



First record of the Rubicundus Eel goby, *Odontamblyopus rubicundus* (Hamilton, 1822) (Perciformes: Gobiidae) from the Gulf of Khambhat, Gujarat, India

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ABSTRACT

Three individuals of Rubicundus Eel Goby fish, *Odontamblyopus rubicundus* (Hamilton 1822) were reported for the first time from various coasts of the Gulf of Khambhat (Cambay), west coast of India during November 2021-January 2022. Meristic characters, morphometric measurements, and radiographs were recorded for the identification of specimens. The present paper validates the first report of *O. rubicundus* Hamilton 1822 from the Gulf of Khambhat, Saurashtra coast of Gujarat. The specimens are stored in a repository with a specific voucher number at the Department of Marine Science, Maharaja Krishnakumarsinhji Bhavnagar University, Bhavnagar. The current locations of these findings represent the northernmost record on the western coast of India.

INTRODUCTION

The order Gobiiformes of Osteichthyes is comprised of nine families, of which the Gobiidae family is one of the largest fish families with 2086 species (Parenti, 2021). The Amblyopinae subfamily of Gobiidae comprises 13 genera and 35 species including the genus *Sovvityazius*. The genus *Odontamblyopus* (Gobiidae: Amblyopinae) are widely distributed in shallow marine habitats, estuaries, and freshwater habitats of the Indo-West Pacific region, and western Atlantic Ocean (Chanda *et al.*, 2019). Murdy and Shibukawa (2001; 2003) reported five species of *Odontamblyopus* from the muddy intertidal habitat of the Western coast of India eastern to Japan. *O. rubicundus* is widely distributed in India, Bangladesh, and Myanmar (Siddique *et al.*, 2015). The members of the genus *Odontamblyopus*, are also referred to as eel gobies because their bodies are elongated with continuous dorsal fin (Murdy and Shibukawa, 2001), cylindrical anterior, and laterally compressed posterior (Chanda *et al.*, 2019). Hamilton-Buchanan (1822) described *Gobioides rubicundus* currently known as *Odontamblyopus rubicundus* locality from the estuaries of Ganges River, India.

Along with *Odontamblyopus rubicundus* (Hamilton 1822), four other species were described in the genus *Odontamblyopus*: *O. lacepedii* (Temminck and Schlegel, 1842), *O. rebecca* (Murdy and Shibukawa, 2003), *O. roseus* (Valenciennes, 1837), and *O. tenuis* (Day, 1876). The records of *O. rubicundus* from Maharashtra (1973), Kerela, and Kochi

(1964) from the western coast of India were fuzzy and were lacking events. Although this species is well distributed in the coastal area of Bangladesh (Meghna river estuary and Bakkhali River estuary) (Siddique *et al.*, 2015), there is no previous record of *O. rubicundus* reported from the Gujarat coast. Thus the paper describes the first record of *O. rubicundus* from the coast of Gujarat. However, the diversity of gobies along the Gujarat coast is still scarcely known.

MATERIALS AND METHODS

Three specimens of Eel Goby fish were collected from the local fishermen from November 2021 to January 2022 from the Gulf of Khambhat, Gujarat. The specimens were captured by local fishermen using gill nets (16 mm mesh size) during ebb tide from the intertidal mudflats of Gadhula (21°13'39.29" N, 72°06'3.31" E), and Sartanpar (21°18'7.99" N, 72°6'53.14" E) (Fig. 1). The collected specimens were photo-documented using Canon EOS 60d with EF-S 18-135mm lens (Fig. 2), stored in an icebox, and were brought to the laboratory within 24hrs for further examination. The specimens were first washed under tap water and were preserved in 4% Formalin. The morphometric measurements were made using digital calipers (Moore&Wright MW100-20B/8inch) and were recorded nearest to 0.1 millimeters. Murdy (1989); Murdy and Shibukawa (2001); Murdy (2006) were followed for standard measurements and counts. For meristic characters, the specimens (dorsal, anal, caudal, and pectoral fins rays) were cleaned, stained with safranin, and were counted using a binocular stereomicroscope (Magnus MS24, Magnus Opto Systems India). The vertebrae count, pleural ribs, and anal fin pterygiophores were documented using MAMMOMAT (Siemens Mammomat 3000 Nova Mammography) (Fig. 2). The method proposed by Birdsong *et al.* (1988) was used for skeletal count (vertebrae and anal fin pterygiophores). Identification of the specimen was carried out using standard taxonomic keys (Day, 1994; Talwar PK & Jhingran AG, 1991; Murdy & Shibukawa, 2001, 2003; Larson *et al.*, 2008; Murdy, 2011; Habib & Islam, 2020). The accepted scientific name was determined from Fishbase (Froese and Pauly, 2021) and Eschmeyer's Catalog of Fishes (Fricke *et al.*, 2022). The species distribution was determined from Global Biodiversity Information Facility (GBIF, 2022), and Fishbase (Froese & Pauly, 2021). The examined specimens are mentioned along with the geographical area in the section of material examined. The specimens were stored in a repository with a specific voucher number at the Department of Marine Science, Maharaja Krishnakumarsinhji Bhavnagar University, Bhavnagar.

RESULTS

During the present study, three specimens were collected and were reported as *Odontamblyopus rubicundus* Hamilton 1822

Systematics

Order Gobiiformes

Family Gobiidae Cuvier, 1816

Subfamily Amblyopinae Günther 1861

Genus *Odontamblyopus* Bleeker 1874

Odontamblyopus rubicundus Hamilton 1822 (Fig. 2) (Table 1)

Synonyms

Gobioides rubicundus Hamilton-Buchanan, 1822:37, pl.5, (type locality: Estuaries of the Ganges river)

Amblyopus mayenna Valenciennes in Cuvier and Valenciennes 1837 (type locality: Rangoon, Burma)

Amblyopus taenia Günther 1861 (type locality: East Indies)

Taenioides rubicundus Hamilton 1822

Material examined: MI/GoKt/Act/GFS-01, 181.1mm TL, Sartanpur coast, Bhavnagar District, Gujarat, India (21°18'7.99" N, 72°06'53.14" E) from the sediments of Intertidal Mudflats, coll. Dinesh Makwana (01 specimens utilized for radiography), 24th November 2021; MI/GoKt/Act/GFS-02-03, 163.4mm TL, 172.8mm TL, Gadhula coast, Bhavnagar district, Gujarat, India (21°13'39.29" N, 72°06'03.31" E) from the intertidal mudflats and stationary stake nets, coll. Ashokbhai Vaghela (02 specimens utilized for staining and radiography), 11th January 2022.

Description. The total number of elements in the dorsal fin is 44 (mean: 44); the first dorsal fin comprises six flexible rays; the second dorsal fin and anal fin were connected to the caudal fin with a membrane; the total number of anal fin elements is 35-38 (mean: 36.5); the total number of pectoral-fin rays 32 (mean: 32); pectoral-fin rays were un-branched, free, and silklike; the caudal fin was black and elongated; small cycloid scales were substantially present on the head and whole body; two symphyseal canines were present on lower jaw; the total number of elements in caudal fin was 17; the number of upper-jaw teeth (outer row) 6–9 (mean: 7.0); the number of lower-jaw teeth (outer row) 6–12 (mean: 9.0); pre-caudal vertebrae 10; caudal vertebrae 17; 3 anal-fin pterygiophores present before first hemal spine; Eyes are small, covered by skin.

Colour of Specimen. Based on the live specimen obtained for the study, the specimens were greenish-brown on the dorsal side and reddish on the ventral side (similar to those described in **Koumans 1941**). The dorsal, anal, and pelvic fins were greenish at the base to reddish, while the caudal fin was black with a reddish-purple base.

Colour of Formalin preserved Specimen. In preserved specimen the colour on the dorsal side has turned to dull greenish with small brown spots and white on the ventral side; the dorsal, anal, and pelvic fins were greenish to pale white; the caudal fin remained black. (Fig. 2)

Distribution. Eastern coast of India, Bangladesh, Malaysia, Singapore, Indonesia, and Myanmar (**Murdy & Shibukawa, 2001; Larson et al., 2008, 2016; Rema Devi, 2010; Alam et al., 2013; Rajan et al., 2013; Froese & Pauly, 2021**). Individual records from Maharashtra in 1973 (**Catania & Fong, 2022**), Kerala, and Kochi (1964) were reported from the western coast of India based on Global Biodiversity Information Facility (**GBIF, 2022**) (Fig. 1).

Ecology. Found in Estuarine of Ganges River, India (**Hamilton-Buchanan, 1822**). *O. rubicundus* is found to inhabit the muddy substrates of freshwater, brackish, and marine habitats (**Murdy & Shibukawa, 2001, 2003; Alam et al., 2013**). **Tian et al., (2008)** reported that the species mostly feeds on crustaceans and other fishes. Moreover, the species is found to be commercially important (**Nath & Patra, 2015; Kar et al., 2017**). As per **Xu et al., (2016)** the maximum recorded total length of the species was 33.4 cm.

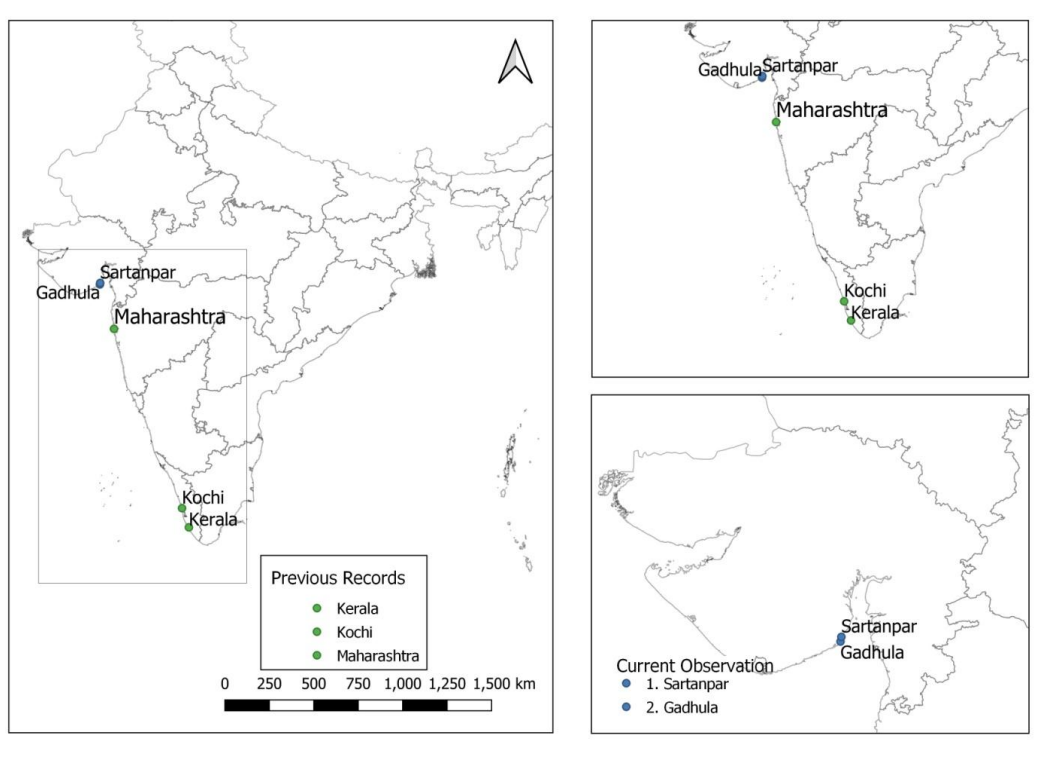


Fig. 1. The distribution of Rubicundus Eel Goby *O. rubicundus* from the western coast of India along with the current observations



Fig. 2. *Odontamblyopus rubicundus* Hamilton, 1822: (A) Photographic documentation of preserved Eel goby specimen MI/GoKt/Act/GFS-01, 181.1mm TL, Sartanpar, Gujarat, India (Image captured by Azaz A. Sidat) (B) Radiograph of Eel goby *O. rubicundus* MI/GoKt/Act/GFS-01 from Gulf of Khambhat.

Table 1. Morphometric measurements and meristic characters of *O. rubicundus* from the Gulf of Khambhat, Western coast of India

Morphometric measurement	Current Study MI/GoKt/Act/GFS	
	Mean (mm)	Range (mm)
Total length (TL)	172.25	163.4 - 181.1
Standard length (SL)	140.85	131.9 - 149.8
Head Length (HL)	20.7	19.7 - 21.7
Head Width (HW)	10.3	10.2 - 10.4
Head Depth (HD)	11.95	11.4 - 12.5
Snout length (SNL)	5.75	5.3 - 6.2
Predorsal length (PDL)	33.25	32.2 - 34.3
Eye Diameter (ED)	1	0.9 - 1.1
Body depth (BD)	13.6	12.6 - 14.6
First Dorsal length (D1 L)	14.5	14.4 - 14.6
Second Dorsal length (D2 L)	85.85	80.1 - 91.6
Pelvic fin length (PEFL)	15	14.3 - 15.7
Pectoral fin length (PFL)	17.45	14.1 - 20.8
Anal fin length (AFL)	81.35	76.3 - 86.4
Caudal fin length (CFL)	33.7	31.3 - 36.1
Caudal peduncle length (CPL)	5.45	5.2 - 5.7
Meristic characters		
First Dorsal fin rays (D1)	6	6
Second Dorsal fin rays (D2)	38.5	38 - 39
Pectoral fin rays (P1)	32	32
Anal fin rays (A)	36.5	35 - 38
Caudal fin rays (CF)	17	17
Upper jaw (Outer)	7.5	6 - 9
Lower Jaw (Outer)	9	6 - 12
Symphyseal canine tooth	2	2

DISCUSSION

The meristic and morphometric characters of the collected specimen were compared with the previous records of **Murdy and Shibukawa (2001, 2003)**. The diagnostic characteristics of the collected specimen were almost similar to the previous records. Thus the current study reports the occurrence of *O. rubicundus* from the intertidal zone of the Gulf of Khambhat, Gujarat. In India, two species of *Odontamblyopus* (*O. roseus*, and *O. rubicundus*) were reported from the eastern and western coasts of India (**GBIF, 2022**). Three individual records of *O. rubicundus* (Mumbai, Cochi, and Kerela) were reported from the western coast of India (**Catania & Fong, 2022**). An Individual specimen which was cataloged as (ANSP 85791) *Amblyopus buchani*, locality from Mumbai, donated by BNHS to Henry Fowler in 1925 was erroneous according to E.B. Bohlke (**Murdy and Shibukawa, 2001**). A preserved specimen with catalogue number CIFE:FRM03319 of dataset INSDC

sequences (COI Sequence) *O. rubicundus*, from Kerela was fuzzy as it was lacking identification and event. A preserved specimen with catalogue number 29747 *O. rubicundus*, locality from Kochi was reported in August 1964. Two preserved specimens with catalogue number 29610 *O. rubicundus*, locality from Maharashtra during November 1973. We have included these records on our distribution map as previous records.

In the review of Genus *Odontamblyopus*, **Murdy & Shibukawa (2001)** revised and defined the genus based upon the characters for recognition of the species and their descriptive account. The information pertaining to *O. rubicundus* was compared with its congeners *O. roseus*, *O. lacepedii*, *O. rebecca*, and *O. tenuis* for the following combination of characters: Number of pectoral-fin ray counts were greater than 40 in *O. tenuis* and *O. rebecca* compared to *O. roseus*, *O. rubicundus*, and *O. lacepedii* (less than 35). The number of dorsal-fin rays in *O. rubicundus* was 40-47, compared to *O. roseus* (43-49), *O. lacepedii* (44-54), *O. rebecca* (39-42), and *O. tenuis* (40-42). According to **Murdy & Shibukawa (2003)**, the distal margin of the dorsal and anal-fin remains the same colour as of other fins when preserved in *O. rubicundus*, while the colour changes to chocolate-brown in *O. tenuis*, *O. rebecca*, and *O. roseus*. Moreover, the number of caudal vertebrae was 17 in *O. rubicundus* and *O. tenuis* lesser as compared to *O. lacepedii* (20-24), *O. roseus* (22), and *O. rebecca* (20). *O. rubicundus* and *O. tenuis* have 3 anal-fin pterygiophores preceding the first hemal spine compared to 2 in *O. lacepedii*, *O. roseus*, and *O. rebecca*.

O. rubicundus is widely distributed on the eastern coast of India, Bangladesh, Malaysia, Singapore, Indonesia, and Myanmar (**Murdy & Shibukawa, 2001; Larson et al., 2008, 2016; Rema Devi, 2010; Alam et al., 2013; Rajan et al., 2013; Froese & Pauly, 2021**). *O. tenuis* is distributed in Pakistan and Myanmar (**Murdy & Shibukawa, 2001, 2003**). *O. roseus* is distributed along the coast of Pakistan and the west coast of India (**Murdy & Shibukawa, 2001; Bhendekar et al., 2016**). *O. lacepedii* is distributed from China, Hong Kong, Taiwan, Korea, and Japan (**Murdy & Shibukawa, 2003**). While *O. rebecca* is known only from Haiphong city, Vietnam (**Murdy & Shibukawa, 2003**).

No specific occurrence of *O. rubicundus* was reported from the western coast of India. Thus the current occurrence from the Gulf of Khambhat reveals the extension of its distribution on the western coast of India. Further, quantitative analysis of specimens along the western coast of India will help to understand the biology and ecology of the species.

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