Journal of the Marine Biological Association of the United Kingdom

cambridge.org/mbi

Marine Record

Cite this article: Ragul S, Manoj A, Mahadevan G, Murugan A, Larson H (2024). First record of two gobioid fishes (Perciformes: Gobiidae) from Indian waters. *Journal of the Marine Biological Association of the United Kingdom* **104**, e35, 1–7. https://doi.org/10.1017/S0025315424000316

Received: 31 October 2023
Revised: 5 February 2024
Accepted: 20 February 2024

Keywords:
by-catch; estuary; gobioid; mangroves; new record

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First record of two gobioid fishes (Perciformes: Gobiidae) from Indian waters

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Abstract

The present research documents new distributional records of two gobioid fishes, *Acentrogobius vanderloosi* Allen, 2015 and *Pseudogobius fulvicaudus* Huang, Shao, and Chen, 2014 from the southeastern coast of India. Indian coastal waters provide suitable habitats for many gobioid fishes due to its varied ecosystems. The confusion over the identity of a number of gobioid fishes in India suggests the need for more studies on these fishes to better understand their diversity, taxonomy, and geographical distribution. The present record of these species from the southeastern coast of India expands the known distribution of these species.

Introduction

Gobiidae (Perciformes, Gobioidei) are the most diverse group of marine teleost fishes, well represented in marine, brackish, and freshwater habitats (Eschmeyer *et al*., 2010; Larson *et al*., 2022*a*, 2022*b*) with well over 2000 extant species currently recognized (Fricke *et al*., 2023). The Indo-Pacific gobiid genus *Acentrogobius* Bleeker 1874 typically inhabits soft substrata of coastal bays, mangrove streams, estuaries, and freshwater (Allen *et al*., 2015). Allen (2015) discussed some taxonomic problems associated with this group, which Larson and Lim (2005) referred to as a confusing group and a 'catch basket' for many gobies of similar appearance. A total of 25 valid species have been described under this genus worldwide (Fricke *et al*., 2023). In India, a number of species of *Acentrogobius* and its close relatives (*Amoya, Aulopareia, Yongeichthys*) have been reported, under a variety of names; work on this group remains to be done.

The tridentigerine genus *Pseudogobius* comprises 15 valid species which inhabit marine, estuarine to fresh waters (Larson, 2001; Larson and Hammer, 2021). In India, two species of this genus have been reported, namely *P. melanosticta* (Day, 1876) and *P. minimus* (Hora, 1923), with other records being misidentifications. *Pseudogobius fulvicaudus* Huang *et al*. (2014), commonly known as Yellowfin snubnose goby, is so far known from the waters of Brunei, Malaysia, Northern Australia, Vietnam, Singapore, and Thailand (Larson and Hammer, 2021).

During recent monthly fish surveys conducted along the estuaries and fish landing centres of Tamil Nadu coast, Southeast India, from April 2021 to June 2023, we recorded the above two species for the first time from Indian waters.

Methods

The present specimens were collected at regular weekly intervals for a period of two years from April 2021 to June 2023 along the estuaries and fish landing centres of Tamil Nadu coast, Southeast India, to document estuarine cryptic species, trawl bycatch species, and their diversity. Four specimens of *P. fulvicaudus* were collected during this study from the Ennore estuary (13°13′24″N 80°18′57″E) and Vellar estuary (11°29′26″N 79°45′58″E) which are lined with mangroves (Figure 1). The specimens were collected by using scoop net and by hand-picking methods during the receding period of the incoming tides. Five specimens of *A. vanderloosi* were collected from the bycatch of bottom trawlers targeting non-penaeid shrimp (mesh size range, 20–40 mm) at Mudasal Odai (11°29′06″N 79° 46′28″E) and Pazhayar (11°21′32″N, 79°49′22″E) (Figure 1) fish landing centres. Trawling was carried out nearshore at depths ranging from 10 to 15 m, at a distance of 1–10 km from the shore.

After collection, the specimens were cleaned from mucus, debris, and mud prior to fixation and fresh photographs were taken. The meristic counts were noted, and morphometric characters were measured using Mitutoyo CD-6"ASX® digital Vernier calliper with the nearest 0.1 mm accuracy. Later, the specimens were preserved in 10% formaldehyde and then into 70% ethanol (R). specimens were identified using Allen (2015) and Larson and Hammer (2021) and measured as per Hubbs and Lagler (1958). Specimens examined are deposited in the

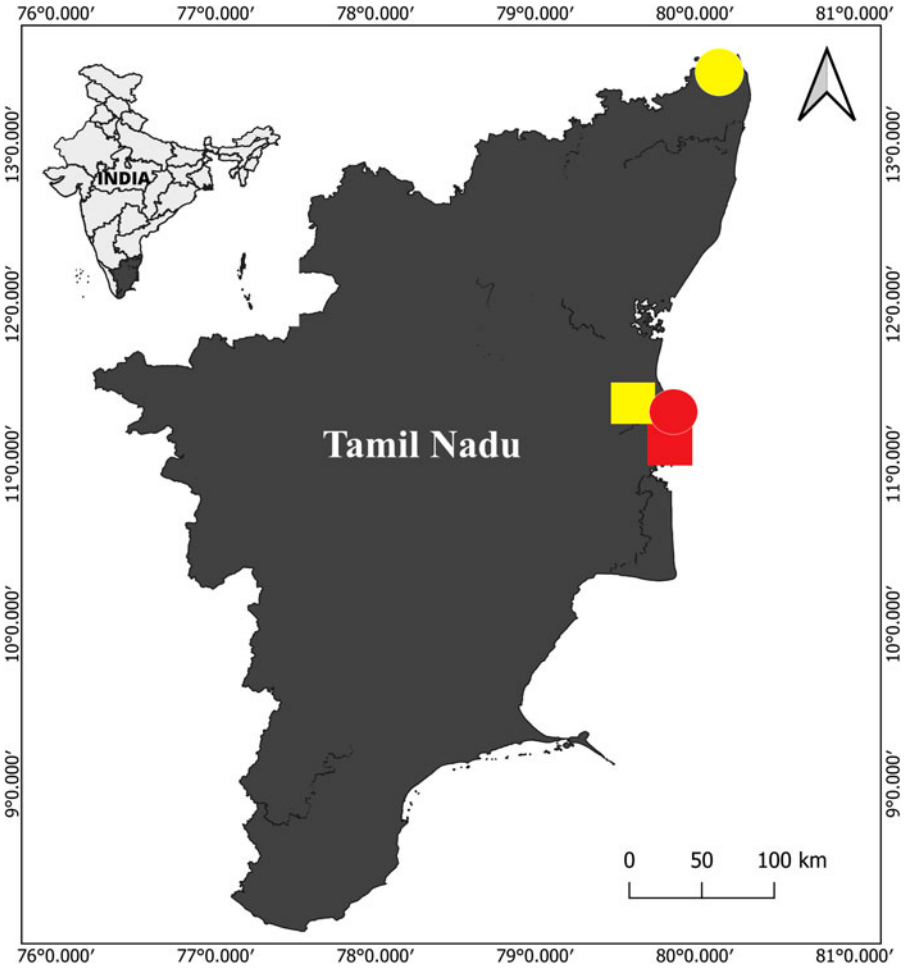

Figure 1. Map representing present sampling points. *Acentrogobius vanderloosi* (red): Mudasal Odai fishing harbour (Red circle), Pazhayar fish landing centre (red square); *Pseudogobius fulvicaudus* (yellow): Ennore estuary (Yellow circle), and Vellar estuary (yellow square).

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Results

Systematics

Family Gobiidae Cuvier, 1816
Subfamily Gobiinae Cuvier, 1816
Genus *Acentrogobius* Bleeker, 1874

Acentrogobius vanderloosi Allen, 2015
(Figure 2 & Table 1)

Materials examined

One female specimen (CASMBAURM/2312711), 85.79 mm *SL*, from Pazhayar fish landing centre (11°21′32″N, 79°49′22″E), coll. A. Murugan, June 2021. 1 female specimen (CASMBAURM/2312712), with *SL* of 79.88 mm, June 2022; 1 male and 2 female specimens (CASMBAURM/2312713–15), 69.72–89.85 mm *SL*, June 2023 from Mudasal Odai fish landing centre (11°29′06″N 79°46′28″E), India: Tamil Nadu, coll. S. Ragul.

Figure 2. Fresh coloration of *Acentrogobius vanderloosi* (85.79 mm *SL*) from Pazhayar fish landing centre, Southeast coast of India: Tamil Nadu (scale 10 mm). Photo by A. Murugan.

https://doi.org/10.1017/S0025315424000316 Published online by Cambridge University Press

Table 1. Morphometric and meristic data for *Acentrogobius vanderloosi* Allen, 2015 (Mudasal Odai, India) compared to data from type specimens (Allen, 2015)

Parameters	Type specimens from Alotau, Papua New Guinea (Allen, 2015) Range ($n = 3$)	Specimens from Southeast India ($n = 5$) Range	mean
Sex	Male = 1 & Female = 2	Male = 2 & Female = 3	
Standard length(mm)	30.4–47.7	79.88–89.85	84.86
Counts			
First dorsal-fin spines	VI	VI	-
Second dorsal-fin elements	I, 10	I, 10	-
Anal-fin elements	I, 10	I, 10	-
Pectoral-fin rays	20	20	-
Pelvic-fin rays	-	I, 5	-
Segmented caudal-fin rays	17	17–18	18
Longitudinal scale series	30	30–31	31
Transverse scale count	9–10	9–11	10
Pre-dorsal scales	12–13	11–13	12
Circumpeduncular scales	12	12–13	12
Measurements (% standard length)			
Head length	27.1 –28.5	25.87–27.04	26.45
Head width	17.9–20.1	15.86–16.08	15.976
Head depth	16.8–18.4	16.14–16.68	16.41
Snout length	6.4–7.3	6.71–6.96	6.83
Eye diameter	8.2–9.7	6.87–7.72	7.29
Cheek depth	7.0–7.8	7.86–8.34	8.1
Upper jaw length	8.6–11.7	8.19–9.53	8.86
Body depth at pelvic fin origin	19.1–20.5	19.73–20.89	20.31
Body depth at anal fin origin	16.6–18.4	16.33–17.17	16.75
Length of caudal peduncle	14.7–18.5	15.13–18.09	16.61
Depth of caudal peduncle	11.3–12.0	10.65–11.04	10.84
Width of caudal peduncle	-	4.09–4.58	4.33
Pre-first dorsal length	32.6–37.3	30.41–33.14	31.77
Pre-second dorsal length	51.3–53.8	54.4–56.17	55.28
Pre-pelvic-fin length	30.2–31.1	29.28–31.81	30.54
Pre- anal fin length	55.7–57.5	56.61–57.92	57.26
Length of dorsal fins base	49.2–52.0	46.5–48.02	47.26
Length of anal fin base	-	25.6–26.67	24.63
Length of first dorsal spine	20.3–36.7	36.29–36.57	37.54
Length of second dorsal spine	31.5–42.9	34.29–37.92	34.99
Length of third dorsal spine	14.6–25.2	25.46–28.74	27.1
Length of second dorsal-fin spine	9.4–11.0	8.24–9.32	8.78
Length of longest soft dorsal ray	11.0–18.7	13.55–16.09	14.82
Length of longest soft anal ray	13.7–16.4	13.23–16.7	14.96
Pectoral-fin length	25.7–28.6	23.88–24.55	24.21
Pelvic-fin length	22.5–25.3	19.59–22.27	20.93
Pelvic-fin spine length	8.7–9.3	6.47–8.03	7.25
Caudal-fin length	28.7–31.0	26.85–28.18	27.51

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Additional material observed

Larson and Murugan collected this species on 2 August 2018 at Pazhayar fish landing, Tamil Nadu (specimens not retained). During 2008–2012, Sedeepta Biswas, Ravi Velayudham, and Dijpanan Ray have sent Helen K. Larson, photos of this species collected from Northeast and Southeast coast of India.

Diagnosis

Dorsal-fin rays VI + I,10; anal-fin rays I,10; pectoral-fin rays 20; caudal fin pointed; longitudinal scale series 30; transverse-scales 9–10; predorsal-scales 12–13; body covered with ctenoid scales, cycloid on breast, pectoral-fin base and head; uppermost portion of opercle with three scale rows; and scaled cheek (Allen, 2015).

Description

Dorsal-fin rays VI + I, 10; anal-fin rays I, 10; pectoral-fin rays 20; pelvic-fin rays I, 5; segmented caudal-fin rays 18 (17–18); longitudinal scale series 31(30–31); transverse scales 10 (9–11); predorsal scales 12 (11–13); and circumpeduncular scales 12 (12–13). Body elongate, compressed laterally; body depth at pelvic-fin base 19.73–20.89% *SL* and body depth at anal origin 19.73–20.89% of *SL*; head length 25.87–27.04% of *SL*. Body scales ctenoid up to pectoral fin base, predorsal with cycloid scales; pectoral fin base naked, belly scales cycloid; distance between snout and origin of first dorsal fin 30.41–33.14 in % of *SL*, between snout and origin of second dorsal fin 54.4–56.17, between snout and origin of anal fin 56.61–57.92, between snout and origin of pelvic fins 29.28–31.81, and between snout and origin of pectoral fin 25.51–28.2 all in % of *SL*. Caudal peduncle slender with length of 15.13–18.09% of *SL* and with compressed width of 4.09–4.58% of *SL* and caudal peduncle depth 10.65–11.04% of *SL*.

Head rounded and wide, width at the posterior preopercular margin 15.86–16.08% of *SL*. Head depth at posterior preopercular margin 16.14–16.68% of *SL*. Opercle with 1–3 rows of cycloid scales, fully scaled cheek (*i.e.* preopercle) with depth of 7.86–8.34% of *SL*; and belly scales cycloid. Snout rounded and contributing 6.71–6.96% of *SL*. Eyes large, diameter width 6.87–7.72% of *SL*. Terminal mouth, jaws reaching to a vertical below mid-eye region, upper jaw length 8.19–9.53% of *SL*. Maxilla extending up to vertical anterior margin of the eye. Small teeth in jaws, with several rows of posteriorly curved canine teeth: a pair at upper jaw and a single row at lower jaw. Bilobed broad tongue. Gill-opening extending anteriorly up to below mid-preopercle. Triangular first dorsal fin with second spine longest (34.29–37.92% of *SL*), with first spine (36.29–36.57% of *SL*), and third (25.46–28.74% of *SL*). Correspondingly, the length of second dorsal fin base (35.12–37.45% of *SL*) is greater than the first dorsal base (10.37–12.88% of *SL*). Oval shaped pectoral and pelvic fins with length of 23.88–24.55% of *SL* and 19.59–22.27% of *SL*; pelvic fin spine length 6.47–8.03% of *SL*; Short anal fin with base length of 25.6–26.67% of *SL*; narrow caudal fin with tapered point, 26.85–28.18% of *SL* (Table 1).

Coloration (*live specimen*) (Figure 2), pale grey with rows of orange spots on body; five horizontally-elongate to rounded brown blotches on midline of the body, 5th and darkest blotch located at middle of caudal-fin base, two orange stripes on cheek and pale blue short stripe under eye and a variably sized bluish blotch on opercle; pectoral fin base with two orange bars extending close to ray bases; unpaired fins with rows of orange spots or short lines.

Coloration (preserved specimen), body becomes paler than the live specimen, brown blotches become into dark black blotches, the pair of orange stripes become paler into whitish stripes, and the blue spot on the opercle remains bright.

Distribution. This species was previously known from the type locality of Alotau, Milne Bay Province, Papua New Guinea (Allen, 2015; Figure 4).

Remarks

Acentrogobius vanderloosi belongs to the *Yongeichthys* species-group (see Larson in Heemstra *et al*., 2022*a*) in having longitudinal rows of sensory papillae on the cheek, the gill opening extending forward to mid-preopercle, and a single transverse row of papillae on the chin (the *Acentrogobius* species-group has two groups of transverse papilla lines on the chin).

It differs from its congeners by having 10 anal-fin rays, 20 pectoral fin rays, both the cheek and opercle completely scaled, and having all first dorsal fin spines greatly elongate and filamentous. The colour pattern of *A. vanderloosi* is diagnostic, particularly the combination of a pair of yellow cheek stripes, numerous orange spots on the body, and the lack of parallel dark stripes on the side that enclose the large dark marks along the side in other *Acentrogobius* (Allen, 2015).

Systematics

Family Gobiidae Cuvier, 1816
Subfamily Gobionellinae Bleeker, 1874
Genus *Pseudogobius* Popta, 1922
Pseudogobius fulvicaudus Huang *et al*., 2014
(Figure 3 & Table 2)

Materials examined

Two females (CASMBAURM/2312624–25), 14.2–15.3 mm *SL*, from Ennore mangrove forest (13°13′24″N 80°18′57″E), coll. Aravind Manoj, July 2021. One male and 1 female specimen (CASMBAURM/2312626–27), 14.8–17.9 mm *SL* from Vellar mangroves forest (11°29′26″N 79°45′58″E) and Parangipettai, coll. S. Ragul, April 2022; Southeast India: Tamil Nadu.

Diagnosis

Both second dorsal-fin rays and anal-fin rays I, 6–9; pectoral-fin rays 14–17; segmented caudal fin rays 16; lateral scale series 24–30; cheek scales behind eye 1–3; opercle partially scaled; and predorsal scales 6–11 (Larson and Hammer, 2021).

Description

Body slender, anteriorly sub-cylindrical and posteriorly compressed. Body depth at anal origin 15.0–16.1% of *SL*. Caudal peduncle slender and compressed, 28.4–29.5% of *SL* and caudal peduncle depth 11.7–11.9% of *SL*. Ctenoid scales over body up to pectoral fin base, cycloid scales over predorsal; naked pectoral fin base, and belly scales cycloid.

Head appears rounded and wide, width at posterior preopercular margin 70.9–74.5% of *HL*; depth from 53.2 to 59.1% of *HL*. 1–3 cycloid scales rows on opercle, cheek appears scaleless; and scales on ventral region cycloid. Snout rounded and slightly inflated, length 16.1–16.4% of *HL*. Eyes large, diameter 31.7–33.4% of *HL*. Interorbital region moderately wide, 15.6–18.9% of *HL*. Mouth small and terminal, slightly oblique, jaws reaching back to below mid-eye with upper jaw length 26.7–32.2% of *HL*. Anterior nostril in short tube and oval to round shaped posterior nostril opening. Two rows of upper and lower jaw teeth. Short and blunt tongue tip. Gill-opening extending ventrally up to below middle of opercle. Very diminutive gill rakers on outer face of first gill arch (Table 2).

Short triangular shaped first dorsal fin with rounded margin, second spine longer than other spines. Pectoral fin oval, pelvic fin narrow and oval, short anal fin, and round caudal fin.

Coloration (live, Figure 3). Head and body translucent, whitish ventrally. Oblique blackish brown bar extends below rear part of

https://doi.org/10.1017/S0025315424000316 Published online by Cambridge University Press

Figure 3. Live coloration of *Pseudogobius fulvicaudus* (17.9 mm *SL*) from Ennore estuary, Southeast coast of India: Tamil Nadu (scale 5 mm). Photo by Aravind Manoj.

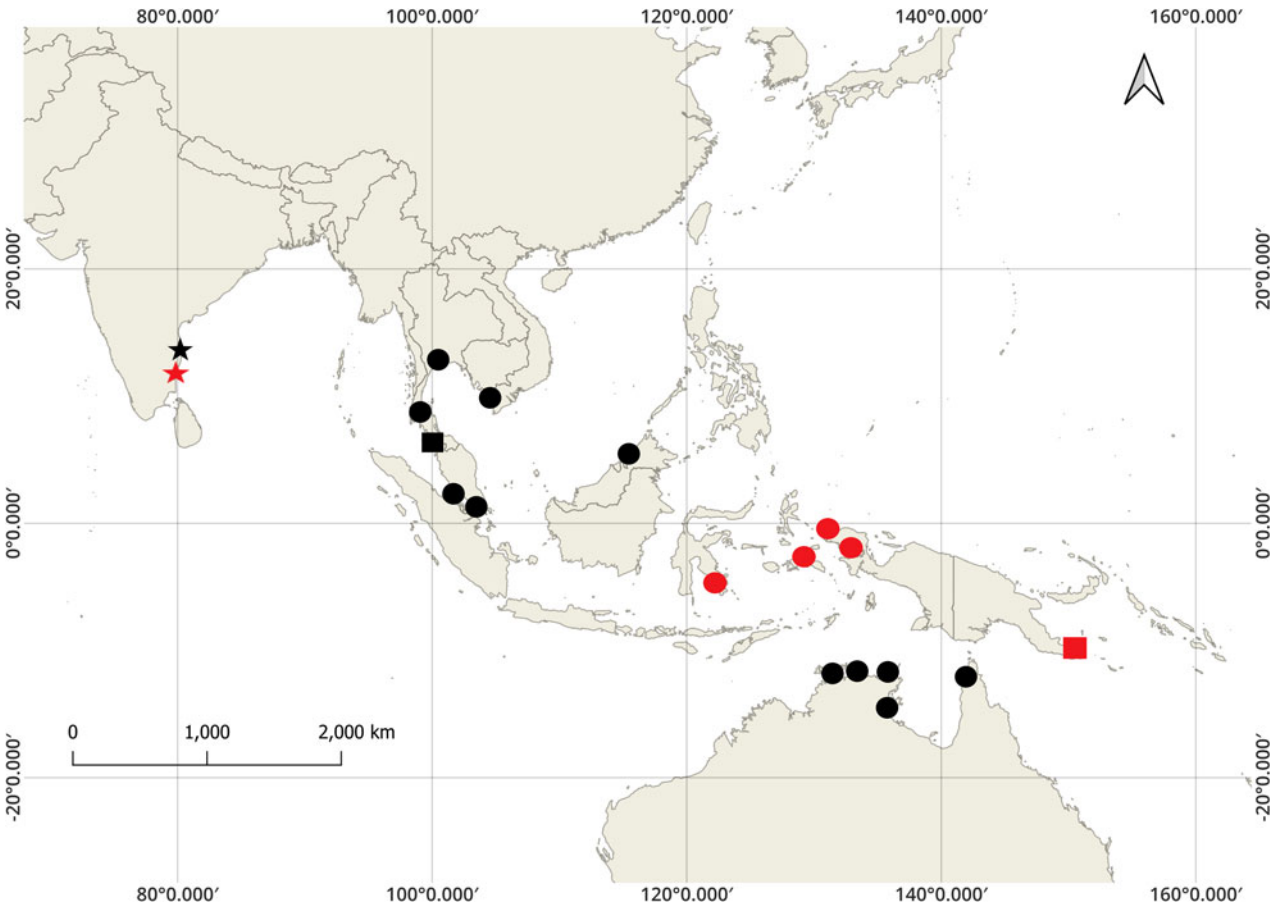

Figure 4. Distribution range of *Acentrogobius vanderloosi* (red) and *Pseudogobius fulvicaudus* (black): present study area (star), type localities (square), and previously known localities (circle) from literature and specimens in collections.

first dorsal fin base halfway down side of body; above the anal fin, two internal blackish ventral spots and two on caudal peduncle. First dorsal fin with rounded black mark posteriorly close to fin base, covering fifth to sixth spines and a yellow bar above the black mark covering second to fourth spines. Scattered dusky grey irregular small spots on cheek and opercle; outer rim of the eye golden. Eye golden brown, opercle with pale blue patch. Base of pectoral fin with dusky grey spots. Caudal fin with two blackish rounded spots, usually larger spot at lowermost caudal base, darker than upper and not in contact with diffuse grey mid-base spot; a broad half-moon yellow band extends out from fin base onto caudal fin. Transparent to faintly grey second dorsal fin with diffuse yellow area on lower part, clear to whitish fin margin. Translucent whitish to translucent yellow anal fin. Transparent pectoral fin. Translucent pelvic fins to whitish.

Coloration (preserved material)

Similar to live colour, but yellow colour fades to pale brown.

Habitat and distribution

Intertidal muddy areas and shallow tidal pools of mangroves are where this species has previously been recorded in Brunei, Malaysia, Northern Australia, Vietnam, Singapore, and Thailand (Larson and Hammer, 2021; Figure 4).

Remarks

Pseudogobius fulvicaudus, differs from its congeners by the following characters: caudal fin base with distinct two black spots. A prominent bright yellow, semicircular to vertical band on anterior part of caudal fin.

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Table 2. Morphometric and meristic data for female *P. fulvicaudus* (Ennore and Vellar estuary, India) compared to data of female type specimens Huang *et al.* (2014); Larson and Hammer (2021)

Parameters	Huang *et al.*, 2014	Larson and Hammer, 2021	Present study Range	mean
Sex (*n*)	Females (*n* = 6)	Females (*n* = 13)	Females (*n* = 4)	
Standard length(mm)	15.1–19.0	7.0–19.0	14.2–17.9	16.0
Counts				
First dorsal-fin spines	VI	VI	VI	-
Second dorsal-fin elements	I, 7	I, 6–7 (I, 7)	I, 6–7	I, 7
Anal-fin elements	I, 6–7(7)	I, 6–7 (I, 7)	I, 6–7	I, 7
Pectoral-fin rays	14–15(15)	13–16 (15)	14–15	15
Segmented caudal-fin rays	-	9/7 (rarely 8/7)	9/7	-
Longitudinal scales count	25–26	23–27 (25)	23–27	25
Transverse backward scale count	7	7–9 (8)	7–8	7
Predorsal scales	6	6–7 (7)	6–7	6
Measurements (% standard length)				
Head length	24.7–26.1	25.3–30.6	24.2–24.5	24.4
Body depth at pelvic fin origin	16.4–17.7	18.8–24.4	15.9–17.3	16.6
Body depth at anal fin origin	15.8–16.6	-	15.0–16.1	15.6
Body width at anal fin origin	11.5–12.0	10.6–14.1	10.0–12.8	11.4
Length of caudal peduncle	30.9–31.6	28.4–33.8	28.4–29.5	29.0
Depth of caudal peduncle	10.6–11.4	11.3–14.7	11.7–11.9	11.8
Length of first dorsal-fin base	11.3–12.2	-	12.3–12.6	12.5
Length of second dorsal fin base	14.4–16.1	-	13.0–17.7	15.4
Length of anal fin base	14.0–15.4	-	15.7–16.3	16.0
Pectoral-fin length	20.4–21.8	15.3–25.3	22.6–22.7	22.7
Pelvic-fin length	17.1–18.1	17.4–21.2	19.2–20.8	20.0
Caudal-fin length	25.5–27.9	26.5–33.1	25.0–26.3	25.6
Measurements (% head length)				
Eye diameter	30.2–32.1	25.0–35.6	31.7–33.4	32.6
Upper jaw length	37.5–39.9	26.5–37.3	26.7–32.2	29.4
Snout length	24.9–26.5	20.8–29.8	16.1–16.4	16.3
Interorbital width	11.0–12.4	16.3–26.1	15.6–18.9	17.2
Head depth	-	57.3–66.0	53.2–59.1	56.1
Head width	72.4–75.7	65.3–81.3	70.9–74.5	72.7

Discussion

This paper presents the first records of *A. vanderloosi* and *P. fulvicaudus* from Indian waters and extends its distributional range considerably. Allen and Erdmann (2012) commented that *Acentrogobius* (Bleeker) genus contains a diversity of morphological forms and is most likely a polyphyletic assemblage.

Pseudogobius fulvicaudus co-occurs with *Acentrogobius audax*, *A. viganensis, A. viridipunctatus, Favonigobius reichei, Psammogobius biocellatus*, *Hemigobius hoevenii, Eugnathogobius mindora*, *Mugilogobius tigrinus*, *Pseudogobius minimus,* and *P. melanostictus* from shallow intertidal muddy habitat of Ennore mangroves and edible oyster beds of Vellar mangrove forest. These types of habitats are common along the Indian coast which likely harbour a greater diversity of gobioids. Larson and Hammer (2021) commented that preliminary DNA analyses shows that *P. fulvicaudus* is likely to be a species-complex, so additional genetic and morphological work is required on the Indian populations to understand this.

Conclusion

The records of these species of *Acentrogobius* and *Pseudogobius* from Tamil Nadu coastal waters are new additions to the list of marine and estuarine fishes of Indian coastal waters as well as drawing attention to the problems in identification of the gobioid fishes of India. It is a well-known fact that coastal areas are utilized for various infrastructure projects and human settlements and linked activities. Due to these developmental activities, gobioid fishes as a whole will be facing problems at present and in the near future. Hence it is very important to document these coastal dwelling fishes at the earliest, so that the coastal impacts can be evaluated on biodiversity as soon as possible.

https://doi.org/10.1017/S0025315424000316 Published online by Cambridge University Press

Acknowledgements. The authors are thankful to the Director and Dean of the Faculty of Marine Sciences, Annamalai University, for providing necessary facilities.

Data Availability Statement. All relevant dataset supporting the conclusions of this article is included within the article.

Author contributions. S.R. and G.M. wrote the first version of the manuscript. A.M. and S.R. carried out field sampling and collected the specimens. All authors contributed to the draft, provided critical feedback and helped shape the research. All authors read and approved the final manuscript.

Financial support. This research received no specific grant from any funding agency, commercial or not-for- profit sectors.

Competing interest. None.

Ethical standards. Not applicable.

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