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Checklist of beloniform fishes of coastal waters of Thoothukudi, southeast coast of India

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Abstract
Thoothukudi located in the Gulf of Mannar Biosphere Reserve is one of the most important potential fishing areas along the southeast coast of India. In India, the marine fishes constitute 75.6 %, comprising of 2443 species belonging to 927 genera, under 230 families of 40 orders. Of these 40 orders, the order Beloniformes constitutes a minor pelagic fishery in India whereas it forms a remarkable pelagic fishery in Tamil Nadu contributing an average of 42.6% of total Beloniform fish catch in India. In Tamil Nadu, Thoothukudi is known for fishing which target Beloniform fishes. However, no study has been undertaken in the recent times to document the biodiversity of Beloniform fishes in this region. In this regard, occurrence and abundance data of Beloniform fishes were collected from three different marine fish landing centers viz., Tharuvaikulam, Therespuram and Punnaikayal located along Thoothukudi coast from August 2017 to July 2018. The number of individuals in each species and their length were also noted down. The present check list includes 17 species of beloniform fishes belonging to 9 genera under 3 families. The checklist would help to evolve strategies for the sustainable exploitation and conservation of these fishes along Thoothukudi coast.

Keywords: Beloniformes, Belonidae, Hemiramphidae, Excoetidae, Thoothukudi

1. Introduction
India is one of 17 mega-biodiverse countries harbouring a variety of species-rich ecosystems including marine habitats. It has a coastline of 8,118 km, with an Exclusive Economic Zone (EEZ) of 2.02 million sq km and a continental shelf area of 4,68,000 sq km. Tamil Nadu which is one of the maritime states of India is blessed with a coastline of 1076 km which is around 13 % of the country's coast, 0.19 million sq.km of EEZ and 41,412 sq.km of the continental shelf area. The marine fisheries potential of Tamil Nadu has been estimated to be 0.719 million tonnes of which 0.369 million tonnes from less than 50 meter depth area and 0.35 million tonnes from beyond the 50 meter depth area. Tamil Nadu shares around 12 to 20 % of the total marine fish landings of India. Among the 13 coastal districts of Tamil Nadu, Thoothukudi (Tuticorin) is the third largest one having 163.5 km long coast line and 23 marine fishing villages [17]. A total of 414 species of marine fish species have been reported from Tamil Nadu during 2016 [2]. Pelagic resources have become more dominant over demersal and other resources. Among the several pelagic fishery resources, belonids and hemiramphids commonly known as full and halfbeaks respectively support good fishery in Tamil Nadu and on an average 42.6% of this resource in India is landed in Tamil Nadu. Along Thoothukudi coast, Beloniform fishes are dominant and they are caught selectively in the fishing village, Tharuvaikulam using specific fishing gears, meanwhile, they are caught as bycatch in fullbeak net and hook and lines in Therespuram and only in a drift gillnet in Punnaikayal.

2. Material and Methods
The occurrence and abundance data of Beloniform fish species caught by various types of fishing gears were collected fortnightly from three different fish landing centres viz., Tharuvaikulam (8°89' N, 78°17' E), Therespuram (8°48' N, 78°9' E) and Punnaikayal (8°38' N, 78°7' E) located along Thoothukudi coast from August 2017 to July 2018 (Fig. 1). The Belonifrm fish specimens were collected and kept in an insulated ice box with ice to maintain the quality of fish till they reached the laboratory. The fish specimens were cleaned, photographed and finally preserved in 10% formalin. The standard literatures were referred for the identification of fish species (Fischer and Bianchi [7]; Jayaram [11]; Whitehead *et al*. [24]). Gillnets of different types such as fullbeak net (Mural valai) with mesh size of 48 to 60 mm,

halfbeak net (Kattamural valai) with mesh size of 38 to 65 mm and flyingfish net (Parava valai) with mesh size of 40 to 60 mm were used to target Beloniform fishes in Tharuvaikulam whereas in Therespuram, they were caught in large quantities as bycatch using fullbeak net (Mural valai) with mesh size of 48 to 50 mm and hook and lines with hooks bearing nos. 4, 5, 7 and 9. Meanwhile, they were caught as bycatch only in drift gillnets with mesh size of 32 – 50 mm in Punnaikayal. In addition, number of individuals in each fish species and their total length were also recorded at all the three landing centres to understand the dominant species and size composition of Beloniform fishes. Fishbase was also referred to confirm the names of the species and to know their status of International Union for Conservation of Nature and Natural Resources (IUCN).

Fig 1: Map showing the study area

3. Results and Discussion

The present study revealed the presence of 17 species of beloniform fishes belonging to nine genera under three families along Thoothukudi coast. Of the three families, Hemiramphidae (Halfbeak) consisted of five species with *Hemiramphus far* as dominant species, whereas Belonidae (fullbeak / needlefish) comprised six species with *Ablennes hians* as dominant species and Exocoetidae (flyingfish) consisted of six species with *Cheilopogon suttoni* as dominant species (Table 1). Hastings *et al*. [10] reported that the needlefishes and their relatives are diverse group that included six families, 36 genera and 260 species. The order, Beloniformes is a large order of marine and freshwater epipelagic fishes represented worldwide by six families and 285 species, including: Rice and Duck-billed Fishes (Adrianichthyidae), Needle Fishes (Belonidae), Sauries (Scomberesocidae), Halfbeaks (Hemiramphidae), Flyingfishes (Exocoetidae) and Viviparous halfbeak (Zenarchopteridae) [25]. A total of 19 species (representing four families) have been reported from European waters and the Mediterranean Sea, including at least four species from Irish waters [16].

Gopi and Mishra [9] reported 50 Beloniform fish species belonging to 17 genera under three families along the Indian coast. Laxmappa and Bakshi [13] reported four species belonging to three genera under three families from Telangana State. Venkataraman *et al*. [22] reported nine species of beloniform fishes belonging to 7 genera under three families along Digha coast in West Bengal. Joshi *et al*. [12] reported 1182 species of marine fishes belonging to 476 genera under 144 families of 39 orders from the Gulf of Mannar, of which nine species each belonging to Exocoetidae and Hemiramphidae and eight belonging to Belonidae.

The family, Hemiramphidae (Halfbeak) consists of 62 species belonging to 8 genera at global level [25] whereas this family is represented by 16 species belonging to 5 genera in India [9]. A total of 18 species and subspecies in six genera in the Far East region, the distribution of most of them are limited to tropical region, and only a few species such as *Hyporhamphus sajon*, *H. intermedius* and *H. gemaerti* are characteristic of subtropical and temperate waters [3]. Weber and de Beaufort [23] reported 32 species from the lndo-Australian Archipelago. Smith [20] listed eight species from South Africa and Munro [15] reported six species from Sri Lanka. Halfbeaks are primarily confined to tropical and sub-tropical waters and only three species have been reported from the Mediterranean Sea. Collette [6] reported a hybrid halfbeak and listed 22 species of Hemiramphidae from Australia. Collette [5] also reported five species of halfbeak under the genus *Hemiramphus* and subgenus *Hyporhamphus* from the Indo-West Pacific region. Talwar and Jhingran [21] described ten species of Hemiramphidae from the inland waters of India. Jayaram [11] reported three genera under the family Hemiramphidae. Shaji and Easa [19] reported two species of Hemiramphidae from the rivers of the Western Ghats. In the present study, a total of 5 species belonging to 2 genera were recorded along Thoothukudi coast with *Hemiramphus far* as the most dominant species, followed by *Hemiramphus archipelagicus*. The landings of *H. far* were observed to belong to the size group 19 – 37.5 cm whereas *H. archipelagicus* belonged to 14 to 19.5 cm. Further, all these 5 species are reported to be under the category 'Not Evaluated' by IUCN.

The family, Belonidae (Fullbeak) consists of 47 species belonging to 10 genera at global level [25] whereas this family is represented by 8 species belonging to 4 genera in India [9]. However, Hastings *et al*. [10] reported ten genera and 38 species of belonidae at global level. On the other hand, Golani *et al*. [8] reported only 32 species of fullbeak, occurring in all tropical and temperate seas of the world. Two genera, *Tylosurus* and *Strongylura* contain most of the species in the family with 6 and 14 respectively. Most of the needlefishes are marine, but 12 species are restricted to freshwaters and several species of *Strongylura* move long distances into freshwater [4]. In the present study, a total of 6 species belonging to 4 genera were recorded along Thoothukudi coast with *Abelnnes hians* as the most dominant species, followed by *Strongylura leiura*. The landings of *A. hians* were observed to belong to the size group 42.6 – 98.2 cm whereas *S. leiura* belonged to 47 to 55 cm. Further, of all these 6

species, 3 species each are reported to be under the categories 'Least Concern' and 'Not Evaluated' by IUCN.

The family, Exocoetidae (Flyingfish) consists of 71 species belonging to 7 genera at global level [25] whereas this family is represented by 18 species belonging to 6 genera in India [9]. Hastings *et al*. [10] reported 66 species under eight genera. Declan and Quigley [16] reported ten species of flyingfish from the North East Atlantic and Mediterranean Sea, only three of these have been confirmed (albeit rarely) from North West European waters (north of Biscay). Barman and Mishra [1] reported 14 species of flyingfishes belonging to six genera in Indian waters. In the present study, a total of 6 species belonging to 3 genera were recorded along Thoothukudi coast with *Cheilopogon suttoni* as the most dominant species, followed by *C. furcatus*. The landings of *C. suttoni* were observed to belong to the size group 26 – 34 cm whereas *C. furcatus* belonged to 18 to 25 cm. In addition, of all these 6 species, 3 species each are reported to be under the categories 'Least Concern' and 'Not Evaluated' by IUCN.

Table 1: Checklist of Beloniform fish species collected from coastal waters of Thoothukudi, Southeast coast of India

S. No.	Species Name	Common Name	Stations	No. Recorded	Size Range (cm)	IUCN Status
	Belonidae					
1	*Ablennes hians* (Valenciennes, 1846)	Flat needlefish	TK,TH,PK	13781	42.6 – 98.2	LC
2	*Platybelone argalus* (Lesueur, 1821)	Keeltail needlefish	TK,TH,PK	1221	20 - 40.5	LC
3	*Strongylura leiura* (Bleeker, 1850)	Banded needlefish	TK,TH,PK	7921	47 - 55	NE
4	*Strongylura strongylura* (van Hasselt, 1823)	Spottail needlefish	TK,TH,PK	3899	18 - 45	NE
5	*Tylosurusacus melanotus* (Bleeker, 1850)	Keel-jawed needlefish	TK,TH,PK	3912	59.2 - 88	NE
6	*Tylosurus crocodilus* (Peron & Lesueur, 1821)	Hound needlefish	TK	3519	35 - 124	LC
	Exocoetidae					
7	*Cheilopogon cyanopterus* (Valenciennes, 1847)	Margined flyingfish	TK	9216	20 - 34	LC
8	*Cheilopogon furcatus* (Mitchill, 1815)	Spotfin flyingfish	TK	9727	18 - 25	LC
9	*Cheilopogon nigricans* (Bennett, 1840)	Blacksail flyingfish	TK	4824	20 - 24.2	LC
10	*Cheilopogon suttoni* (Whitley & Colefax, 1938)	Sutton's flyingfish	TK,TH,PK	13736	26 - 34	NE
11	*Exocoetus monocirrhus* (Richardson, 1846)	Barbel flyingfish	TK	1108	19 - 23.6	NE
12	*Hirundichthys coromandelensis* (Hornell, 1923)	Coromandel flyingfish	TK	579	21.96 -25.3	NE
	Hemiramphidae					
13	*Hemiramphus archipelagicus* (Collette & Parin, 1978) [5]	Jumping halfbeak	TK,TH,PK	8159	14 - 19.5	NE
14	*Hemiramphus far* (Forsskål, 1775)	Black-barred halfbeak	TK	12866	19 - 37.5	NE
15	*Hemiramphus lutkei* (Valenciennes, 1847)	Lutke's halfbeak	TK	6766	14.5 - 20	NE
16	*Hemiramphus marginatus* (Forsskål, 1775)	Yellowtip halfbeak	TK	929	26 - 34.8	NE
17	*Hyporhamphus dussumieri* (Valenciennes, 1847)	Dussumier's halfbeak	TK	881	28.5 - 33.2	NE

TK – Tharuvaikulam; TH – Therespuram; PK – Punnaikayal
LC – Least Concern; NE – Not Evaluated

4. Conclusion

The present checklist of beloniform fishes with scientific names organized within a classification system would definitely enhance the information on each species and provide more information to the stakeholders involved in catching, processing, marketing and conservation. Further, the information on the biodiversity, dominant species and size composition of Beloniform fishes would help to assess the status of stock of Beloniform fishes along Thoothukudi coast. In addition, the present study provides basic information required for inventory, conservation and sustainable use of biodiversity of the Gulf of Mannar Biospehere Reserve in which Thoothukudi coast is one of the productive regions of the reserve.

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