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New Distributional Record of *Halichoeres zeylonicus* (Bennett, 1833) from the Vellar Estuary, Southeast Coast of India

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ABSTRACT

The present study documents for the first time, the presence of *Halichoeres zeylonicus* (Bennett, 1833) (Family: Labridae) in the Vellar Estuary on the southeast coast of India. The fish was obtained through the process of collecting, fixing, preservation, and identification following conventional taxonomic methodologies. The species' identification involved an intensive analysis of the morphometric and meristic characteristics such as dorsal fin rays (IX,14), anal fin rays (III,11), 25 pored lateral line scales and colouration of the body, which is unique to *H. zeylonicus*. The specimen has been preserved in the fish collection of the Centre of Advanced Study in Marine Biology at Annamalai University. The present documentation sheds light on the ecological flexibility of *H. zeylonicus* as a species capable of surviving in both coral reefs and estuaries.

Keywords: *Halichoeres zeylonicus*; Labridae; New distributional record; Vellar Estuary; Range extension; Coral reef fish; Estuarine occurrence

1. INTRODUCTION

Indians boasts of one of the richest faunas existing anywhere in the world, because of the presence of many rivers and estuaries, along with an extensive coastline along the Arabian Sea, Bay of Bengal, and the Indian Ocean. These ecosystems house many different organisms like fishes, mollusks, and crustaceans, which help maintain balance in the ecology. The coral reefs of ecosystems in areas like the Gulf of Mannar, Lakshadweep Island, and Andaman and Nicobar Islands are biodiversity-rich (Kar *et al.*, 2017; Mohapatra *et al.*, 2013; Bijukumar & Raghavan, 2015; Ray *et al.*, 2014). The fishes found in these reef ecosystems have many behavioral and ecological adaptations, such as territorial behavior, schooling behavior, and good predator avoidance and vision, specific to reef ecosystems.

Labridae comprises one of the largest families among the reef fishes. Ecological importance lies in their role as benthic predators and indicators for the ecosystem of the reef. *Halichoeres zeylonicus* (Bennett, 1833) is a small and brightly colored wrasse occurring in the Indo-Western Pacific region, which inhabits mainly in the coral reefs,

lagoons, and rocks ranging from 1-20 meters depth. Protogyny and sexual dimorphism have become common characteristics of Labridae (Raghavan *et al.*, 2012; Marshall *et al.*, 2003; Gopi & Mishra, 2015; Victor, 2016; Joshi *et al.*, 2016; Pradhan & Mahapatra, 2017). Despite the wide occurrence of *Halichoeres zeylonicus* from the coral reef area, the presence of *Halichoeres zeylonicus* from the estuarine region was not documented in the available literature. The present paper documents for the first time the occurrence of *H. zeylonicus* from Vellar Estuary, Southeast Coast of India.

2. MATERIALS AND METHODS

The live specimens were collected from the Vellar Estuary, Tamil Nadu, as part of the routine biological monitoring works. The specimens were collected by the local fishermen using cast nets from the Vellar Estuary, Tamil Nadu (11°29'22.90" N, 79°46'01.05" E). The specimens were then sent to the laboratory and examined. The specimens were identified as *Halichoeres zeylonicus* (Bennett, 1833) based on the unique features using the literature on the taxonomy of fish (Victor, 2016). The morphometric and meristic data were recorded using the method described by Armbruster (2012). The data were recorded using a digital Vernier Calliper manufactured by in size with an accuracy of 0.01 mm.

Photographs of the specimens were taken using a camera prior to the preservation of the specimens (Fig. 1). The specimens were then preserved in 4% formaldehyde solution and stored in the fish collection of the Centre of Advanced Study in Marine Biology (CASMB), Faculty of Marine Sciences, Annamalai University, Tamil Nadu.



Figure 1. *Halichoeres zeylonicus*

3. RESULTS

A single specimen of *Halichoeres zeylonicus* was collected from the Vellar Estuary during the survey.

Systematic Account

Kingdom: Animalia

Phylum: Chordata

Class: Actinopterygii

Order: Labriformes

Family: Labridae

Genus: *Halichoeres* Rüppell, 1835

Species: *Halichoeres zeylonicus* (Bennett, 1833)

Original Description

Bennett, E.T. (1833) originally described this species under the genus *Julis* as *Julis zeylonicus*. Later on, it was transferred to *Halichoeres* genus on the basis of taxonomic revision. Detailed Information: An in-depth account of Labridae family was presented by Gomon & Randall in 1984 in FAO Species Identification Sheets for Fishery Purposes, Western Indian Ocean

Body moderately deep and compressed, completely covered by smooth cycloid scales. Depth of body at gill opening 6.6 cm in a specimen of 20.5 cm total length (TL). Head strongly compressed, knife-like in profile to the rear, with convex interorbital region. Head length 6.47 cm or 31.6% TL. Eye small, 1.03 cm in diameter or 4.9% in head length (HL), 19.9% TL. Snout steep and compressed. Jaws prominent, each bearing two prominent canine teeth at the front, each tooth very prominent in the upper jaw, and the second tooth of the upper jaw distinctly recurved.

Presence of dorsal fin that is continuous with a marked notch between the second and third spines; the fin membrane is not incised to the base. The dorsal fin originates slightly posterior to the midpoint between the posterior end of the orbit and the pectoral fin base. The dorsal fin is IX,14; predorsal length is 5.96 cm (29.1% TL); the dorsal fin base is 12.5 cm (61.0% TL). The anal fin is III,11; the preanal length is 8.85 cm (43.2% TL). The pectoral fin is well developed with 12 rays; the pelvic fin is I,5. The caudal fin is rounded with 14 principal rays.

The lateral line is complete with a marked deflection downwards below the posterior part of the dorsal fin; the pored scales in the lateral line number 25. Three scale rows are present between the dorsal fin origin and the lateral line. The cheeks are naked below the eye; the opercle is provided with eight rows of rudimentary scales. The breast is covered with moderately sized cycloid scales.

The combination of IX,14 dorsal-fin rays; III,11 anal-fin rays; 25 pored lateral-line scales; presence of a distinct black blotch below the pectoral-fin base; and characteristic longitudinal colour pattern confirms the specimen as *Halichoeres zeylonicus*.

Colouration (Fresh Specimen)

Colour pattern is bright, distinct and complex for this species. Snout colour pale yellow, blending into pale blue colouration at the anterior margin of the head. The top part of the head and anterior body part bright greenish in colour, fading into pale grey and pink posteriorly.

Distinct black spot located on the underside of the pectoral fin near its tip; before this spot, pale yellow colouration is present. Bright orange-yellow longitudinal stripe running across the body; narrow blue margin along this stripe. Many small spots scattered over the body; spots more numerous near the lateral line.

Pinkish colouration of the dorsal fin at its tip with orange and blue colouration pattern. Orange and pale blue colouration alternating on the anal fin along its base, fading into pale yellow with blue margins posteriorly. Spot in blue fringing located at the upper base of the pectoral fin; two additional spots also present, located above the lateral stripe on the underside anterior to the caudal peduncle. Vertical pale blue and orange-yellow colouration on the caudal fin with orange or pink spots.

Distinct black spot on the underside of the third scale row below the lateral line is another characteristic colour marking.

Distribution

Halichoeres zeylonicus, or the Goldstripe Wrasse, is widely distributed across the Indo-West Pacific. It is commonly associated with coral reefs, lagoon environments, and rubble substrates in shallow coastal waters. This wide distribution is attributed to the species' ecological flexibility to different environments associated with reefs (Froese & Pauly, 2018).

In the waters of India, the species has been recorded from the Gulf of Mannar, Lakshadweep Archipelago, and recently from the northern part of the Bay of Bengal (Pradhan *et al.*, 2019). This recent record from the Vellar Estuary is noteworthy as the species is now recorded from an estuarine environment compared to its association with coral reefs.

4. DISCUSSION

In the waters of India, the *Halichoeres zeylonicus* has traditionally been linked with coral reef environments, with records from the Lakshadweep Islands and the Gulf of Mannar. Initial records from the Minicoy Islands (Nagabhushanam & Rao, 1972; Yennawar *et al.*, 2017; Pradhan *et al.*, 2019;) were based on the earlier name, and later records were based on morphological and photographic documentation (Randall & Smith, 1982; Victor, 2016; Joshi *et al.*, 2016; Pradhan & Mahapatra, 2017; Roy *et al.*, 2017; Bijukumar & Raghavan, 2015). In recent times, the species has also been recorded from the northern part of the Bay of Bengal, expanding its range along the eastern coast of India. However, these records pertain to reef-associated and offshore environments.

The current record from the Vellar Estuary is therefore noteworthy since the environment is quite different from the typical environments of coral reefs. In fact, the Vellar Estuary is characterized by changing salinity levels, turbidity, soft bottoms, and strong influence from freshwater, while the environments of *H. zeylonicus* are clear waters with structural complexity. This record of *H. zeylonicus* from the Vellar Estuary indicates a degree of plasticity in the environment that was not thought to exist.

Morphometric and meristic features of the collected specimen are found to be quite comparable with the published literature on the species (Table 1), especially regarding dorsal-fin formula, IX,14; anal-fin rays, III,11; 25 pored lateral line scales; presence of a well-defined black spot below the pectoral fin base; and a longitudinal stripe along the sides, bright orange-yellow in color with blue edges, which are quite distinctive and do not cause any confusion with any other closely allied species in the *H. zeylonicus* complex.

Table 1. Morphometric measurements of *Halichoeres zeylonicus*

Character	Measurement (cm)	% SL	% HL
Total Length (TL)	20.50	–	–
Standard Length (SL)	17.02	100	–
Body Depth (BD)	5.45	32.03	–
Body Width (BW)	2.04	11.99	–
Head Length (HL)	6.47	38.02	100
Snout Length (SnL)	1.70	9.99	26.28
Orbit Diameter (OD)	1.45	8.52	22.41
Orbital Depth (HOR)	1.11	6.52	17.16
Interorbital Width (IOW)	1.53	8.99	23.65
Post-orbital Length	1.70	9.99	26.28
Pre-orbital Length	1.02	5.99	15.76
Upper Jaw Length	1.93	11.34	29.83
Lower Jaw Length	2.04	11.99	31.52
Caudal Peduncle Depth	2.47	14.51	–
Caudal Peduncle Length	2.98	17.51	–
Pre-dorsal Length	5.96	35.02	–
Pre-anal Length	8.85	52.00	–
Pre-pectoral Length	5.11	30.02	–
Pre-pelvic Length	5.66	33.26	–
Base of Dorsal Fin	5.45	32.03	–
First Dorsal Spine	0.77	4.52	–
Second Dorsal Spine	1.11	6.52	–
Third Dorsal Spine	1.36	7.99	–
Base of Anal Fin	3.74	21.97	–
First Anal Spine	0.68	4.00	–
Second Anal Spine	1.02	5.99	–
Third Anal Spine	1.36	7.99	–
Pectoral Fin Length	3.40	19.97	–
Pelvic Fin Length	2.89	16.98	–
Pelvic Spine Length	1.36	7.99	–
Caudal Fin Length	3.74	21.97	–
Caudal Fin Height	4.25	24.97	–

The distributional range of *H. zeylonicus* has also been clarified by Victor (2016). It is differentiated from Western Pacific congeners, such as *H. hartzfeldii*, thereby confirming the presence in the Indian Ocean. The presence of reef-associated labrids in non-reef habitats has also been reported in the non-reef areas along the northern Bay of Bengal, where authors have suggested possible reef structures or benthic ridges in the offshore areas, which could be possible refugia for the reef-associated labrids. This could be the possible

explanation for the presence of reef-associated labrids in the Vellar area. The proximity of the Vellar Estuary to the Bay of Bengal and the seasonal marine influx could be possible reasons for the occurrence of reef fishes in the estuary, especially during high salinity periods.

Another possible reason for this could be the species' tolerance to moderate variability in the environment. Labrids are known for their behavioural flexibility, such as substrate foraging, and their use of sandy or rubble habitats adjacent to reefs. The sandy-muddy substratum, along with the benthic invertebrates, in the estuary could be sufficient for feeding grounds. Since *H. zeylonicus* mainly feeds on small invertebrates in the benthos, the trophic resources in the estuary could be sufficient for temporary habitation.

The present record is part of the emerging literature supporting the notion that several species of reef-associated fishes along the Indian coast are more ecologically tolerant than previously perceived. The present record emphasizes the need for detailed ichthyofaunal surveys in the estuarine and nearshore habitats, especially in the southeast coast of India. Detailed seasonal studies on the salinity profile and underwater topography in the nearshore waters may reveal the presence of cryptic reefs and underwater hard substrates where such species are known to occur.

5. CONCLUSION

Therefore, in conclusion, it could be said that the finding of *Halichoeres zeylonicus* from the Vellar Estuary represents an amazing expansion in its range and distribution along the southeastern coast of India. Apart from being a part of the fish fauna of the area, the species also shows that it is adaptable to various habitats. Future studies involving other estuarine ecosystems will result in the identification of various other reef species, which could prove beneficial in determining biodiversity in this area of the Bay of Bengal.

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Author contributions

This manuscript has been read and approved by all the authors. Each of the authors believes that this manuscript represents honest work done by us.

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Conflict of Interest

The authors declare that they have no conflicts of interest, competing financial interest or personal relationship that could have influenced the work reported in this paper.

Informed consent

Not applicable.

Ethical approval & declaration

In this article, the animal regulations are followed as per the ethical committee guidelines of Centre of Advanced Study in Marine Biology, Faculty of Marine Sciences, Annamalai University, Parangipettai - 608 502, Tamil Nadu, India; the authors observed the new distributional record of *Halichoeres zeylonicus* (Bennett, 1833) from the Vellar Estuary, Southeast Coast of India. The Animal ethical guidelines are followed in the study for species observation, identification & experimentation.

Data and materials availability

All data associated with this study are present in the paper.

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