

## A new distributional record of alligator pipefish, *Syngnathoides biaculeatus* (Bloch, 1785) along Goa, central west coast of India

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Present study is based on a single male specimen of alligator pipefish, *Syngnathoides biaculeatus* (Bloch, 1785) collected from the bay-estuarine system of Goa (central west coast of India) which is the new distributional record for this species. A comparison of 20 morphometric and 5 meristic characters of the specimen collected from Goa waters with those from the eastern coast of India revealed significant differences in the number of pre and post-anal rings. An attempt has been made to elucidate its rare occurrence along the coast of Goa in the light of its ecological prerequisites.

**[Keywords:** Alligator pipefish, *Syngnathoides biaculeatus*, Goa, *Sargassum* sp., distribution]

### Introduction

Pipefishes are members of the Family Syngnathidae (Order: Syngnathiformes) distinguished by a body encased in a series of bony rings and brood pouches in male to incubate the embryos<sup>1</sup>. Recently, these fishes have received global attention due to large-scale exploitation as ingredients in Traditional Chinese Medicine, as aquarium fish, in artworks and curios<sup>2</sup>. *Syngnathoides* is a monospecific genus consisting of the alligator pipefish, *Syngnathoides biaculeatus* (Bloch, 1785). Currently this species is listed under the 'Data Deficient' category of IUCN red list<sup>3</sup>. Previously, *S. biaculeatus* has been reported from the Andaman and Nicobar Islands<sup>4</sup> and Palk Bay and Gulf of Mannar regions on the southeast coast of India<sup>5</sup>. On the west coast, this species has been reported from Lakshadweep islands<sup>6</sup> and southwest region of Kerala coast<sup>7</sup>. However, no records on the distribution of this species along central west coast of India are available. The present paper describes a new distributional record of *S. biaculeatus* for Goa coast. Attempts have been made to understand the probable reasons for its rare occurrence along the Goa coast in light of eco-biological aspects.

### Material and Methods

#### Sampling strategy:

During the extensive survey in documenting the ichthyofaunal biodiversity along the coastal

waters of Goa, central west coast of India, a single male alligator pipefish, *S. biaculeatus* (Bloch, 1785), accidentally caught in gill net with shredded branches of seaweed *Sargassum* sp., at depth of 20 m on 15 January 2012 formed the basis of the present study, (Fig. 1). The ichthyofaunal biodiversity survey included 250 trawl hauls in the near shore and bay-estuarine waters of Goa. In addition, fish composition in landings from beach seines and gill net operations in the estuarine embayment (where trawling was restricted) was also recorded. Gill nets (25 mm mesh size) were operated from fibre reinforced plastic (FRP) canoes.

#### Taxonomic identification and morphometric analysis:

*Syngnathoides* is a mono-specific genus consisting of the alligator pipefish, *Syngnathoides biaculeatus* (Bloch, 1785) which is identified following Murugan *et al.*<sup>5</sup>; Schultz<sup>8</sup>; Dawson<sup>9</sup>; Kuitert<sup>10</sup>; Froese and Pauly<sup>11</sup>. Detailed morphometric and meristic characters were measured following Cakic *et al.*<sup>12</sup>; Lourie<sup>13</sup>; Gurken and Taskavak<sup>14</sup>; Gurken<sup>15</sup> with species specific modifications for alligator pipefish. Morphological measurements were recorded using vernier caliper with an accuracy of 0.01 mm. Wet weight of alligator pipefishes was measured using digital electronic balance with an accuracy of 0.001 g.

Table 1. Comparison of morphometric and meristic characters of *S. biaculeatus* collected from Goa waters (central west coast of India) and Palk Bay, Tamil Nadu (southeast coast of India)

Measuring characters	Goa specimen (N=1)	Palk Bay specimens (N=30)
Wet weight (g)	3.7145	4.2238±0.47
<b>Morphometric character</b>		
Total length ( $L_T$ )	179 mm	185±13.35 mm
Maximum body height (H)	6 mm	7±0.46 mm
Maximum body width (iH)	9 mm	12±0.70 mm
Minimum body width (ih)	3.5 mm	5±0.38 mm
Antedorsal distance (aD):	63 mm	63±4.92 mm
Postdorsal distance (pD) :	80 mm	88±6.61 mm
Length of dorsal fin basis (ID)	30 mm	25±1.51 mm
Height of dorsal fin (hD)	4 mm	3±0.39 mm
Length of anal fin basis (IA)	1 mm	1±0.00 mm
Height of anal fin (hA)	2 mm	2±0.00 mm
Length of pectoral fin (IP)	5 mm	6±0.50 mm
Head length ( $L_H$ )	36 mm	35±2.19 mm
Occipital height of head (OHH)	7 mm	8±0.73 mm
Head width (Hw)	6 mm	7±0.48 mm
Snout length (SnL)	18 mm	17±1.20 mm
Snout depth (SnD)	3 mm	2±0.44 mm
Mouth width (MW)	2.5 mm	2±0.22 mm
Eye diameter (ED)	6 mm	6±0.48 mm
Post-orbital length (PO):	12 mm	12±0.73 mm
<b>Meristic character</b>		
Number of rays in dorsal fin (D):	40	39±1.20
Number of rays in anal fin (A):	4	4±0.00
Number of rays in pectoral fin (P)	21	21±1.10
Number of Preanal rings (PaR)	16	17±0.00
Number of postanal rings (PoAR)	35	47±1.17

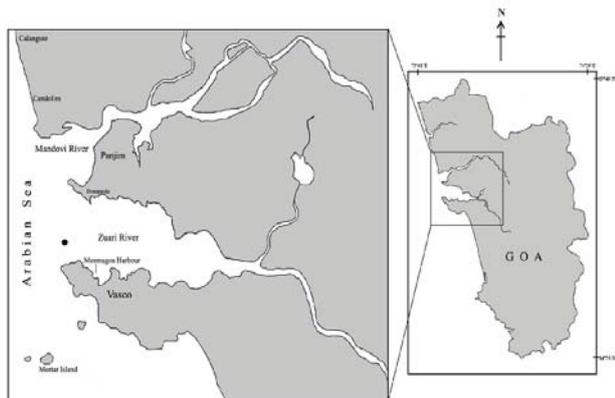


Fig. 1. Map showing location of new occurrence for *Syngnathoides biaculeatus*, shown by (●), off Goa, central west coast of India

## Results

A single male specimen of alligator pipefish (Fig. 2) accidentally caught in one of the gill net (25 mm mesh size) operated in the bay estuarine system of Zuari River at a depth of 20 m.

The collected specimen was observed to be associated with shredded branches of *Sargassum* sp.

### Material examined

One male specimen; SB-1, 177 mm total length, TL(location co-ordinates: 15°25'42.20"N, 73°47'19.14"E; water depth: 20 m). S. Sanaye.

### Comparative material

30 specimens, which were caught as by-catch in wind driven country trawl or 'Vallams' mainly operated for crab/shrimp fishery were collected and no fish were specially caught or kill for this study; 172-198 mm TL; Palk Bay, Tamil Nadu (location co-ordinates: 9°39'24.48"N, 78°58'14.05"E and 9°46'35"N, 79°0'28"E; water depth: 5-10 m). S. Sanaye.

Details of morphometric and meristic measurements of all fish specimens along with their mean and standard deviation are provided in Table 1. Reference voucher sample is deposited at the museum, CSIR-National Institute of Oceanography, Goa.

### Family Syngnathidae Rafinesque, 1810

Body elongate and encased in a series of bony rings; one dorsal fin, usually with 15–60 soft rays; anal fin very small and usually with 2–6 rays; pectoral fin usually with 10–23 rays (the dorsal, anal, and pectoral fins may be absent in adults of some species); no pelvic fins; caudal fin absent in some species; caudal peduncle may be prehensile and employed for holding on to objects when caudal fin is absent; gill openings very small; supracleithrum absent; kidney present only on right side, aglomerular. Some

species are very colorful. Maximum recorded length about 65 cm<sup>16</sup>.

#### *Genus Syngnathoides Bleeker, 1851*

Head essentially in line with longitudinal axis of body or bent very little in ventral direction. Principal body ridges without enlarged spines. Sclera of eye without bony platelets. Lateral trunk ridge bent dorsally, ending just below superior ridge near rear of dorsal-fin base. Distal part of tail clearly prehensile and tapered<sup>11</sup>.



Fig. 2. Lateral (A) and dorsal (B) views of alligator pipefish, *S. biaculeatus* collected from Goa, Central west coast of India

#### *Syngnathoides biaculeatus (Bloch, 1785)*

Depressed, tetragonal body; superior and inferior trunk ridges continuous with respective tail ridges; lateral trunk ridge deflected dorsally, ending below superior tail ridge near dorsal fin base; dorsal fin originates on trunk; caudal fin absent; brood below the trunk in front of anal fin in case of male; plates and folds absent; chin with two barbells; variable greenish in color<sup>5,8&9</sup>.



Fig 3. Dorsal view of alligator pipefish, *S. biaculeatus* from Palk Bay (upper) and Goa (lower) is indicating the number of pre-anal rings.

Mean body width of specimen collected from Goa waters (9 mm) was found to be narrower than the specimens collected from Palk bay, east coast of India ( $12 \pm 0.70$  mm). Conspicuous differences in the meristic characters such as body width and number of

trunk rings or pre-anal rings of specimens collected from the two localities were discernible (Fig. 3) Numbers of pre-anal or trunk rings in the specimen collected from Goa were 16, while they were 17 in the specimen collected from Palk Bay, east coast of India.

#### Discussion

The present report is the first reliable record documenting the new distributional range of the alligator pipefish, *Syngnathoides biaculeatus* along the central west coast of India and is also an extended distributional range from the southwest coast of India. The existing distributions of this species suggest that it is native to Indo-Pacific region<sup>9&11</sup>. Published literature from the Indian waters<sup>5&17</sup>, indicates that *S. biaculeatus* is most common in the Palk Bay and Gulf of Mannar regions along the east coast of India (Fig. 4). Bijukumar and Deepthi<sup>7</sup> recorded this species in the trawl by-catches off Kerala along the south west coast of India albeit in very low numbers.

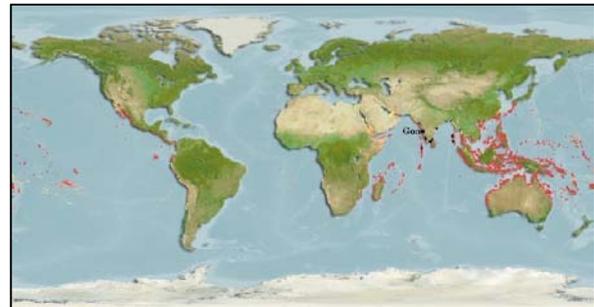


Fig. 4. Map of world indicating native range of alligator pipefish, *S. biaculeatus*. (Fishbase, 2013) with (●) solid black point denoted report of its occurrence along Indian coast and (■) present record of alligator pipefish along Goa.

A review of published literature on fish biodiversity of Goa coast<sup>18,19,20,21</sup> do not cite the occurrence of *S. biaculeatus* from coastal waters and wetlands of Goa. Extensive trawl samplings off Goa coast during years 2006-2012 (Padate V., Goa University, Goa, pers. comm.) also confirmed the absence of this species in the catches. The relative probabilities of its occurrence along Goa coast (Fig. 4) as per the distribution maps generated on (www.fishbase.org) is quite low (0.01 to 0.19 nos./m<sup>2</sup>). Despite extensive sampling efforts, collection of a single specimen reflects that *S. biaculeatus* is uncommon in the coastal waters of Goa.

At the same time for such a small, camouflagic and un-economic species,

confirmation on its new finding is often very difficult to indicate a real expansion or simply that they had been overlooked previously<sup>22</sup>.

The rare occurrence of *S. biaculeatus* along Goa coast can be linked to the lack of its preferred habitat. Published literature on the habitat preferences of this species<sup>5&9</sup> suggest that it occurs at shallow depth of 2-5 m in seagrass beds of *Thalassia hemprichii*, *Cymodocea serrulata* and *Enhalus acoroides*. Jagtap<sup>23</sup> reported only two species of seagrasses, *Halophila ovalis* and *H. beccarii* from the mangrove-fringed mudflats along the Mandovi and Terekhol rivers of Goa. Absence of extensive seagrass beds in coastal waters of Goa might have forced *S. biaculeatus* to associate with seaweeds.

Adults of syngnathid fishes are known to exhibit two different mechanisms for long range dispersal such as drifting by storms and transport while grasping floating debris<sup>24</sup>. Several other studies<sup>25,26,27,28,29</sup> have reported different syngnathid species associated with floating *Sargassum* and attributed to the same for habitat and prey availability. Due to limited mobility, syngnathid fishes are often found attached to seagrasses, seaweeds, corals and any submerged substratum with their prehensile tail<sup>24</sup>. Long range migration has been earlier reported in some pipefish species<sup>30&31</sup>, while some are known to occupy the shallow seagrass beds throughout the year, exhibiting no seasonal movement<sup>32</sup>. Further, Froese and Pauly<sup>11</sup> reported that *S. biaculeatus* is a non-migratory species and the lack of caudal fin<sup>1</sup> is a major obstacle for long range migration. Therefore, the patchy seagrass habitat combined with morphological constraints might hinder the establishment of a sizeable population of *S. biaculeatus* along Goa coast.

The incidental occurrence of *S. biaculeatus* in coastal waters of Goa might be due to its association with the drifting seaweeds (*Sargassum sp.*) from its known habitats such as Andaman and Nicobar Island<sup>4</sup>, Palk Bay and Gulf of Mannar in east coast of India<sup>5</sup>, Lakshadweep Islands<sup>6</sup>, and Kerala<sup>7</sup>. According to Shenoi *et al.*<sup>33</sup> and Shankar and Shetye<sup>34</sup>, west monsoon current flows around Lakshadweep high and then entered into west India coastal current and spread along west coast of India during winter monsoon (January). Alligator pipefish has been previously reported to occur in association with drifting *Sargassum*<sup>10&25</sup> and these currents could provide possible means of

translocation from its known habitats (Lakshadweep Islands and Kerala) to coastal waters of Goa.

Syngnathid fishes prey upon amphipods, fish larvae and other small invertebrates<sup>35,36,37,38</sup>. Harmelin-Vivien<sup>39</sup> recorded zoo-benthos including benthic crustaceans and shrimps as main food items in juveniles and adult alligator pipefish inhabiting Madagascar waters. Ingolfsson and Kristjansson<sup>40</sup> recorded abundant prey taxa (copepods, crustacean's larvae, ostracods) in and around floating seaweeds. The diversity and abundance of its prey organisms in the coastal and estuarine waters of Goa<sup>41&42</sup> might have enabled this species to support its feeding requirements.

The present observations on the specimen collected from Goa and its comparison with Palk Bay specimens revealed considerable variations in the morphometric parameters (Table 1). These differences could be attributed to two factors namely, ontogenic variations in morphological characters and habitat availability. Present specimen from Goa is 177 mm long. The maximum reported size for this species 290 mm TL<sup>11</sup>. It is apparent from the above that the present specimen is a small adult and its morphological differences with the Palk Bay specimens probably arose due to age differences or if the single specimen collected from Goa waters is genetically different from Palk Bay specimens.

IUCN Red List of Threatened species includes *Syngnathoides biaculeatus* in 'Data Deficient' category. Hence, its occurrence along Goa, central west coast of India is of biogeographic significance indicating a possible means of extension of native range, largely attributed to habitat heterogeneity. Rare occurrence of this species in the coastal waters of Goa could be attributed to habitat patchiness. The differences in morphometric parameters and meristic counts with the Palk Bay specimens are attributed to ontogenic differences in size of the fish and seagrass cover. Further studies involving mitochondrial and microsatellite DNA of the specimens from two localities is required to confirm whether the Palk Bay population is genetically different from Goa population. Such studies have greater importance to confirm whether a new finding is indicative of expansion in its native range or simply that they had been overlooked previously. It is further conjectured that less seagrass cover might have resulted in its association with seaweeds along Goa coast.

Present paper is a preliminary attempt to assess the causes of its rarity along the Goa coast and necessitates the examination of larger number of samples and the use of molecular techniques to assess its taxonomic status and enhance our understanding on the establishment of this species in this region.

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