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New Distributional Record of *Triacanthus nieuhofii* Bleeker, 1852 (Tetraodontiformes: Triacanthidae) from Maharashtra, North West Coast of India

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ABSTRACT

Background: Fishes of the family triacanthidae are highly diversified throughout the world, but studies on these fishes were very limited in India. Now a day's catch of species belongs to this family increasing and showing new geographical distributions due to overfishing of top predators.

Methods: Experimental fishing method was conducted by using the M.F.V Narmada-IV vessel of ICAR- Central Institute of Fisheries Education, Mumbai. The vessel operated with a demersal trawl net with a cod-end mesh size of 30 mm. Spatial distribution map of the family Triacanthidae was generated from previous literature using the IDW interpolation method in Arc GIS 10.4.

Result: New distributional record of silver tripodfish, *Triacanthus nieuhofii* Bleeker, 1852 was recorded for the first time from the Mumbai waters, northwest coast of India. Spatial map showing that the species of the family Triacanthidae were highly diversified along the east coast than the west coast of India.

Key words: IDW, Silver tripodfish, Spatial mapping, Tetraodontiformes, Triacanthus.

INTRODUCTION

Fishes of the order 'Tetraodontiformes' are distributed in tropical to temperate seas of the world, but completely absent from cold water (Matsuura, 1997). This order comprises of approximately 436 valid species under 106 valid genera, categorised into 10 families namely Triacanthidae, Tricanthodidae, Triodontidae, Molidae, Diodontidae, Tetraodontidae, Aracanidae, Ostraciidae, Monocanthidae and Balistidae (Fricke *et al.,* 2021). Among these, Triacanthidae consists of 7 valid species under 4 valid genera in the world (Fricke *et al.,* 2021).

Tetraodontiformes have attracted the attention of ichthyologists and biologists around the world due to their great diversity of size, structure, and behaviour (Matsuura, 2015; Tyler, 1980). Majority of these fishes are vital components of coral reefs and seagrass ecosystems and play functional roles of herbivores, macroinvertivores, piscivores, zooplanktivores, and corallivores (Matsuura, 2015; Stump *et al.,* 2018; Eduardo *et al.,* 2020). They have been reported to influence the trophic structure and composition of their habitats by feeding on multiple trophic groups and/or integrating the diet of other fishes (Darling *et al.,* 2017; Patankar *et al.,* 2018).

Tetraodontiformes catch data have not been properly documented as they often exploited as bycatch. Further, the taxonomy of the species is not stable as the same species is often recorded under different names from different parts of the country causing much confusion. The identification of Triacanthidae species is very difficult due to their morphological ambiguity and poor taxonomic descriptions. *Triacanthus nieuhofii* is closely related to *T. biaculeatus* (Psomadakis, 2015, Mohanty *et al.,* 2018) and it's only difficult to distinguish in large specimens (Tyler, 1968, Karna *et al.,* 2018).

Fish distribution and abundance vary across a spatial scale and elucidating the variations on a spatio-temporal scale have ecological and management significance (Ciannelli *et al*., 2008). GIS application in marine fisheries was adopted from the 1990s (Meaden, 2000; Nishida and Booth, 2001). Arc GIS is a very powerful software for computerized mapping and spatial analysis which is an overall idea about the distribution of selected parameters (Shivakrishna *et al*., 2020; Shivakrishna *et al*., 2021) and it is widely used for fisheries data analysis and mapping of

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abundance pattern and distribution of species. Recently Saha *et al.* 2019 mapped the Spatio-temporal distribution of *Lagocephalus inermis* (Tetraodontiformes: Tetraodontidae) in the South-Eastern Arabian Sea. This study reports the extended distribution of *Triacanthus nieuhofii* from the north-west coast of India. This information is useful for fishery managers, ecologists and conservationists to formulate the management measures.

MATERIALS AND METHODS

Specimen of single species of *Triacanthus nieuhofii* was collected from Mumbai coastal waters (Lat. 19°11′35.76″N, Long. 72°36′24.45″E), the Northeastern part of Arabian Sea, Northwest coast of India (Fig 1) on 4 March 2020. The fish was captured in an experimental fishing programme conducted by M.F.V Narmada (IV) using a Trawl net (Shrimp trawl attached with otter boards; cod-end mesh size 30 mm) operated at a depth ranging from 20 to 21 m from the water surface with a speed of 2.5 knots. The collected specimen was brought to the laboratory and photographed in fresh condition and identified based on standard morphological keys given by Matsuura (2001) and Psomadakis (2015). The morphometric characters with an accuracy of 0.01 mm and total body weight with an accuracy of 0.1 g were measured using a digital calliper and weighing balance, respectively. After identification, specimen was fixed in 10% formalin and then preserved in 70% ethanol and stored at the Department of Fisheries Resource Management, ICAR-Central Institute of Fisheries Education, Mumbai, India for future reference. Spatial distribution map of family Triacanthidae was generated using IDW (Inverse Distance Weighted) method in Arc GIS 10.4 according to (Shivakrishna *et al.,* 2020).

RESULTS AND DISCUSSION

A single specimen of the Silver tripodfish, *Triacanthus nieuhofii* Bleeker, 1852, is captured between the depths of 20 to 22 m with 2.5 knots speed demersal trawl net for the first time from the Mumbai waters, northwest coast of India. Diagnostic characters of the *T.niuhofii* are a moderately elongate and strongly compressed body with a small and terminal positioned mouth. Body supported by thick skin with small scales that can be visible clearly under the magnifying glass. Compressed head with large eyes (Fig 2). Cleary separated dorsal fin, first dorsal fin with 5 spines and first spine very longer and stronger with half of the spine much darker than the distal part (Mohanty *et al.* 2018) and second dorsal fin with 24 soft rays. Though this character is very similar to *T. biaculeatus, T. niuhofii* is distinguished by the presence of spiny dorsal fin membrane (very black) between the 1st and 2nd spines, marginally too much less dark between the 2nd and 3rd spines, and pale between the 3rd and 5th spines (Gopalakrishna *et al.,* 2009, Psomadakis, 2015). Pelvic fin with single large spine and ventral surface of the pelvis about as broad at the front as at the rear not tapered to a point. It contains 14 branched pectoral-fin rays. Deeply forked caudal fin and with narrow caudal peduncle. The head is convex between the base of the first dorsal-fin spine and eyes, somewhat convex in front of the spine and then slightly concave over the eye. Colour of the fresh specimen body silvery on the lower half and slightly dusky in the upper half. The soft fins of the fish are a yellowish colour. Previously it is reported in India from Lakshadweep (Jones and Kumaran, 1968), Kerala (Naomi *et al.,* 2011), Goa (Hegde *et al*., 2013), Tamil Nadu (Karuppasamy, 2016), Odisha (Karna *et al*., 2018), West Bengal (Mohanty *et al.,* 2018) and Andhra Pradesh (Naranji *et al.,* 2019). Globally, it is reported from the Arabian Sea, Bay of Bengal, Andaman Sea, Indonesia, South China Sea, and northern Australia (Matsuura, 2015).

Based on the available literature it was found that the family Triacanthidae consists of 6 valid species under 4 valid genera along with the Indian coastal waster. Table 1 showing family Triacanthidae distributional records from India, IUCN status (FishBase) and Threat to humans (FishBase). More than 70% of Tetraodontiform fishes are poisonous for human consumption due to the presence of the deadliest neurotoxins (tetrodotoxins) in the liver, gonad, muscle, and skin *etc.* but all Triacanthidae species are harmless for humans. Among 7 species of family Triacanthidae only one species is not reported from India that is Black-flag tripodfish, *Tripodichthys angustifrons* (Hollard, 1854) 1968. The spatial map of the family Triacanthidae gives a clear representation of the species distribution in India and it shows the east

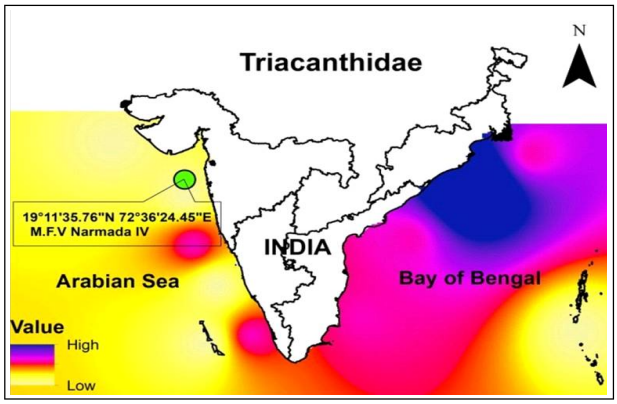


Fig 1: Triacanthidae species distribution in India with a new distributional record from the Maharashtra coast.



Fig 2: Photograph of *Triacanthus nieuhofii* Bleeker, 1852.

Table 1: Distributional records of Triacanthidae family from the Indian coast.

Family/Species name	IUCN status	Threat to human	Common name	NW	NE	SW	SE	A and N	LAK
TRIACANTHIDAE			Tripod fishes /triple spines						
Pseudotriacanthus strigilifer (Cantor, 1849)	NE	Harmless	Longspined tripodfish	Murty 1969 (MH); Barman *et al*. 2000 (GUJ)	Barman *et al* 2007 (ODI); Pal *et al*. 2014 (WB)	Pillai 1929 (K); Baman *et al*. 2013(KA); Talwar 1974 (GOA)	Venkataraman *et al*. 2002 (TN); Barman *et al*. 2004 (AP)	Rao et al. 2000; Devi and Rao 2003	
Triacanthus biaculeatus (Bloch, 1786)	NE	Harmless	Short-nosed tripodfish	Barman *et al*. 2000 (GUJ); Barman *et al*. 2012 (MH)	Murty 1969 (ODI);Manna and Goswami 1985 (WB)	Pillai 1929 (K); Barman *et al*. 2013(KA)	Krishnamurthy and Jayaseelan 1981 (TN);Krishnan and Mishra 1993 (AP); Mishra and Krishnan 2003(PUD)	Rao *et al*. 2000; Devi and Rao 2003	Jones and Kumaran 1980
Triacanthus nieuhofii Bleeker, 1852	NE	Harmless	Silver tripodfish	Present Study	Karna *et al*. 2018 (ODI); Mohanty *et al*. 2018 (WB)	Naomi *et al*. 2011 (K); Hegde *et al*. 2013 (GOA)	Karuppasamy 2016 (TN): Naranji *et al*. 2019 (AP)		Jones and Kumaran 1968; Jones 1969; Jones and Kumaran 1980
Tripodichthys blochii (Bleeker, 1852)	NE	Harmless	Long-tail tripodfish			Talwar 1974(GOA)			
Tripodichthys oxycephalus (Bleeker, 1851)	NE	Harmless	Short-tail tripodfish		Barman *et al*. 2007(ODI)				
Trixiphichthys weberi (Chaudhuri, 1910)	NE	Harmless	Blacktip tripodfish		Barman *et al*. 2007 (ODI)				

NE: Not Evaluated, GUJ: Gujarat, MH: Maharashtra, ODI: Odisha, WB: West Bengal, K: Kerala, KA: Karnataka, AP: Andhra Pradesh, TN: Tamil Nadu, PUD: Puducherry, NE: North West, NE: North East, SW: South West, SE: South East, AandN: Andaman and Nicobar, LAK: Lakshadweep.

coast of India is highly diversified than the west coast of India (Fig 2). Several authors have reported species diversity of east and west coast of India (Gopi and Mishra, 2015, Venkataraman and Raghunathan, 2015) and these two coasts are disticnt in habitat diversity, variation in coral distribution, water circulation pattern and other physical factors that can affect the distribution of species (Huston, 1985). GIS map, which mapped using interpolation technique in Arc GIS showing the different colour grading from low to high based upon the previous reports of all species of Triacanthidae from the different coastal districts and Islands of Indian coast. Several previous studies have studied the spatio-temporal distribution of fishes and represented their distribution and abundance (Saroj *et al.,* 2018; Bhendekar *et al.,* 2019; Pradhan *et al.,* 2020).

Recently, Gopi and Mishra, (2015) reported an estimated number of 105 species under 53 genera under 8 families of Tetraodontiformes. However, 2 families named Aracanidae and Triodontidae are not reported from Indian coastal waters indicating the the lack of research on the order Tetraodontiformes.

Only two species namely *Tricanthus biaculaetus* and *T. nieuhofii* have been reported under the genus Tricanthus. Though these species have some morphological similarities, several studies have reported distinguishing morphological characters between them (Matsuura, 2001; Gopalakrishna *et al.,* 2009; Karna *et al.,* 2018). *T. nieuhofii* was first reported from India by Jones and Kumaran (1968) from Lakshadweep islands and it is not reported from Andaman and Nicobar islands. Present study reports extended distributional range of *T. nieuhofii* to the Northern part of the west coast of India, from Maharashtra coast.

CONCLUSION

T. nieuhofii possibly exists on the entire Indian coast and might have been often confused as *T. biaculeatus* due to very similar external morphology. The absence of two families from the order, as well as the relatively high rate of new species discoveries, suggests that there remains much to be survey and discovery. More Triacanthidae species are reported from the east coast of India than the west coast.

Conflict of interest

All authors declare that they have no conflict of interest.

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