pakistan and now to the west coast of India. Although a total of 32 pipefish species have hitherto been reported from India, the presently reported finding of *B. analicarenis* constitutes the first record of the genus from the country. Morphometric characters, like the absence of the anal fin, the number of trunk rings (15) and tails rings (34), and dorsal fin rays (25) distinguish the species from other species in the region. *Bryx analicarenis* differs from its congeners by having alternately arranged irregular brownish and white bands along the snout. The presently reported study also emphasizes the need for a detailed study of syngnathid biodiversity and a stock assessment of the coral reef ecosystems of the Gulf of Kachchh Marine National Park and Sanctuary for developing conservation strategies.

Keywords: pipefish, first country record, Syngnathidae, taxonomy, new distribution, Gulf of Kachchh

INTRODUCTION

The family Syngnathidae (the pipefishes) comprises 319 valid species (Fricke et al. 2019a) and its representatives are characterised by having fused jaws (Kuitert 2009). They predominantly inhabit coastal waters, but rarely occur in brackish or fresh waters of temperate and tropical seas around the world (Froese and Pauly 2019). ‘Male pregnancy’ is an exceptional form of reproduction found amongst syngnathids (Wilson et al. 2001, Stölting and Wilson 2007). Pipefish look like ‘straight-bodied seahorses’ with a slender and elongate body, a tiny tube-like mouth without teeth, the presence of lobate and pore-like gills openings above the opercle, soft-rayed fins (variably present), and the body surface with a ring-like arrangement of dermal plates (Dawson 1985). They also have the capability of moving their eyes independently and of camouflaging well in their habitat. Generally, pipefishes feed on microcrustaceans such as copepods, amphipods, isopods, mysids, and cumaceans (Ryer and Orth 1987, Franzoi et al. 1993, Kitsos et al. 2008).

In the ocean, syngnathids are found from exposed intertidal pools with just centimetres of water down to more than 400 m depth. Like seahorses, the pipefishes have been exploited for the preparation of medicines and aphrodisiacs, especially in the Traditional Chinese Medicine (TCM) (Murugan et al. 2008). Thus, many species are categorised as ‘highly threatened’. Moreover, seagrass and coral reef-associated species are also threatened by trawl fishing, coral reef degradation, and other direct and indirect causes of habitat destruction worldwide.

Pipefishes of the Indo-Pacific region have been reviewed by Kaup (1853, 1856), Weber and Beaufort (1922), Schultz et al. (1953), Dawson (1985), and Kuitert (1998, 2003). A total of 32 species of pipefishes have been recorded from marine, brackish and riverine habitats of the Indian sub-continent (James 1970, Dawson 1985, Murugan et al. 2008, Rajan et al. 2013, Sanaye et al. 2016). The presently reported account confirms the occurrence of the pink pipefish, *Bryx*

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analicarens (Duncker, 1915), in the Gulf of Kachchh along the north-west coast of India, which represents a new record of this genus from Indian waters.

MATERIALS AND METHODS

A single live specimen of the pink pipefish, *Bryx analicarens*, was collected from an intertidal reef flat, off Laku Point reef (22°24.032'N, 069°12.522'E), Gulf of Kachchh, Gujarat State, north-western coast of India in March 2019 (Fig. 1). Immediate after collection, the specimen was preserved in 80% ethanol. Morphological characters and morphometric details were recorded using a Leica-S8AP0 model stereo-zoom microscope. Morphometric and meristic character counts and measurements were recorded using a digital Vernier calliper following the standard protocol as given in Lourie et al. (1999). The specimen was identified using relevant publications (Dawson 1977, 1985, Senou 2013). After carrying out the taxonomic examination, the specimen was deposited at the National Zoological Collection, MBRC-Zoological Survey of India, Chennai- 600 028, India (Registration No. ZSI/MBRC/FISHES F.1998) for further reference.

RESULTS

Family SYNGNATHIDAE

Bryx analicarens (Duncker, 1915)

(Figs. 2, 3, 4; Table 1)

Collection details. The specimen was found underneath a dead coral boulder overgrown with macroalgae, in an exposed pool on the intertidal reef flat. The fish was a female, yellowish orange in colour when collected, fading to grey when preserved in ethanol.

Diagnosis. (according to Dawson 1981): Snout length 36.22% in head length; anal fin absent; caudal-fin rays 10; trunk rings 15; dorsal-fin rays 25; total rings 49; ridges entire.

Description of the Indian specimen. Body thin, elongate (Fig. 2), with elongate, tapering snout (Fig. 3), encased with series of bony rings (Fig. 4A). Total body length from snout to tail reaching 80.59 mm, maximum width

3.01 mm, and maximum body height 2.96 mm. Anterior part of head with tubular snout, ending with small superior mouth. Lower jaw with irregular shaped, alternatingly arranged, white and brown bands (Fig. 3). Head length (L_H) occupying 9.86% of total length of specimen; head slender, its width 15.61% than wider abdominal part; snout length covering 36.22% of total head length; orbit diameter (OD = 1.48 mm). Dorsal fin with 25 rays. Pectoral fin with 13 rays and caudal fin 10 with rays (Fig. 4B). Anal fin absent (Table. 1). Trunk with 15 rings, and tail with 34 pearl-white rings (colour in preserved specimen) (Fig. 4D). Superior trunk and tail ridges discontinuouing near rear of dorsal-fin base (Fig. 4C). Lateral trunk and tail ridges also discontinued. Inferior trunk ridge merging with tail ridge. Opercle lobate, bearing straight ridge, not angled dorsal, complete, without prominent striae above or below. Pore-like gill opening above opercle. No brood pouch observed beneath anus.

DISCUSSION

The pink pipefish, *Bryx analicarens*, was originally described from the Makran coast, Beluchistan (Pakistan), the Persian Gulf and Zanzibar (Tanzania) (Duncker 1915). This species was subsequently reported from Eritrea, Red Sea (Dawson 1981, Golani and Fricke 2018), Aldabra, Seychelles (Dawson 1981), Kuwait to Abu Dhabi (Persian Gulf) (Dawson 1981), Gulf of Oman (Randall 1995), and Madagascar (Fricke et al. 2018). As *Bryx clarionensis* Fritzsche, 1980 is currently treated as a junior synonym of *Bryx veleronis* Herald, 1940 according to Dawson (1985), the genus *Bryx* presently includes only four valid species (see Fricke et al. 2019b) namely, *Bryx analicarens* (Duncker, 1915), *Bryx dunckeri* (Metzelaar, 1919), *Bryx randalli* (Herald, 1965), and *Bryx veleronis* Herald, 1940.

Bryx analicarens is distinguished from its congeners by having alternately arranged irregular brownish and white bands along the entire snout length (Fig. 2). The colour of the body is yellowish-orange while the ventral side of the tail is whitish. A dark, prominent band over the orbital periphery can be observed in the photograph of the presently

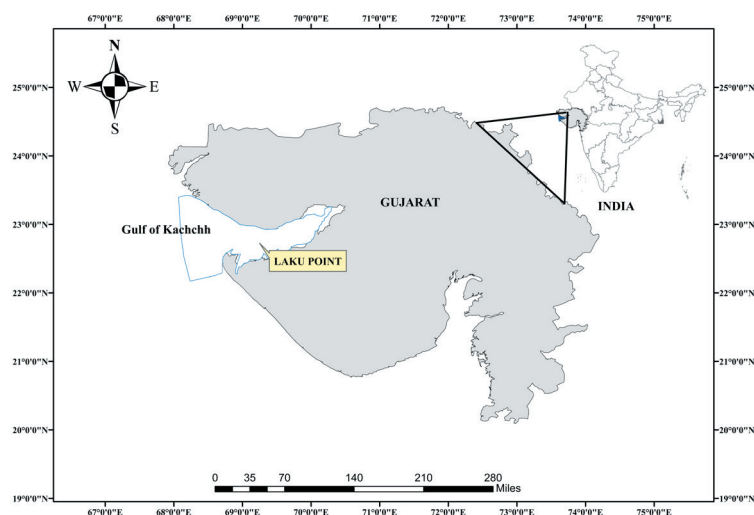


Fig. 1. Map showing the reef where the specimen of *Bryx analicarens* was collected (Gulf of Kachchh, India)

reported specimen (Fig. 3). Duncker (1915), based his description of the new species '*Syngnathus analicarens*' on two specimens, a damaged male (115 mm long) and a female. The former was labelled as ZSI-F 14295 while the latter as ZSI-F 14297. The fish originated from India, but no detailed locality was provided. '*Syngnathus analicarens*' is now considered a member of the genus *Bryx*. Therefore, the Duncker's (1915) study was an ambiguous evidence of the distribution of *B. analicarens* in Indian waters, which is confirmed by the present account.

In Indian waters, a total of 32 species of pipefishes, of the family Syngnathidae, divisible into 15 genera have hitherto been recorded (Table 2). The maximum number of species was documented from Andaman and Nicobar Islands (19 species) followed by Tamil Nadu coast (13 species). Maharashtra and Goa coasts recorded three species each. Likewise, the distribution of pipefishes also recorded

from north-east regions riverine ecosystems (1 species) and Kerala coast (1 species). The present account adds a new distribution record of the genus *Bryx* found for the first time from the Indian waters. More intensive studies along the Indian coast may fetch more species from the region.

The coral reefs of the Gulf of Kachchh are unique in their isolation in sub-tropical location, experiencing large tidal amplitude fluctuations, heavy water current, and heavy sediment depositions rate. Nevertheless, they are inhabited by a diverse marine fauna especially in their vast cryptic habitats (Satyanarayana et al. 2017). Studies indicate that the habitat preferences of this species are shallow areas, not deeper than 2–5 m, with seagrass beds of *Thalassia hemprichii* and *Cymodocea serrulata* (see Steffe et al. 1989). As there are not much seagrass beds in the Gulf of Kachchh (Kamboj 2014), this species might have adapted to inhabit other cryptic habitats like underneath dead coral boulders in the Kachchh to overcome heavy sedimentation and water current. This also might be one of the reasons for the rare occurrence of *B. analicarens* along the Gulf of Kachchh. Currently, this species is included under the 'least concern' category (Pollom 2016) and all Syngnathidae are protected under the Schedule-I (Part-IIA) of Indian Wildlife (Protection) Act, 1972 (Anonymous 1972). But a detailed study needs to be conducted for evaluating their present status and actual distribution along the Indian coast.



Fig. 2. *Bryx analicarens* (80.59 mm TL, Female) Gujarat coast, Gulf of Kachchh

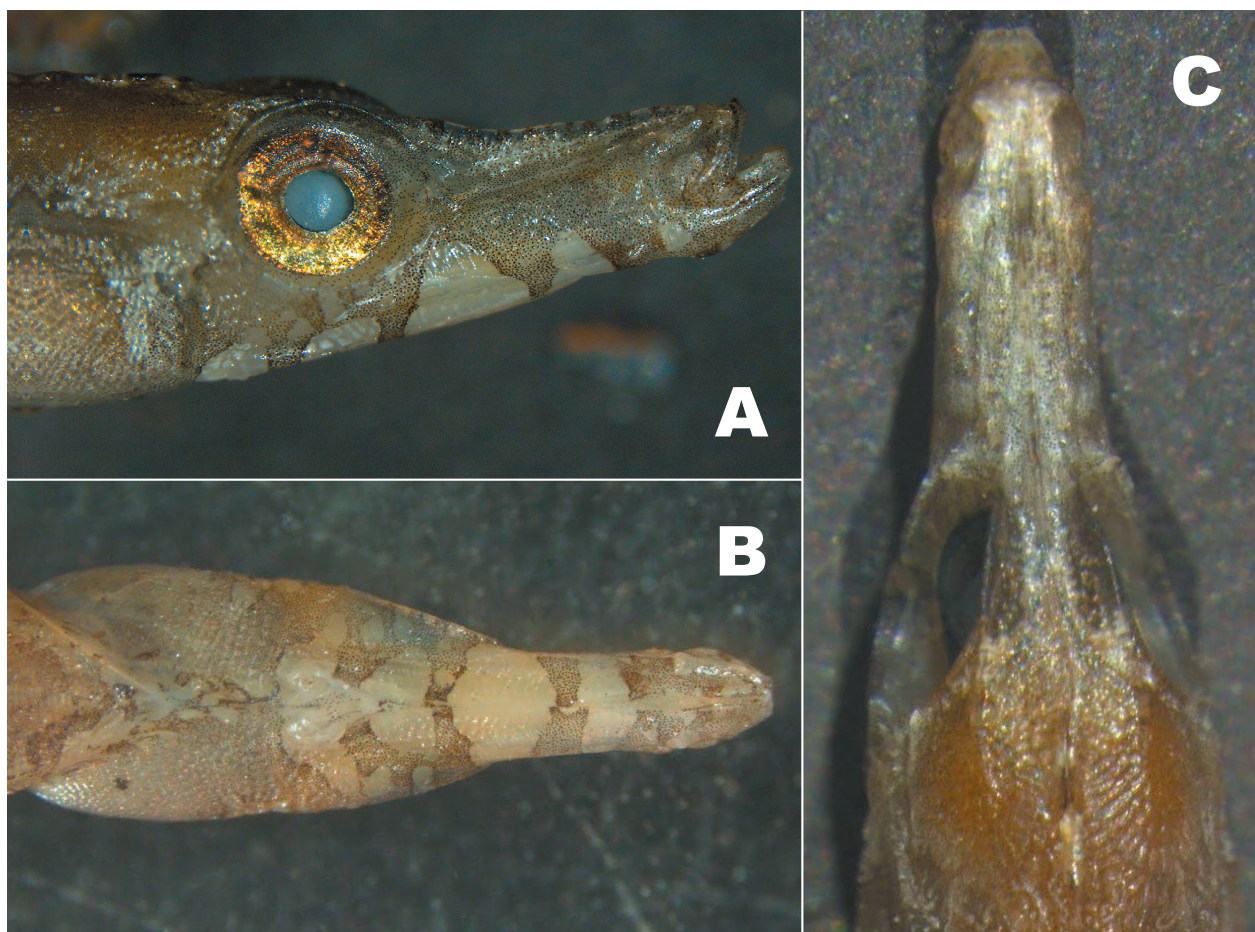


Fig. 3. Head of the specimen of *Bryx analicarens* from the Gulf of Kachchh. (A) lateral view; (B) ventral view; (C) dorsal view

Table 1

Comparison of morphometric and meristic characters of the collected specimen of *Bryx analicarenis* with the existing species of pipefishes of the genus *Bryx*

Character	<i>Bryx analicarenis</i> (Duncker, 1915)		<i>Bryx dunckeri</i> (Metzelaar, 1919)	<i>Bryx randalli</i> (Herald, 1965)	<i>Bryx veleronis</i> Herald, 1940
Reference	This study	Dawson 1981	Robertson and Van Tassell 2019		Dawson 1985
Total length (TL) [mm]	80.59	≤108.5	≤100	≤46–93	33–60
Maximum body width (iH)	3.01	—	2.4	—	—
Minimum body width (ih)	1.84	—	1.6	—	—
Head length (L_H) in %TL=	9.864%	8.20%–9.861%	9%–12.7%	9.03%–10.43%	7.6%–10.3%
Snout length (L_S) in % L_H	36.22%	21.49%–24.29%	22.04%–29.13%	24.74%–28.86%	—
Snout depth (D_S)	2.54	2.9–3.6	0.7–2.2	2.8–3.7	—
Dorsal fin rays No.	25	28–33	21–27	22–27	22–28
Caudal fin rays No.	10	10	10	10	10
No. of pectoral fins	12	13–14	9–13	12–14	11–13
No. of trunk bony rings	15	16–18	15–18	17–18	14–15
No. of tail bony rings	34	35–39	30–36	30–33	33–37
Anal fin	Absent	Absent	Absent	Absent	Absent

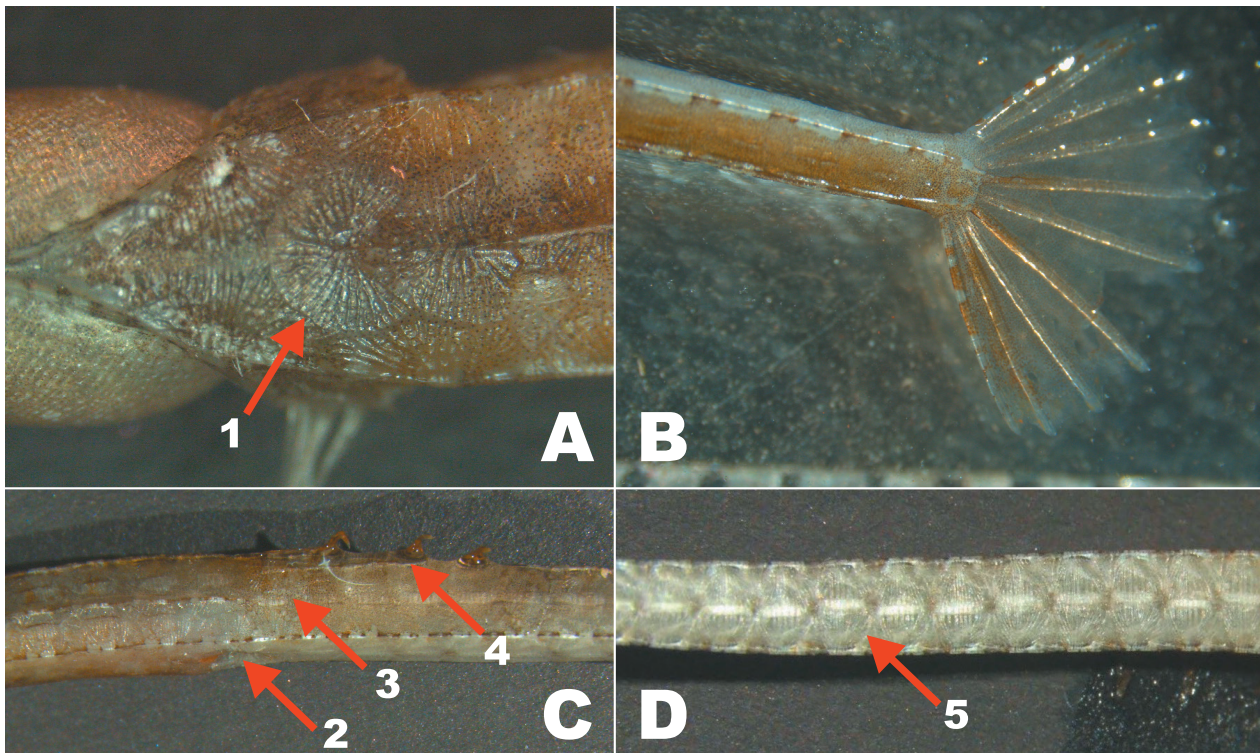


Fig. 4. Body and tail of the specimen of *Bryx analicarenis* from the Gulf of Kachchh, India; (A) anterior body, dorsal view, arrow indicates ring of bony plates (1); (B) tail with caudal fin; (C) lateral view of side of body, arrows indicate anus (2), lateral trunk and tail ridges (3), and discontinued superior trunk and tail ridges (4); (D) ventral view of body, arrow indicates ventral bony plates (5)

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Table 2

Pipefishes hitherto recorded from Indian waters

Species Name	Habitat	Locality	Reference
<i>Bhanotia fasciolata</i>	Marine	Andaman Islands	Dawson 1978
<i>Bryx analicarenis</i>	Marine	Andaman Islands	Rajan et al. 2013
<i>Choeroichthys sculptus</i>	Marine	Gulf of Kachchh	Presently reported study
		Nicobar Islands	Dawson 1985
		Andaman Islands	Rajan et al. 2013
<i>Corythoichthys amplexus</i>	Marine	Andaman and Nicobar	Rajan et al. 2013
<i>Corythoichthys benedetto</i>	Marine	Andaman and Nicobar	Rajan et al. 2013
<i>Corythoichthys haematopterus</i>	Marine	Tamil Nadu; Andaman and Nicobar	Dawson 1985
		Andaman Islands	Rajan et al. 2013
<i>Corythoichthys intestinalis</i>	Marine	Andaman and Nicobar	Rajan et al. 2013
<i>Corythoichthys ocellatus</i>	Marine	Andaman and Nicobar	Rajan et al. 2013
<i>Corythoichthys schultzei</i>	Marine	Andaman and Nicobar	Rajan et al. 2013
<i>Dorychthys martensii</i>	Freshwater	Andaman and Nicobar	Rajan et al. 2013
<i>Dunckerocampus dactyliophorus</i>	Marine	Andaman and Nicobar	Rajan et al. 2013
<i>Doryrhamphus excisus</i>	Marine	Andaman and Nicobar	Rajan et al. 2013
<i>Halicampus grayi</i>	Marine	Tamil Nadu coast	Murugan et al. 2008
<i>Halicampus macrorhynchus</i>	Marine	Andaman and Nicobar	Rajan et al. 2013
<i>Halicampus matafiae</i>	Marine	Andaman and Nicobar	Rajan et al. 2013
<i>Hippichthys cyanospilos</i>	Marine and brackish waters including mangroves channels and estuaries	Tamil Nadu coast	Dawson 1985
		Lakshadweep Islands	Murugan et al. 2008
		Gulf of Kachchh	Suresh 1997
		Gujarat (listed only)	Anonymous 1996
<i>Hippichthys spicifer</i>	Marine	Tamil Nadu; Andaman and Nicobar	Dawson 1985
		Tamil Nadu coast	Murugan et al. 2008
		Andaman Islands	Rajan et al. 2013
<i>Hippichthys penicillus</i>	Marine	Gujarat coast	Dawson 1985
<i>Hippichthys heptagonus</i>	Marine and estuary	Andaman and Nicobar	Rajan et al. 2013
<i>Ichthyocampus carce</i>	Freshwater	Maharashtra	Dawson 1985
		Tamil Nadu coast	Dhanya et al. 2007
<i>Micrognathus andersonii</i>	Marine	Tamil Nadu coast	Dawson 1985
<i>Micrognathus brevirostris</i>	Marine	G. of Mannar, and Kachchh (list only)	James 1970
<i>Microphis brachyurus</i>	Marine and freshwater	Andaman and Nicobar	Rajan et al. 2013
<i>Microphis cuncalus</i>	Freshwater and brackish	Maharashtra; Tamil Nadu	Dawson 1985
		Cuddalore	Dhanya et al. 2007
<i>Microphis deocata</i>	Freshwater	Darjeeling, Assam	Hora 1921
		Assam coast	Sehgal 1956
		NE India	Sen 2000

Table continues on next page.

Table 2 cont.

Species Name	Habitat	Locality	Reference
<i>Microphis insularis</i>	Freshwater	Meghalaya Andaman Islands Andaman Islands Tamil Nadu coast Tamil Nadu coast Andaman and Nicobar Tamil Nadu coast Tamil Nadu coast Kerala coast Andaman Islands Goa coast	Khyriam 2016 Dawson 1985 Rajan et al. 2013 Dawson 1985 Dawson 1985 Rajan et al. 2013 Dawson 1985 Murugan et al. 2008 Bijukumar and Deepthi 2009 Rajan et al. 2013 Sanaye et al. 2016 Dawson 1985
<i>Nannocampus pictus</i>	Marine	Tamil Nadu coast	Murugan et al. 2008
<i>Phoxocampus belcheri</i>	Marine	Tamil Nadu coast	Murugan et al. 2008
<i>Phoxocampus tetraphthalmus</i>	Marine	Tamil Nadu coast	Dawson 1985
<i>Syngnathoides biaculeatus</i>	Marine	Gulf of Kachchh Gujarat (list only)	Murugan et al. 2008 Brahmane et al. 2014
<i>Trachyrhamphus bicoarctatus</i>	Marine	Tamil Nadu coast	
<i>Trachyrhamphus longirostris</i>	Marine	Tamil Nadu coast	
<i>Trachyrhamphus serratus</i>	Marine	Tamil Nadu coast	

REFERENCES

- Anonymous** 1972. The Wildlife (Protection) Act, 1972 (No. 53 of 1972) (9th September, 1972). Legislative Department, Ministry of Law and Justice, Government of India.
- Anonymous** 1996. Biological diversity of Gujarat: Current knowledge. Gujarat ecology commotion, Vadadora, India.
- Bijukumar A., Deepthi G.R.** 2009. Mean trophic index of fish fauna associated with trawl bycatch of Kerala, southwest coast of India. *Journal of Marine Biological Association of India* **51** (2): 145–154.
- Brahmane V.T., Temkar G.S., Metar S.Y., Sikotaria K.M., Desai A.Y.** 2014. Ichthyofaunal diversity in the vicinity of marine protected areas, Jamnagar, Gulf of Kachchh, India. *Asian Journal of Advanced Basic Sciences* **3** (1): 78–88.
- Dawson C.E.** 1977. Synopsis of Syngnathinae pipefishes usually referred to the genus *Ichthyocampus* Kaup, with description of new genera and species. *Bulletin of Marine Science* **27** (4): 595–650.
- Dawson C.E.** 1978. Review of the Indo-Pacific genus *Bhanotia*, with description of *B. nuda* n. sp. *Proceedings of the Biological Society of Washington* **91** (2): 392–407.
- Dawson C.E.** 1981. Notes on four pipefishes (Syngnathidae) from the Persian Gulf. *Copeia* **1981** (1): 87–95. DOI: 10.2307/1444043
- Dawson C.E.** 1985. Indo-Pacific pipefishes (Red Sea to the Americas). Gulf Coast Research Laboratory, Ocean Springs, MS, USA.
- Dhanya S., Rajagopal S., Balasubramanian T.** 2007. On the occurrence of pipefishes in Vellar estuary, Parangipettai. *Journal of Marine Biological Association of India* **49** (2): 237–238.
- Duncker G.** 1915. Revision der Syngnathidae. Erster Teil. *Mitteilungen aus dem Naturhistorischen (Zoologischen) Museum in Hamburg* **32**: 9–120.
- Franzoi P., Maccagnani R., Rossi R., Ceccherelli V.U.** 1993. Life cycles and feeding habits of *Syngnathus taenionotus* and *S. abaster* (Pisces, Syngnathidae) in a brackish bay of the Po River delta (Adriatic Sea). *Marine Ecological Progress Series* **97**: 71–81. DOI: 10.3354/meps097071
- Fricke R., Eschmeyer W.N., Fong J.D.** 2019a. Species by family/subfamily in Eschmeyer's Catalog of Fishes. California Academy of Sciences, San Francisco, USA. [Accessed on 15 June 2019.] <http://researcharchive.calacademy.org/research/ichthyology/catalog/SpeciesByFamily.asp>
- Fricke R., Eschmeyer W.N., van der Laan R.** (eds.) 2019b. Eschmeyer's catalog of fishes: Genera, species, references. California Academy of Sciences, San Francisco, USA. [Accessed on 15 June 2019.] <http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp>
- Fricke R., Mahafina J., Behivoke F., Jaonalison H., Léopold M., Ponton D.** 2018. Annotated checklist of the fishes of Madagascar, southwestern Indian Ocean, with 158 new records. *Fish Taxa* **3** (1): 1–432.

- Froese R., Pauly D.** (eds.) 2019. FishBase. [Version 02/2019] <http://www.fishbase.org>
- Golani D., Fricke R.** 2018. Checklist of the Red Sea fishes with delineation of the Gulf of Suez, Gulf of Aqaba, endemism and Lessepsian migrants. *Zootaxa* **4509** (1): 1–215. DOI: 10.11646/zootaxa.4509.1.1
- Hora S.L.** 1921. On some new or rare species of fish from the eastern Himalayas. *Records of the Indian Museum* **22** (5): 731–744.
- James P.S.B.R.** 1970. *Micrognathus brevirostris* (Ruppell) (Family Syngnathidae: Pisces)—A new record from the Indian seas with observations on its early development. *Journal of the Marine Biological Association of India* **12** (1–2): 158–162.
- Kamboj R.D.** 2014. Biology and status of seagrasses in Gulf of Kachchh Marine National Park and Sanctuary, India. *Indian Ocean Turtle Newsletter* **19**: 8–11.
- Kaup J.J.** 1853. Uebersicht der Lophobranchier. *Archiv für Naturgeschichte* **19** (1): 226–234.
- Kaup J.J.** 1856. Catalogue of lophobranchiate fish in the collection of the British Museum. Taylor and Francis, London, England. DOI: 10.5962/bhl.title.21150
- Khyriam D.** 2016. First record of pipefish *Microphis deocata* (Hamilton, 1822) from Meghalaya, India. *Records of the Zoological Survey of India* **116** (4): 485–488.
- Kitsos M.-S., Tzomos Th., Anagnostopoulou L., Koukouras A.** 2008. Diet composition of the seahorses, *Hippocampus guttulatus* Cuvier, 1829 and *Hippocampus hippocampus* (L., 1758) (Teleostei, Syngnathidae) in the Aegean Sea. *Journal of Fish Biology* **72** (6): 1259–1267. DOI: 10.1111/j.1095-8649.2007.01789.x
- Kuiter R.H.** 1998. Pipefishes of the syngnathid genus *Dunckerocampus* (Syngnathiformes: Syngnathidae), with a description of a new species from the Indian Ocean. *aqua, Journal of Ichthyology and Aquatic Biology* **3** (2): 81–84.
- Kuiter R.H.** 2003. Seahorses, pipefishes and their relatives. A comprehensive guide to Syngnathiformes. TMC Publishing, Chorleywood, U.K.
- Kuiter R.H.** 2009. Seahorses and their relatives. Aquatic Photographics, Seaford VIC, Australia.
- Lourie S.A., Vincent A.C.J., Hall H.J.** 1999. Seahorses: an identification Guide to the World's Species and their conservation. Project Seahorse, London, UK.
- Murugan A., Dhanya S., Rajagopal S., Balasubramanian T.** 2008. Seahorses and pipefish of the Tamil Nadu coast. *Current Sciences* **95**: 253–260.
- Pollom R.** 2016. *Bryx analicarenis*. The IUCN Red List of Threatened Species 2016: e.T46102582A46665229. DOI: 10.2305/IUCN.UK.2016-1.RLTS.T46102582A46665229.en
- Rajan P.T., Sreeraj C.R., Immanuel T.** 2013. Fishes of Andaman; Andaman and Nicobar Islands: A checklist. *Journal of Andaman Sciences Association* **18**: 47–87.
- Randall J.E.** 1995. Coastal fishes of Oman. Crawford House Publishing, Bathurst NSW, Australia.
- Robertson D.R., Van Tassell J.** 2019. Shorefishes of the Greater Caribbean: online information system. Version 2.0. Smithsonian Tropical Research Institute, Balboa, Panamá. <https://biogeodb.stri.si.edu/caribbean/en>
- Ryer C.H., Orth R.J.** 1987. Feeding ecology of the northern pipefish, *Syngnathus fuscus*, in a seagrass community of the lower Chesapeake Bay. *Estuaries* **10** (4): 330–336.
- Sanaye S.V., Rivonker C.U., Ansari Z.A., Sreepada R.A.** 2016. A new distributional record of alligator pipefish, *Syngnathoides biaculeatus* (Bloch, 1785) along Goa, central west coast of India. *Indian Journal of Geo-Marine Sciences* **45** (10): 1299–1304.
- Satyanarayana Ch., Chandran R., Ramkumaran K., Rajan R., Tripathi B., Chandra K., Venkataraman K., Yogesh Kumar J.S., Tikidar S., Kamboj R.D., Nisha J.C.** 2017. Transplantation / Restoration of extirpated and threaten corals at Gulf of Kachchh—A marginalized reef region of India. Published by Director, Zoological Survey of India, Kolkata, India.
- Schultz L.P., Herald E.S., Lachner E.A., Welander A.D., Woods L.P.** 1953. Fishes of the Marshall and Marianas Islands. *Bulletin of the United States National Museum* **202** (1): 1–685.
- Sehgal K.L.** 1956. [23] On a collection of fish from Assam. *The Journal of the Bombay Natural History Society* **53** (4): 717–724.
- Sen N.** 2000. Occurrence, distribution and status of diversified fish fauna of North East India. Pp. 31–48. In: Ponniah A.G., Sarkar U.K. (eds.) *Fish biodiversity of North East India*, NBFGR, NATP Publication 2.
- Senou H.** 2013. [Syngnathidae.] Pp. 615–635. In: Nakabo T. (ed.) *[Fishes of Japan with pictorial keys to the species.]* 3rd edn. Tokai University Press, Kanagawa, Japan. [In Japanese.]
- Steffe A.S., Westoby M., Bell J.D.** 1989. Habitat selection and diet in two species of pipefish from seagrass: sex difference. *Marine Ecology Progress Series* **55**: 23–30. DOI: 10.3354/meps055023
- Stölting K.N., Wilson A.B.** 2007. Male pregnancy in seahorses and pipefish: Beyond the mammalian model. *BioEssays* **29** (9): 884–896. DOI: 10.1002/bies.20626
- Suresh V.R.** 1997. Distribution and diversity of reef associated fishes at Lakshadweep atolls with a note on their fishery potential. *Environment and Ecology* **15** (4): 965–970
- Weber M., de Beaufort L.F.** 1922. The fishes of the Indo-Australian Archipelago. IV. Heteromi, Soleichthyes, Syngnathidae, Percosoces, Labyrinthici, Microcyprini. E.J. Brill, Leiden: i–xiii, 1–410. DOI: 10.5962/bhl.title.12497
- Wilson A.B., Vincent A., Ahnesjö I., Meyer A.** 2001. Male pregnancy in seahorses and pipefishes (family Syngnathidae): Rapid diversification of paternal brood pouch morphology inferred from a molecular phylogeny. *Journal of Heredity* **92** (2): 159–166. DOI: 10.1093/jhered/92.2.159

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