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New Distributional Record of Greater Amberjack *Seriola dumerili* (Risso, 1810) (Perciformes: Carrangidae) from the Eastern Arabian Sea, India

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ABSTRACT

Background: The fishes of the family Carangidae forms one of the largest families of bony fishes, representing about 140 species, widely distributed in all tropical and temperate marine waters of the world. In recent past, fishes of this family are exhibiting new geographical distribution which could be attributed to climatic variability.

Methods: The specimens were collected from multiday trawl boats operated along Karnataka coast. Morphometric and meristic characteristics together with genetic analysis using DNA bar coding was used to validate the identity of the specimen. Spatial distribution map of the species in Indian Ocean was generated using the information from the present study and available literature.

Result: The morphometric and meristic characteristics of the specimens of greater amberjack, *Seriola dumerili* collected during the study were comparable with the previous investigations. The phylogenetic tree constructed using sequences of COI (MW974826 and MW974827) of the *Seriola* species showed distinct clustering among species with significant bootstrap values confirming the identity to the extent of 99% with the sequences of *Seriola dumerili* deposited in NCBI GenBank. This study confirms the first distributional record of *Seriola dumerili* from the eastern Arabian Sea.

Key words: Arabian sea, Carrangidae, Greater amberjack, *Seriola dumerili*.

INTRODUCTION

The family Carangidae forms one of the largest families of bony fishes comprising various marine fishes that are ecologically and commercially important species such as the jacks, scads, trevallies, pampano, amberjacks and queenfishes (Rekha *et al*. 2010; Abdussamad *et al*. 2013). The fishes of this family represent about 140 species, widely distributed in all tropical and temperate marine waters of the world (Nelson, 1994; Kim *et al*. 1997). Carangid fishes are widely distributed along both west and east coast of India mainly concentrated in coral and rocky beds representing 60 species having intricate morphological and meristic characters, which makes their identification highly complicated (Abdussamad *et al*. 2008, 2013). Presence of two separate dorsal fins, lateral line scutes and two detached anal spines, cutaneous fleshy lateral keels, dorsal and ventral grooves on caudal peduncle with wide variation in shape of the body, size, scale pattern and colouration are the general characteristics of the fishes of this family (Smith-Vanitz, 1984). However, the detached anal spines are visible externally only during younger stages in jacks and become resorbed or embedded beneath the skin in adults with no lateral line scutes.

The greater amberjack, *Seriola dumerili* is widespread in subtropical and temperate waters of the world Ocean (Mohamed *et al*. 2018; Manooch and potts, 1997) and often associated with rocky reefs between the depth range of less than 20 and 80 metres but also recorded at depths of up to 360 m (Fischer *et al*. 1987). Juveniles of this species always moves in school but adults are mostly solitary (Khalaf, 2004). The greater amberjack, one of the largest carangid, which supports important recreational and commercial fisheries, grows to a maximum of 1.9 m length and weighs 80.6 kg (Kulbicki *et al*. 1993; Thompson *et al*. 1999). It is an opportunistic predator, feeds voraciously on teleosts, crustaceans, molluscs and sea grass (Andaloro and Pipitone, 1997; Badalamenti *et al*. 1993; Mohamed *et al*., 2018) while juveniles feed on plankton, small invertebrates and sea grass (Feitoza *et al*. 2005).

The previous studies recorded the species only from South Africa northward to Algoa Bay and the Gulf of Western Indian Ocean and from Bay of Bengal in the eastern Indian

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Ocean. In addition, it was reported from Japan, Australia and the Hawaiian Islands of Indo-west Pacific the Bay of Bengal, east coast of India (Fischer and Bianchi, 1984; Abdussamad *et al*. 2008). Hence, the specimens described in this study confirm the first distributional record of *S. dumerili* from the eastern Arabian Sea based on the morpho-meristic characteristics and molecular analysis.

MATERIALS AND METHODS

In the present study, a total of 28 specimens of *S. dumerili* were procured from Mangalore (12°853′N, 74°833′E) and Malpe Fishing Harbours (13°347′N, 74°701′E) of Karnataka during December 2020 to April 2021. The specimens collected were caught from multiday trawl boats operating hook and lines at a depth of 60-80m. Fresh specimens were brought to the laboratory of the Regional Centre of ICAR-Central Marine Fisheries Research Institute, Mangalore in iced condition for the detailed morphological and molecular investigations. Specimens were photographed in fresh condition and identified based on the key given by Smith-Vaniz, (1984). The morphometric and meristic measurements were taken following standard procedure (Hubs and Lagler, 2004) and compared with the published information available about this species from different parts of the world (Abdussamad *et al*. 2008; Sley *et al*. 2016; Luzhmiak *et al*. 2020). The morphometric measurements were taken for each specimen with an accuracy of 0.01mm and total body weight was recorded to the nearest 0.1 g using digital calliper and electronic weighing balance respectively. The natural colour patterns and tones were recorded from freshly collected specimen as these characters may be lost completely or partially when stored using preservatives.

Genetic analysis

Before tissue collection for DNA analysis, the scissors and forceps were cleaned thoroughly of any possible DNA between each sample by plunging it into high concentration ethanol and igniting with a lighter. Muscle tissue (about 5 mm^2) was taken from caudal peduncle area with a cleaned scissors and preserved in 95% ethanol (10:1 ratio) in small plastic vials at room temperature for further analysis. Triplicate samples were taken labelled with sample numbers, date of collection and species and other information like locality, type of collection fish length and sex, *etc*., was recorded on data sheet (FAO, 2016).

DNA extraction and amplification of the Cytochrome C Oxidase 1 (COI) gene sequences

DNA of the specimens was extracted using standard phenol/choloroform extraction protocol and a universal primer (Folmer *et al*. 1994) was used for the amplification of mitochondrial Cytochrome C oxidase 1 (COI) gene using PCR. The PCR products were sequenced subsequently using the primer (LCO1490 and HC02198; Folmer *et al*. 1994) and a 650bp region of COI genes submitted to NCBI GenBank with accession nos. MW974826 and MW974827.

Materials examined

Seriola dumerili (Risso, 1810): 28 ex: 425-495mm TL, 745-1107 g TW, collected from Mangalore and Malpe Fishing harbours, Karnataka, India, 29 December 2020, 27 January 2021, 11, 16 February 2021, 17 March 2021 and 20 April 2021.

RESULTS AND DISCUSSION

Seriola dumerili (Risso, 1810), Greater amberjack

Morphometric measurements

Slightly compressed and elongated body (Fig 1) with depth at first and second dorsal fin origin was about 24.2-28.9 and 23.8 -27.7% of the TL respectively (Table 1). The first gill arch had 5-6 and 14-16 gillrakers on upper and lower lobe respectively. Two dorsal fins separated by a narrow space 0.65-1.18% TL; first dorsal fin with seven spines and second dorsal had one spine and 31-32 rays. First two spines of anal fin feebly developed followed by a spine and 18-20 soft rays. Pelvic fins (11.31-14.82% of TL) slightly longer than pectoral fins (10.37-12.00% of TL). Lateral line slightly curved with no scutes on it, a distinct caudal peduncle groove present. Very minute pointed teeth directed backward.

Colouration

Dorsal side of the body dark with olivacious or greenish-blue, light silvery white on sides and belly; thick golden yellow

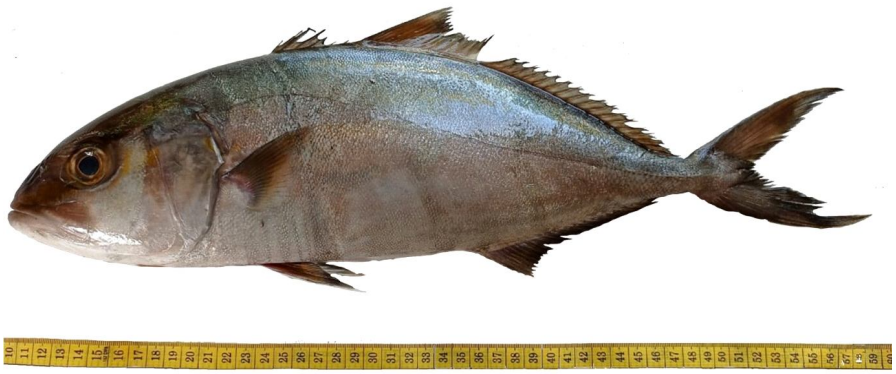

Fig 1: *Seriola dumerili*, 473 mm, landed at Mangalore Fishery harbour, Karnataka, India.

Table 1: Morphometric and meristic characters of *Seriola dumerili*. Body proportions are expressed as a percentage of total length.

Species	*S. dumerili*			
	Arabian sea, India (Present study) *n*=28	Bay of Bengal, India (Abdussamad *et al*. 2008) *n*=1	Mediterranean sea (Sley *et al*. 2016) *n*=267	Black sea (Luzhniak *et al*. 2020) *n*=1
Total weight (g)	745-1107	-	-	934
Total length (TL mm)	425-495	489	155-1660	447
In % of TL Fork length	83.84-87.27	86.0	-	90.60
Standard length	74.74-81.82	76.0	-	87.47
Head lengh	22.83-26.56	21.0	17.46-26.60	22.37
Snout length	7.58-8.67	8.0	-	-
Eye diameter	3.93-4.63	4.0	-	-
Interorbital width	8.69-9.89	7.0	-	-
Upper jaw length	9.57-11.11	9.0	-	-
lower jaw length	9.05-10.59	-	-	-
Caudal peduncle depth	4.09-5.15	4.0	-	-
Depth at I Dorsal	24.24-28.87	25.0	16.96-28.53	20.36
Depth at II dorsal	23.84-27.71	27.0	16.42-26.08	17.22
Maximum body depth	25.27-28.87	27.0	-	-
Pre-first dorsal length	29.55-34.32	28.0	25.71-48.39	31.32
Pre-second dorsal length	39.08-43.84	38.0	34.24-48.72	40.49
pre-pectoral length	24.84-27.06	21.0	-	-
Pre-pelvic length	27.07-29.41	24.0	-	-
Pre-anal length	52.22-55.63	50.0	-	-
Inter dorsal space	0.65-1.18	1.0	-	-
I Dorsal base length	8.00-9.45	10.0	6.56-13.52	9.39
II dorsal base length	31.83-36.36	36.0	24.88-38.44	36.24
Pectoral base length	3.56-4.84	-	-	-
Pelvic base length	1.98-3.23	-	-	-
Anal base length	19.19-24.83	24.0	-	-
I dorsal height	4.04-6.35	-	-	-
II dorsal height	8.42-10.37	-	-	-
Anal height	6.67-8.47	12.0	-	-
Pectoral length	10.37-12.00	16.0	8.88-14.11	11.86
Pelvic length	11.31-14.82	15.0	-	-
Pre-orbital length	7.68-9.47	-	-	-
Post-orbital length	65.66-79.79	-	-	-
Meristic counts				
I dorsal spine	7	8	6-7	7
I dorsal rays	0	0	0	0
II dorsal spine	1	1	1	0
II dorsal rays	31-32	28	29-35	34
Pectoral spines	0	1	0	0
Pectoral rays	19-21	21	19-20	-
Pelvic spines	1	1	1	-
Pelvic rays	5	4	5	-
Anal spines	3	0+1	3	2
Anal rays	18-20	19	18-21	22
Gillrakers on the upper limb	5-6	8	-	-
Gillrakers on the lower limb	14-16	17	13-21	-
Brancheostegal rays	7	7	-	-

strip on sides of head runs through the eyes along the centre of the body. First dorsal dark or greyish; second dorsal fin completely dark; Caudal and anal fins with slight yellow tinge.

Most of the morphometric and meristic characteristics (Table 1) of the specimens of greater amberjack, *S. dumerili* collected during the study were comparable with the previous investigations (Smith-Vanitz, 1984; Abdussamad *et al*. 2008; Sley *et al*. 2016; Luzhmak *et al*. 2020). The total length range of the specimens of *S. dumerili* obtained in the present study were narrower and comparable with the earlier reports from Black Sea (Luzhmak *et al*. 2020) and Bay of Bengal (Abdussamad *et al*. 2008), while the length range of the specimens of *S. dumerili* reported from the Mediterranean Sea (Sley *et al*. 2016) were broader. Similarly, the depth at first and second dorsal fins, maximum body depth, pre dorsal length of first and second dorsal fins were comparable with the ranges obtained by previous studies from Black Sea, Mediterranean Sea and Bay of Bengal (Table 1). However, the head length of the specimens of *S. dumerili* collected in this study are comparable with the specimens of Mediterranean Sea, but slightly higher than that of the specimens reported from Black Sea. Similar slight variations in the ranges of pectoral and pelvic fin lengths of *S. dumerili* were observed in the present study compared to the specimens of Mediterranean Sea and Black Sea (Table 1). The slight variations recorded in the proportions for some morphometric measurements such as head length, pre dorsal length, pelvic length, pectoral length, anal length and anal height in comparison to previous studies could be due to the differences in the size range of the specimens examined and geographic variations. Further, individual morphological traits are not depending on the species but on the temperature of the environment in which the fish grows (Nikolioudakis *et al*. 2014).

Sequence alignment and analysis

Molecular identification through DNA bar coding (Fig 2) was also employed for the confirmation of the species. The species identity of the samples of the present study was confirmed using NCBI, Blast. Molecular analysis confirmed 100% identity with the sequence of *S. dumerili* deposited in NCBI, GenBank. Further, the sequences of cytochrome c oxidase 1 (COI) of *S. dumerili* were aligned with sequences retrieved from GenBank of other valid species of *S. dumerili*, *S. lalandi*, *S. quinqueradiata*, *S. hippos*, *S. fasciata*, *S. rivoliana* and *S. zonata* using Clustal W in MEGA 6. A phylogenetic tree was constructed using UPGMA method with 1000 bootstraps. Tree topology was also tested using maximum likelihood, maximum parsimony and neighbour-joining methods. The tree was then rooted with CO1 sequences of *Mugil cephalus* retrieved from GenBank.

Genetic analyses

The phylogenetic tree constructed using sequences of COI (Fig 2) of the *Seriola* species showed distinct clustering among species with significant bootstrap values confirming the identity. The sequences of the present study also clustered with sequences of *S. dumerili* deposited in NCBI GenBank. Similar tree topology was also obtained when phylogenetic analyses were conducted using maximum likelihood, maximum parsimony and neighbour joining method.

This species is widely distributed in the Indo-West Pacific to Atlantic regions and were reported from South Africa, Persian Gulf, southern Japan and the Hawaiian Islands, eastern part of Indian Ocean (Bay of Bengal), Mariana and Caroline islands in Micronesia in the New Caledonia, Bermuda, Nova Scotia in the Western Atlantic,

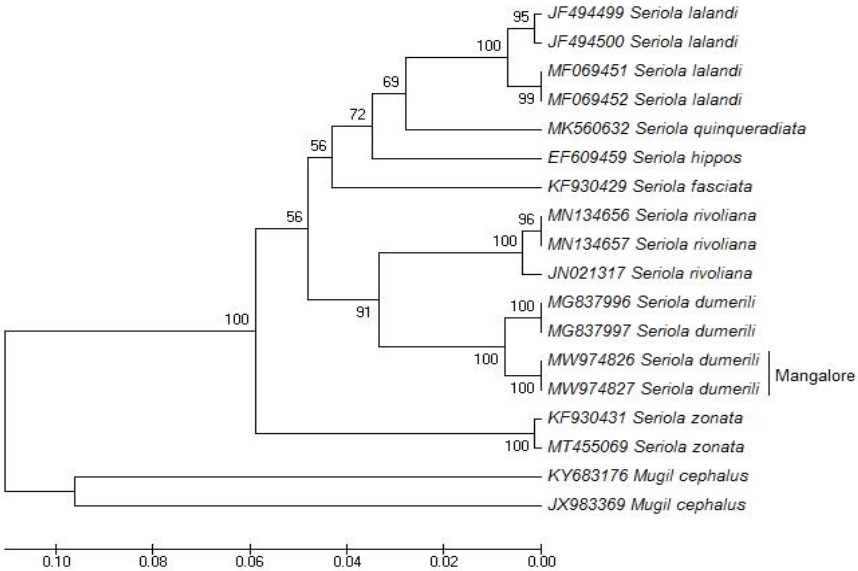

Fig 2: Phylogenitic tree of *Seriola* spp. based on DNA sequences of mitochondrial COI gene constructed using UPGMA method (MW974826 and MW974827, *S. dumerili* for the present study).

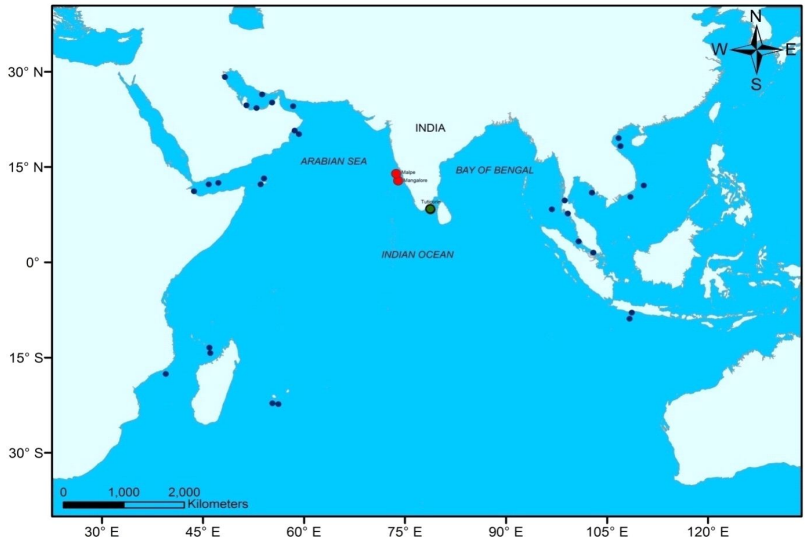

Fig 3: New distributional record of *Seriola dumerili* (Risso, 1810) in the southeastern Arabian Sea. The red circles indicates the present record, green circle indicates the report of Abdusamad *et al*. 2008 and blue circle indicates earlier records as given in Fishbase (Froese and Pauly 2021) along the Indian Ocean.

Canada to Brazil, from the Gulf of Mexico and the Caribbean Sea, British coast (vagrant) to Morocco in the Eastern Atlantic and the Mediterranean (Smith, 1997; Abdussamad *et al*. 2008; Froese and Pauly 2021). However, the distribution of *S. dumerili* has not been reported in the eastern Arabian Sea till date and hence, this report confirms the first distributional record from eastern Arabian Sea (Fig 3). According to the information gathered from local fisherman, this species is caught at depth range of 60-80 m depth employing hooks and lines from the multiday trawl boats. The fishery of *S. dumerili* was reported previously along the Indian Ocean from South African Coast (Smith-Vanitz, 1984) and Tuticorin coast of India (Abdussamad *et al*. 2008). Hence, this indicates that *S. dumerili* could have extended its geographical range by migrating towards south-eastern Arabian Sea from the African coast and/or from the Tuticorin waters, southeast coast of India. Molecular analysis also confirmed these findings as there was a 100% identity with sequence deposited in NCBI, GenBank. The substantial migration abilities of this species to move from Mediterranean waters to Black Sea have been reported (Lezhmiak *et al*. 2020). The size of the specimens collected in the present study (425-495mm, TL) were comparable with that of the tuticorin waters (489 mm, TL), Bay of Bengal, India (Abdussamad *et al*. 2008) and Black Sea (447 mm, TL) (Luzhniak *et al*. 2020) but smaller than the reports from Mediterranean Sea (165-1650 mm TL) (Sley *et al*. 2016). Occurrence of small sized greater abmerjacks in shallow near shore waters and larger ones between 18 and 72m and up to as deep as 360 m has been reported (Fischer and Bianchi, 1984). Thus, further studies are essential to investigate the abundance of greater amberjack in different depths and breeding and nursery grounds in the Arabian Sea.

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