



New distributional record of four Dragonet species (Perciformes: Callionymidae) from Odisha coast, India with comments on occurrence of other *Callionymus* species in Indian waters

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The present paper reports four uncommon fish species of dragonets of the family Callionymidae viz. *Callionymus filamentosus* Valenciennes, 1837, *C. hindsii* Richardson, 1844, *C. margaretae* Regan, 1905 and *C. recurvispinis* (Li 1966) for the first time from Odisha coast, India. Diagnosis, morphometric and meristic characters of the recorded species are provided herein. The records of *Callionymus* species in Indian waters are discussed. It is concluded that only 15 species of the genus *Callionymus* are occurring in India, while reports of *C. belcheri*, *C. japonicus*, *C. kaianus* and *C. melanopterus* are erroneous.

[**Keywords:** Callionymidae, Geographic distribution, New record, Odisha coast, Range extension]

Introduction

The family Callionymidae consists of small benthic fishes popularly known as dragonets. The family comprises about 200 species belonging to 19 genera¹. Dragonets generally occur in the upper 900 meters of all temperate, subtropical and tropical oceans of the world on sandy or muddy bottom among sea grasses, or coral reef bed, but few are also found in estuarine and freshwater habitats². Many species of Callionymidae are normally thrown away as bycatch in bottom trawls (e.g. prawn trawls), but a few species are commercially used for production of fish meal, or marketed fresh³.

An 'annotated checklist of dragonets' listed 113 species belonging to the genus *Callionymus* Linnaeus 1758 world over⁴. Subsequently, 8 more species of the genus have been described, viz., *C. kanakorum* Fricke 2006 from New Caledonia⁵; *C. profundus* Fricke & Golani 2013 from Red Sea⁶; *C. omanensis* Fricke *et al.* 2014 from Oman⁷; *C. madangensis* Fricke 2014, *C. alisae* Fricke 2016, *C. petersi* Fricke 2016 and *C. boucheti* Fricke 2017 from Papua New Guinea⁸⁻¹¹ and *C. vietnamensis* Fricke & Vo 2018 from Vietnam¹². From Indian waters, 19 species of the genus *Callionymus* have been reported^{2,13-17} from different

states and Andaman Islands, of which only three species, i.e. *C. carebares* Alcock, *C. fluviatilis* Day and *C. sagitta* Pallas, were earlier recorded from coastal waters of Odisha¹⁸.

During the process of assessing fish faunal components among bycatch trashes at different fish landing centers of Odisha, four interesting dragonets were collected and later identified as *C. filamentosus* Valenciennes, 1837, *C. hindsii* Richardson, 1844, *C. margaretae* Regan, 1905 and *C. recurvispinis* (Li, 1966). These findings confirmed to be new records for Odisha state and are reported herein.

Materials and Methods

A total of 13 specimens of dragonet fish species were collected from fish faunal components of different fish landing centers of Odisha (specific locality given with material examined list of each species), mostly from bycatch trashes. The specimens were preserved in 10 % formaldehyde. Measurements were taken in mm by digital caliper with 0.1 mm accuracy. The specimens were identified using standard literature² and web based information¹⁹. The specimens are registered and deposited at Estuarine Biology Regional Centre, Zoological Survey of India,

Gopalpur-on-Sea, Odisha (EBRC/ZSI) and Fish Division, Zoological Survey of India, Kolkata (ZSI F). Abbreviations used are: TL = Total Length, and SL = Standard Length.

Material examined

Callionymus filamentosus: EBRC/ZSI/F-11421, 01 ex. (♀), 105.6 mm TL (86.1 mm SL), Paradip fish landing centre (20°16'20.32" N, 86°40'44.15" E), Odisha, 15/03/2019.

Callionymus hindsii: EBRC/ZSI/F-9867, 03 ex. (2 ♂, 1 ♀), 60–70.5 mm TL (48–56 mm SL), Pallibandha, near Rushikulya river mouth (19°18'38.91" N and 84°58'20.68" E), Odisha, 30/03/2018; EBRC/ZSI/F-11356, 02 ex. (♀), 63–67 mm TL (49–51 mm SL), Arjyapalli fish landing centre (19°18'23.56" N, 84°57'4.60" E), Odisha, 28/06/2019; ZSI F-11745/2, 1 ex. (♀), 64.3 TL (50.2 SL), Barkul (19°42'30" N, 85°11'33" E), Chilika Lake, Odisha, 06/09/2016.

Callionymus margaretae: EBRC/ZSI/F-11357, 01 ex. (♂), 280 mm TL (149.7 mm SL), Pallibandha fish landing centre, Rushikulya river mouth (19°15'47.56" N, 84°54'59.26" E), Odisha, 20/03/2019; ZSI F 11645/2, 5 ex. (2 ♂, 3 ♀), 195–265 mm TL (115–145 mm SL), Gopalpur (19°15'33" N, 84°54'42" E), Ganjam, Odisha, 18/02/2010.

Callionymus recurvispinnis: EBRC/ZSI/F-11358, 01 ex. (♂), 101.7 mm TL (75.2 mm SL), Paradip fish landing centre (20°16'20.32" N, 86°40'44.15" E), Odisha, 15/03/2019.

Results

Taxonomic accounts of the four species are given here based on the collected specimens. All the four specimens have common characteristics such as elongated body with dorso-ventrally flattened, conical head; bands of small villiform teeth on both jaws; gill opening positioned dorsally as an open pore; fan shaped pelvic fins; second dorsal fin and anal fin base longer with unbranched rays except for the last ray, divided at base. Preopercular spine with a strong main tip, smooth ventral margin, dorsal margin with antrorse serrae or curved points and a strong antrorse spine at its base; lateral line simple^{2,3}. Specific diagnostic characters are expressed to record their presence in coastal waters of Odisha. Morphological characters of all species reported are represented in Table 1.

Taxonomic account

Class: Actinopterygii Klein, 1885

Order: Perciformes Bleeker, 1863

Family: Callionymidae Bonaparte, 1831

Genus: *Callionymus* Linnaeus, 1758

1. *Callionymus filamentosus* Valenciennes, 1837 (Blotchfin dragonet) (Fig. 1)

Callionymus filamentosus Valenciennes, in Cuvier & Valenciennes, *Hist Nat Poiss*, 12 (1837), p. 303, Pl. 359 (Type locality: Manado, Sulawesi, Indonesia). (Type locality: Manado, Sulawesi, Indonesia).

Diagnostic characters: D IV + viii, 1; A viii, 1; P ii, 15; V I, 5; C i, 7, ii. Upper jaw slightly

Table 1 — Comparison of morphological characters of four reported species from Odisha

S.NO.	Morphological characters	<i>C. filamentosus</i> Valenciennes, 1837	<i>C. hindsii</i> Richardson, 1844	<i>C. margaretae</i> Regan, 1905	<i>C. recurvispinnis</i> Li, 1966
1.	Total length (TL)	105.6 mm	60.0 – 70.5 mm	195.0 – 279.7 mm	103.86 mm
2.	Standard length (SL)	86.16 mm	48.0 – 56.0 mm	115.0 – 149.7 mm	77.2 mm
3.	Body depth in SL	8.7	8.5 – 9.8	9.8 – 11.6	9.8
4.	Predorsal length in SL	3.1	2.7 – 2.8	3.4 – 3.8	3.3
5.	Preanal length in SL	1.9	1.8 – 1.9	1.8 – 2.1	1.9
6.	1 st spine of 1 st Dorsal fin length in SL	9.7	7.3 – 7.7	1.8 – 2.9	5.8
7.	2 nd spine of 1 st Dorsal fin length in SL	10.7	8.3 – 10.6	5.9 – 8.4	9.1
8.	1 st ray of soft dorsal fin	8.0	5.2 – 6.4	5.5 – 6.2	7.4
9.	Last dorsal fin soft ray length in SL	6.1	8.6 – 8.9	4.0 – 5.3	4.3
10.	Caudal fin length in SL	4.2	3.8 – 4.0	1.2 – 1.5	2.9
11.	Caudal peduncle length in SL	7.9	5.3 – 5.6	5.8 – 6.6	7.4
12.	Caudal peduncle depth in SL	14.0	15.4 – 16	20.0 – 24.7	21.7
13.	Head length (HL) in SL	3.9	3.5 – 3.8	3.5 – 4.1	4.0
14.	Snout length in HL	3.3	2.9 – 3.3	2.2 – 2.8	3.3
15.	Orbit diameter in HL	2.7	3.0 – 3.2	2.8 – 3.8	2.6
16.	Inter Orbital Space in eye	4.8	4.0 – 5.0	4.5 – 6.6	5.6
17.	Upper jaw length in HL	5.9	2.1 – 2.6	2.8 – 3.4	5.9
18.	Lower jaw length in HL	5.5	2.6 – 3.2	3.1 – 3.6	5.1

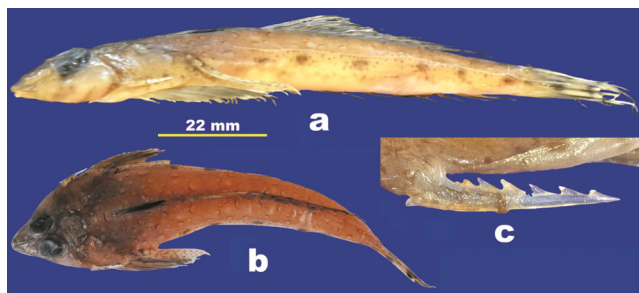


Fig. 1 — Photographs of *Callionymus filamentosus* Valenciennes, 1837 (86.1 mm SL); a) Alcohol preserved specimen, lateral view; b) Fresh specimen, dorsal view; and c) Preopercular spine

protruding than lower jaw; all spines of first dorsal fin connected by membrane (in male, first spine supposed to be separate and elongate); preopercular spine with a strong straight main tip and six antrorse serrae at its dorsal margin; anal fin low, originates vertically below first and second dorsal soft ray; pectoral fin long, reaching to about level of second anal fin ray base; pelvic fin large with the longest ray nearly reaching first anal fin ray; caudal fin slightly elongate, distally convex.

Colour: Head and body light brown; dorsal surface with many white and dark spots or blotches; body below lateral line with a horizontal rows of dark brown blotches; ventral side of body white. Second dorsal fin translucent, with many dark brown spots and blotches; anal fin hyaline with a black distal margin; upper part of pectoral fin with dark spots; pelvic fin with dark spots on fourth and fifth rays; caudal fin white with small dark brown spots and fin base is body colour. In female specimen, first dorsal fin pale but dusky distally, with a large black ocellus between 3rd and 4th dorsal spine.

Distribution: This species is widely distributed in the Indo-west Pacific region, from west coast of Africa (Tanzania, Mosambique), and Seychelles, to the Red Sea and the Persian Gulf in west, through India, Indonesia to Vanutau (Pacific Ocean) in the east, South China Sea in north and Western Australia in south; also immigrated to the Mediterranean⁴. In India, it was reported from Tamil Nadu², Andhra Pradesh²⁰ and Andaman Islands²¹. The present record of this species from Paradip, Odisha extends its distributional range further northward along east coast of India.

2. *Callionymus hindsii* Richardson, 1844 (Hinds' dragonet) (Fig. 2)

Callionymus hindsii Richardson, 1844, *Ichthyology-Part 1, Zool Voyage H.M.S. Sulphur*, 64

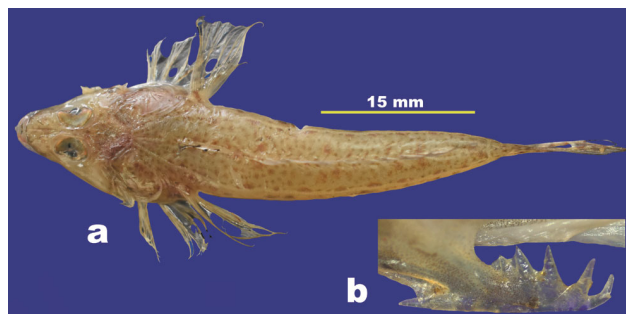


Fig. 2 — Photographs of *Callionymus hindsii* Richardson, 1844 (51 mm SL); a) Alcohol preserved specimen, dorsal view; and b) Preopercular spine

(1844), Pl. 37 (figs. 3-4) (Type locality: Pacific [no specific locality]).

Diagnostic characters: D III + ix, 1; A viii, 1; P 13-15; V I, 5; C i-ii, 6-7, ii. Upper jaw highly protruding; inter dorsal distance about equal to first dorsal fin base; main tip of preopercular spine curved upward, four curved serrae at its dorsal margin; first dorsal fin filamentous and elevated in males, compared to short and non-filamentous in female; pectoral fin long, reaching to base of second anal-fin ray; caudal fin distally convex without filamentous middle rays.

Colour: Body light brown dorsally, turning whitish-yellow ventrally. Dorsum with numerous small dark brown spots. First dorsal fin light brown with three transverse black bands in males; females with two dark spots on the fin membrane between second and third spine. Other fins translucent; caudal fin irregularly spotted.

Distribution: This species is widely distributed in the Indo-Pacific region, between Persian Gulf through India, Andaman Sea, the Gulf of Thailand, and Malaysia to South China Sea⁴. From India it was reported from Andhra Pradesh and Tamil Nadu coast². The present report extends geographic distribution of *C. hindsii* northward to Odisha coast along east coast of India.

3. *Callionymus margaretae* Regan, 1905 (Margaret's dragonet) (Fig. 3)

Callionymus margaretae Regan, 1905, *J Bombay Nat Hist Soc*, 16 (2) (1905) p. 326, Pl. 3(C) (fig. 3) (Type locality: Muscat, Oman, Gulf of Oman, Arabian Sea).

Diagnostic characters: D IV + viii, 1; A vii, 1; P ii, 15; V I, 5; C i, 7, ii. Upper jaw slightly protruding; head length 3 times in caudal fin length; first spine of first dorsal fin elongated and filamentous, second to

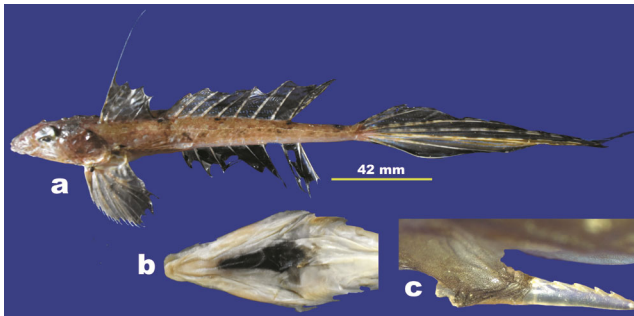


Fig. 3 — Photographs of *Callionymus margaretae* Regan, 1905 (149.7 mm SL); a) Fresh specimen; b) Elongate triangular black marking at thorax area of male specimens; and c) Structure of preopercular spine with serrae

fourth spine normal; first dorsal spine base length 1.9 times in head length; preopercular spine consists of a short straight main tip and six small curved serrae at its dorsal margin; anal fin originates vertically in line with second and third dorsal-fin ray; pectoral fin reaching to about base of first anal fin; elongated caudal fin with long middle rays.

Colour: Head and body brownish with small dark brown spots; ventral whitish with an elongated triangular black marking on the thorax area in male; dorsal surface with small white and dark spots and blotches; series of elongated dark markings below lateral line; operculum with minute dark spots; eye dark grey; a white blotch dorsally on snout. First dorsal fin light brown with 4 curved darker bands, distally darkish; filament of first spine black; second dorsal fin translucent and have 5 ocellated orange coloured streaks on each membrane; anal fin white with a broad black colouration increasing distally towards the caudal fin; pectoral fin with a dark brown blotch basally and small spots on upper part; distal margin of caudal fin black, with vertical rows of dark spots near the centre.

Distribution: *Callionymus margaretae* is widely distributed from Somalia coast, Persian Gulf and Muscat, east to Pakistan and western and southern peninsular coast (Bay of Bengal) of India⁴. From India, it was reported from, Andhra Pradesh, Tamil Nadu, Kerala and Goa². However, reports of *Callionymus japonicus* Houttuyn from Tamil Nadu²² and Karnataka²³ are to be referred as of this species.

4. *Callionymus recurvispinnis* (Li 1966) (Belcher's dragonet) (Fig. 4)

Calliurichthys recurvispinnis Li, 1966, *Acta Zool Sini*, 3 (2) (1996) p. 171 [English 175], Fig. 3 (Type locality: Swamei, Kwangtung, China).

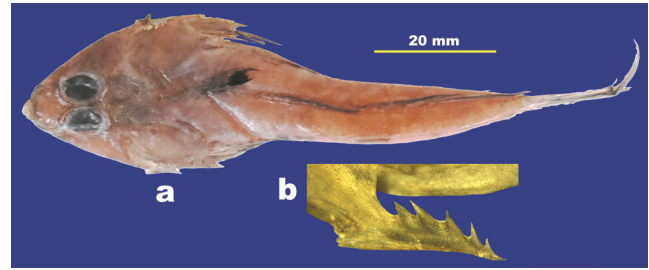


Fig. 4 — Photographs of *Callionymus recurvispinnis* (Li 1966) (75.2 mm SL); a) Preserved specimen; and b) Structure of preopercular spine with serrae

Callionymus belcheri recurvispinnis: Fricke, 2002, *Stutt Beitr Naturkd, Serie A (Biologie)*, 645 (2002) p. 13.

Diagnostic characters: D IV + viii, 1; A viii, 1; P ii, 16; V I, 5; C i, 7, ii. Upper jaw slightly protruding; orbit diameter bigger than snout length; interorbital space much smaller than orbit diameter; preopercular spine with a short downwardly pointed main tip and five curved serrae at its dorsal margin; first spine of first dorsal fin elongated but not filamentous, 1.2 times longer than first ray of second dorsal fin; second spine shorter than first spine in length; pectoral fin reaches base of third anal fin ray; caudal fin slightly elongated.

Colour: Head and body yellowish brown; ventral side of body white; head with some brown spots; a row of elongated dark blotches below lateral line. First dorsal fin translucent, numerous minute black spots on the membrane, distal margin black; second dorsal fin with white lines and black tip forming a streak; lower half of anal fin dark black; pectoral fin with vertical rows of dark spots; scattered large brown blotches on pelvic fin; pectoral fin base with small dark brown blotches; membranes between upper caudal fin rays with larger black blotches, while lower half with small black spots.

Distribution: *Callionymus recurvispinnis* is distributed from northern Bay of Bengal, Andaman Sea, through Indonesia to South China Sea and Taiwan⁴. From Indian waters, this species was known only from West Bengal coast^{2,24}. The present report extends its distribution southward to Odisha coast along east coast of India.

Discussion

Five species of dragonets (Callionymidae), viz., *Callionymus carebares* Alcock 1890, *C. fluviatilis* Day 1876, *C. sagitta* Pallas 1770, *Eleotherochir opercularis* (Valenciennes 1837) and *Synchiropus lineolatus*

(Valenciennes 1837), were known from Odisha coast¹⁸. Present record of *Callionymus filamentosus* Valenciennes 1837, *C. hindsii* Richardson 1844, *C. margaretae* Regan 1905 and *C. recurvispinis* (Li 1966), are added to the callionymid diversity of Odisha state, contributing to the range extension and distribution along the east coast of India.

Earlier workers reported a total of 19 species of the genus *Callionymus* from different states and union territories of India, namely *C. belcheri* Richardson 1844 from West Bengal¹⁶; *C. carebares* Alcock from off Madras, Tamil Nadu²⁵ and Odisha¹⁸; *C. enneactis* Bleeker from Andaman Islands¹⁴, *C. erythraeus* Ninni from Gulf of Mannar, Tamil Nadu², *C. filamentosus* Valenciennes from Tamil Nadu², Andaman Islands²¹ and Andhra Pradesh²⁰; *C. fluviatilis* Day from West Bengal²⁶, Tamil Nadu² and Odisha²⁷, *C. hindsii* Richardson from Andhra Pradesh and Tamil Nadu², *C. japonicus* Houttuyn from Tamil Nadu¹³, Karnataka²³ and Andaman Islands²⁸ (in checklist), *C. kaianus* (Gunther) from Kerala²⁵, *C. kothausi* Fricke from Kerala²⁹, *C. margaretae* Regan from Andhra Pradesh, Tamil Nadu, Kerala and Goa², *C. marleyi* Regan from Andhra Pradesh² and Tamil Nadu²², *C. megastomus* Fricke from Calcutta, West Bengal³⁰, *C. melanopterus* Bleeker from Andaman Islands¹⁵ (in checklist), *C. octostigmatus* (Fricke) from Andaman Islands²⁹, *C. recurvispinis* (Li) from West Bengal^{2,24}, *C. sagitta* Pallas from (Hooghly river) West Bengal, (Puri) Odisha and (Madras) Tamil Nadu², *C. schaapii* Bleeker from Gulf of Mannar, Tamil Nadu² and *C. sublaevis* McCulloch, 1926 from Goa coast¹⁷. However, occurrence of *C. belcheri*, *C. japonicus*, *C. kaianus* and *C. melanopterus* seems to be erroneous, most possibly based on misidentification.

In Indian waters, *Callionymus belcheri recurvispinis* (Li) was first reported from Hughly river mouth and off Kolkata, West Bengal². The same species was probably also collected from Digha coast, West Bengal²⁴. However, in the later work¹⁶, this species was replaced by *C. belcheri*, without any voucher specimen information. Both *C. belcheri belcheri* and *C. belcheri recurvispinis* were considered as *C. belcheri* in FishBase¹⁹ and that might have concluded by the authors¹⁶ to list *C. belcheri* from Digha coast. However, recent work considers both *C. belcheri* and *C. recurvispinis* as distinct species¹. With the subspecies being upgraded to species level, *C. belcheri* is currently known from western Pacific only, while *C. recurvispinis* is

distributed in a much wider region including northern Bay of Bengal¹. Moreover, *C. belcheri* differs from *C. recurvispinis* in having a slender body (9.7–13.7 in SL vs 7.5–9.8 in SL), larger first dorsal spine in male (4.3–5.8 in SL vs 5.9–6.5 in SL), distal black blotch on last few membranes of anal fin of female (vs almost all membrane except the first one with dark blotch) and first dorsal fin brownish in male (vs pale with dark grey distal margin). Therefore, listing of *C. belcheri* from Digha coast¹⁶ is erroneous and based on *C. recurvispinis* specimens only.

Reports of *Callionymus japonicus* from India are basically following the record of *Callionymus longicaudatus*, a junior synonym of the former, from Andamans²⁶. Currently, *C. japonicus* is known to be distributed in western Pacific only from southern Japan, Korea, eastern China, South China Sea, Philippines, Indonesia, Papua New Guinea, New Caledonia, to north-western Australia^{1,19}. In a recent work, it is not considered to be present in Andamans³¹. However, the description of *C. longicaudatus* by Francis Day is not sufficient to ascertain its current status. Moreover, ‘anal fin with 9 rays’ indicate it may be a species of ‘*filamentosus*’-group (anal fin with only 8 rays in ‘*japonicus*’-group). Further, inclusion of *Callionymus belcheri* in the synonym by Dr. Francis Day²⁶ under *C. longicaudatus*, confirms that the said species belongs to ‘*filamentosus*’-group and the possibilities are more for it be *C. filamentosus* or *C. belcheri* or *C. recurvispinis*, while last two species are not yet recorded from Andaman Islands³². Although, *C. japonicus* have been first listed from Andamans in a checklist²⁸ and subsequent lists published, none of them are based on specimens collected, but based on report of *C. longicaudatus* by Francis Day. However, *C. filamentosus* was later reported from Hut Bay, Little Andaman²¹. Hence, from the distributional point of view and the discussion above on the description of *C. longicaudatus* from Andamans, it can be inferred that *C. japonicus* is not occurring in Indian waters and *C. filamentosus* specimens are misidentified. On the other hand, examination of specimens in the National Zoological Collections, Zoological Survey of India, Kolkata, the records of *C. japonicus* from Tamil Nadu²² and Karnataka²³ are confirmed to be of *C. margaretae*.

Record of *Callionymus kaianus* from India was based on report from Malabar coast²⁵. However, it has been observed that Alcock’s record is to be referred

as *C. kotthausi*, a new name proposed for 'Diplogrammus indicus Kotthaus 1977' by Dr. R. Fricke²⁹. Hence, *C. kaianus* are possibly restricted to Indonesian region³³ and not occur in India.

The Blackfin dragonet, *C. melanopterus* Bleeker, is currently known from Singapore and western Indonesia only⁴. Its inclusion in the checklist of Andaman fishes¹⁵ is more possibly based on presumption only and was never reported with material evidence.

Therefore, it can be concluded that only 15 species of the genus *Callionymus* are known to be distributed in Indian waters at present and *C. belcheri*, *C. japonicus*, *C. kaianus* and *C. melanopterus* are erroneous inclusions in literature. More clarification can be obtained through molecular studies. However, being it a commercially non-viable fish, sampling for dragonets from Indian waters has been extremely patchy, and it is likely that more intensive efforts would reveal the presence of additional species. Therefore, there is a need for intensive survey and collection to determine the true extent of callionymid diversity and distribution along Odisha as well as from other parts of Indian coast. Based on the record of *Callionymus* species in the present work and other reef associated fishes reported by previous workers in Odisha coast³⁴⁻³⁵ indicates the presence of patchy rocky habitat or reef from Paradip to Vishakhapatnam (particularly near Gopalpur).

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Conflict of interest

Authors don't have any conflict of interest.

Author contributions

SR, JP, DR and SRM: Collection, preservation, identification and manuscript preparation; and SP, SCS, SSM and AM: Identification, manuscript preparation and critical analysis.

References

- 1 Fricke R, Eschmeyer W N & Fong J D, Species of fishes by family/subfamily. Online version dated 6th July, 2020. Accessed at [http://research.calacademy.org/research/ichthyology/catalog/Species By Family.asp](http://research.calacademy.org/research/ichthyology/catalog/Species%20By%20Family.asp), (2020), Electronic version accessed on 31 July 2020.
- 2 Fricke R, Revision of the Indo-Pacific genera and species of the dragonet family Callionymidae (Teleostei), *Theses Zoologicae*, (Braunschweig J Cramer, Germany), 3 (1983), pp. 774.
- 3 Fricke R, Suborder Callionymoidei. Callionymidae. Dragonets, In: *FAO Species Identification Guide for Fishery Purposes. The living marine resources of the western central Pacific. Vol. 6 Bony fishes part 4 (Labridae to Latimeriidae), estuarine crocodiles, sea turtles, sea snakes and marine mammals*, edited by K E Carpenter & V H Niem, (FAO, Rome), 2001, pp. 3381-4067.
- 4 Fricke R, Annotated checklist of the dragonet families Callionymidae and Draconettidae (Teleostei: Callionymoidei), with comments on callionymid fish classification, *Stuttg Beitr Naturkd, Serie A (Biologie)*, 645 (2002) 1-103.
- 5 Fricke R, Two new species and a new record of dragonets from New Caledonia (Teleostei: Callionymidae), *Stuttg Beitr Naturkd, Serie A (Biologie)*, 696 (2006) 1-14.
- 6 Fricke R & Golani D, *Callionymus profundus* n. sp., a new species of dragonet from the Gulf of Aqaba (Gulf of Eilat), Red Sea (Teleostei: Callionymidae), *Stuttg Beitr Naturkd, Serie A (Biologie), Neue Serie*, 6 (2013) 277-285.
- 7 Fricke R, Jawad L A & Al-Mamry J M, *Callionymus omanensis*, a new species of dragonet from Oman, northwestern Indian Ocean (Teleostei: Callionymidae), *J Fish Biol*, 85 (5) (2014) 1303-1319 [1-17].
- 8 Fricke R, *Callionymus madangensis*, a new species of dragonet from Papua New Guinea, southwestern Pacific Ocean (Teleostei: Callionymidae), *J Ocean Sci Found*, 13 (2014) 1-15.
- 9 Fricke R, *Callionymus alisae*, a new species of dragonet from New Ireland, Papua New Guinea, western Pacific Ocean (Teleostei: Callionymidae), *Fish Taxa*, 1 (1) (2016a) 55-66.
- 10 Fricke R, *Callionymus petersi*, a new species of dragonet from New Ireland, Papua New Guinea, western Pacific Ocean (Teleostei: Callionymidae), *J Ocean Science Found*, 21 (2016b) 38-57.
- 11 Fricke R, *Callionymus boucheti*, a new species of dragonet from New Ireland, Papua New Guinea, western Pacific Ocean, with the description of a new subgenus (Teleostei: Callionymidae), *Fish Taxa*, 2 (4) (2017) 180-194.
- 12 Fricke R & Vo V Q, *Callionymus vietnamensis*, a new species of dragonet from the South China Sea off southern Vietnam, with a review of the subgenus *Callionymus* (*Calliurichthys*) Jordan & Fowler 1903 (Teleostei: Callionymidae), *Fish Taxa*, 3 (2) (2018) 433-452.
- 13 Ramayan V, Purushothaman A & Natarajan R, Check-list of estuarine and marine fishes of Parangipettai (Porto Novo) coastal waters, *Matsya*, 12 (13) (1987) 1-19.
- 14 Krishnan S & Mishra S S, New records of the fishes from Andaman and Nicobar Islands, *J Andaman Sci Assoc*, 8 (1) (1992) 82-84.
- 15 Rao D V, Checklist of fishes of Andaman and Nicobar Islands, Bay of Bengal, *Environ Ecol*, 27 (1a) (2009) 334-353.
- 16 Yennawar P, Mohapatra A & Tudu P C, An account of Ichthyofauna of Digha coast, West Bengal, *Rec Zool Surv India*, 117 (1) (2017) 4-21.
- 17 Hegde M R, Padate VP, Velip D T & Rivonker C U, An updated inventory of new records of coastal macrofauna along Goa, west coast of India, *Indian J Geo-Mar Sci*, 42 (7) (2013) 898-902.
- 18 Barman R P, Mishra S S, Kar S, Mukharjee P & Saren S C, Marine and estuarine fish fauna of Orissa, *Rec Zool Surv India, Occ Pap*, 260 (2007) 1-186.

- 19 Froese R & Pauly D (Eds), *FishBase*, World Wide Web electronic publication (2019). www.fishbase.org, version (04/2019).
- 20 Krishnan S & Mishra S S, Fishes. In: *Fauna of Godavari estuary. Estuarine Ecosystem Series* (Publ Zool Surv India, Kolkata), 4 (2001) 85-166.
- 21 Krishnan S & Mishra S S, On a collection of fish from Middle and South Andaman group of Islands, *Rec Zool Surv India*, 94 (2-4) (1994) 265-306.
- 22 Barman R P, Mishra S S, Kar S, Mukherjee P & Saren S C, Marine and Estuarine Fish, In: *Fauna of Tamil Nadu, State Fauna Series* (Publ Zool Surv India, Kolkata), 17 (2) (2011) 293-418.
- 23 Barman R P, Mishra S S, Kar S & Saren S C, Marine and estuarine fishes, In: *Fauna of Karnataka, State Fauna Series*, (Publ Zool Surv India, Kolkata), 21 (2013) 277-388.
- 24 Chatterjee T K, Ramakrishna, Talukdar S & Mukherjee A K, Fish and fisheries of Digha coast of West Bengal, *Rec Zool Surv India, Occ. Paper No. 188* (2000): i-iv, 1-87.
- 25 Alcock A W, *A descriptive catalogue of the Indian deep-sea fishes in the Indian Museum. Being a revised account of the deep-sea fishes collected by the Royal Indian marine survey ship Investigator*, Calcutta, (1899) i-iii + 1-211 + i-viii.
- 26 Day F, *The fishes of India, being a Natural History of the fishes known to inhabit the seas and freshwater of India, Burma and Ceylon*, (Bernard Quaritch, London), Part 2 (1876) 169-368, 41-78 pls. (+ 51 A-C).
- 27 Mishra S S, Remadevi K & Venkateswarlu T, Occurrence of *Callionymus fluviatilis* Day (Callionymidae: Pisces) from Mahanadi estuary, Orissa, *Environment & Ecology*, 13 (3) (1995) 737.
- 28 Talwar P K, Fishes of the Andaman and Nicobar Islands: A Synoptic analysis, *J Andaman Sci Assoc*, 6 (2) (1990) 71-102.
- 29 Fricke R, The *kaianus*-group of the genus *Callionymus* (Pisces: Callionymidae), with descriptions of six new species, *Proc Calif Acad Sci (Ser 4)*, 42 (14) (1981) 349-377.
- 30 Fricke R, A new species of the genus *Callionymus* from India (Teleostei: Callionymidae), *J Nat Hist*, 16 (1982) 345-349.
- 31 Allen G R & Erdmann M V, *Reef fishes of the East Indies*, (Tropical Reef Research, Perth Australia), II (2012) pp. 425-855.
- 32 Rajan P T & Mishra S S, Fishes of Andaman and Nicobar Islands – an updated checklist, *J Andaman Sci Assoc*, 23 (2) (for 2018) (2020) 148-181.
- 33 Fricke R, Eschmeyer W N & Van der Laan R (eds), *Eschmeyer's Catalog of Fishes: Genera, Species, References*. (2019) (<http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp>). Electronic version accessed 09 Sept. 2019.
- 34 Ray D & Mohapatra A, First record of scorpionfish genus *Neomerinthe* Flower, 1935 (Actinopterygii: Scorpaeniformes: Scorpaenidae) from Indian coast, *Indian J Geo-Mar Sci*, 44 (8) (2015) 1224-1228.
- 35 Roy S, Dash S & Mishra S S, First record of *Seriolina nigrofasciata* (Ruppell 1829) (Perciformes: Carangidae) from Odisha coast, India, *Rec Zool Surv India*, 117 (2) (2017) 186-189.