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New distributional record of Hawkfish *Cirrhitichthys bleekeri* Day, 1874 from the west coast of India with taxonomic account

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Abstract
The rarely occurred Hawkfish *Cirrhitichthys bleekeri* Day, 1874 is described based on the single specimen caught during demersal trawling survey conducted at 45 m depth of south west coast of India (9° 02.1'N; 76° 18.2'E at 40-45 m). An analysis of the morphometric, meristic characters and radiographic of the sample are compared with those of existing records of same and sibling species of the genus *Cirrhitichthys* (*C.calliurus, C.aureus*) and probability for putative hybrid of hawkfish species is discussed.

Keywords: Hawkfish, *Cirrhitichthys*, bottom trawl, putative hybrid, southwest coast of India

1. Introduction
Hawkfishes of the family Cirrhitidae are small and generally colourful fishes and reef predators that commonly shelter in the branches of coral colonies [1]. They occurred in tropical waters mostly in shallow water, often only a few feet deep, however, species of the genera *Oxycirrhites* and *Cyprinocirrhites*, reported to live at the depths of about 15 to 60 fathoms [2,1]. In general, the cirrhitids are more active and frequently move short distances from one part of a reef to another, smaller species seek refuge in crevices of living coral [3, 2]. Some studies on food habits of few species of cirrhitids are also available [4, 3, 5]. Studies on reproduction revealed hermaphroditism in Hawk fishes [6, 7]. The Hawk fishes under the family cirrhitidae consist of 12 genera and 33 valid species [8], there are about 4 genus and 8 species were reported from Indian waters [9], amoung these four species have been reported in Andaman and Nicobar Islands [10]. Venkataraman (2002) [11] reported *Cirrhitichthys oxycephalus* from Gulf of Mannar. There are about seven species (*Cirrhitichthys aprinus, C. pinnulatus, C. bleekeri, C. calliurus, C. oxycephalus, Oxycirrhites typus, Paracirrhites forsteri*) listed from Indian waters [12, 10, 13]. However, these 8 species from Indian waters [9] have not been described properly to confirm the authenticity of record. Putative hybrid amoung the *Cirrhitchthys spp*. was also reported form Arabian sea [14]. Day (1874) [15] first described *Cirrhitichthys bleekeri* form East coast of India, further Day (1875) [16] described *C. bleekeri* as the synonym of *C. aureus*. However, Randall (1963) [2] recognized *C. bleekeri* as valid species which in turn did not resemble in all respects with the illustration of *C. aureus.* The hawkfish *C. bleekeri* was reported from Mauritius, Srilanka and Reunion [17] and East coast of India [15]. Randall (1980) [17] commented the misperception of original description on *C. bleekeri* with *C. aureus* as synonym by Day (1874 and 1875) [15, 16], there is no further confirmation or description is available in Indian waters after Day (1874) [15], hence for clarity, *C. bleekeri* from west coast of India is redescribed in this paper including valid characters which mislaid in the original description.

2. Materials and methods
A single specimen of *Cirrhitichthys bleekeri* was collected from bottom trawl catches of the survey vessel M.F.V.*Matsya Varshini* (OAL 36.5 m; Gross tonnage: 268.8) of Fishery Survey of India during March 2019 in the area between 9° 06.7'N; 76° 17.8'E and 9° 02.1'N; 76° 18.2'E at 40-45 m. Expo model fish trawl with 30 mm cod end mesh size was used for sample collection. The specimen was identified following the standard literature [2,17]. Meristic counts were taken following Fricke (1983) [18] and morphometric measurements to the nearest

millimetre (mm) were measured by using digital caliper (Mitutoyo ABS lute Digimatte, Japan) following standard literature for *C. bleekeri* (Randall 1980) [17]. Total weight (TW) weight was taken by means of a digital balance (0.05g accuracy) and an X-ray photograph was taken to count the number of vertebrae in this specimen. The specimen was deposited in the marine museum of Cochin base of the Fishery Survey of India (FSIKM Cb 1, 74mm), Kochi. Kerala, India.

3. Results and Discussion

Order: Perciformes
Suborder: Percoidei
Family Cirrhitidae
Genus *Cirrhitichthys* Bleeker, 1857
Species: *Cirrhitichthys bleekeri* Day, 1874,
Material examined: FSIKM-Cb-1, 74, Indian Ocean, Arabian Sea, west coast of India, Lat. 9° 06.7'N; 76° 17.8'E and 9° 02.1'N; 76° 18.2'E at 40-45 m., March 2019.
Holotype: *Cirrhitichthys bleekeri* Day, 1873. *Proc. Zool. Soc. London*, p. 705 (type locality, Madras, East coast of India).
Paratype: *Cirrhitichthys bleekeri* Randall 1963. Proc. U.S. Natl. Mus., 114, p.441, fig. 32 (type locality, Srilanka).

3.1 Description

Dorsal-fin spine X, 12 rays (all soft rays branched, the last one branched at base); first dorsal soft ray produced into a yellow filament, second and third rays also filamentous reaching more than half of the height of first filament (Fig.1.a & b), membranes of dorsal fin moderately incised, the memberane between rays covered with it whole length by single row of scale (Fig.2); and rays III, 6 (first soft ray simple, the remaining branched, the last one branched at base); pectoral fins moderately long, extending to or beyond origin of anal fin, pectoral-fin rays 14 (i+7+vi), lower unbranched pectoral rays markedly longer than branched rays, (uppermost one is unbranched and next lower 7 rays (i.e., 2nd to 8th ray) are branched and the lower 6 rays are unbranched and the 10th ray is longest, which is 2.5 times than the lowermost ray; branchiostegal rays 5 (Fig.3.b.); lateral line scales 41; there are 3 rows of large scales above lateral line to base of dorsal fin at middle of the body, whereas 4 rows of scales at the origin of dorsal fin to LL; 11 rows of scales below lateral line to origin of anal fin; gill rakers 3+1+8 on first gill arch at both side, caudal-fin rays (v), ii,13, ii,(v); vertebrae 26.
Mouth terminal and upper jaw slightly protruding, the maxilla extending posteriorly to a vertical at front edge of pupil; palatine teeth present, vomer has 6 cardiform teeth fixed in U shaped towards posteriorly. Lower jaw has 26 canine teeth on outer row; 4 rows of villiform teeth fixed on inner row upto half of the jaw posteriorly. Upper jaw also has 26 long canine on outer row and 5 rows of villiform teeth on inner row. However, with the exception of the presence or absence of palatine teeth, the dentition of cirrhitids is relatively unchanging from species to species (Randall 1963, 1980) [2, 17].
Preopercular margin is coarsely serrated excluding lower margin, posterior margin bearing 12 triangle spine with broad base (Fig.3.a); twenty short pointed spines on posterio-dorsal edge of the subopercle, where the first one with flat and broader edge, remaining with sharp margin, the subopercle is almost equal in height to operculum, ventral edge sub-opercle connected with ceratohyal by shot muscle.
All parameters in proportion (table. 2) compared with review of Randall (1980) in parenthesis as follow, Body relatively deep, the depth is 2.62 in SL (2.45-2.65); dorsal profile of head almost straight from snout to above centre of eye and after continuous convex to origin of dorsal fin; head length 3.0 in SL (2.8-3.05); snout 3.3 in head (3.2-3.5); orbit diameter 3.9 (3.7-4.4) in head; interorbital space concave, no scales, slightly rugose, the least bony width of interorbital is 6.3 in head (6.15-6.55); least depth of caudal peduncle 2.4 in head (2.4-2.8); caudal fin slightly emarginated, its length 1.3 in head (1.3-1.5). Dorsal fin origin starts marginally anterior to upper end to gill opening; fourth to eighth spines are subequal, however, sixth and seventh dorsal spines are equal and it is 2 times in head (1.9-2.1), whereas it was 2.3 in in body depth (2.05-2.5); first dorsal soft ray prolonged to a filament, its length is 3.1 times in SL (3.2 – 4.0), 1.03 times in head and 1.6 times longer than second ray (1.2-1.8); caudal fin truncate with slightly emarginate, its length 1.3 (1.3-1.5) in head; lower six pectoral rays longer than upper branched rays, the longest ray (10th) reaching to or beyond a vertical at base of third anal spine, its length is 2.6 times in SL (2.6-3.0); pelvic fins reaching beyond anus, its length is 1.5 in head (1.45 -1.6).
Scales cycloid; no scales on interorbital, predorsal scales 7, diagonal rows of scales on cheek 3; 12 rows of scales horizontally on preopercle ; three rows of large scales above lateral line in middle of body whereas 4 rows just below the origin of dorsal fin; all fins scaled basally (Randall 1963, 1980) [2,17], however a single row scale on inter-spinal membrane of dorsal and the membrane between dorsal soft rays (Fig.2b.).

3.2 Colour

Body rosy orange with light longitudinal lines, which are prominent on lower posterior part of the body on abdomen to caudal, running below the lateral line. larger ill-defined blotch on and below the soft portion of the dorsal fin extending from half way to dorsal side of lateral line; tips of the soft rays are yellow, first soft rays is filamentous, unbranched and yellowish second and third rays yellowish filamentous but branched. Spinous portion of dorsal fin has 2 to 3 block spots on each spine, appears an arch lines between first to last dorsal spines, however the first dorsal spine has a single large black blotch. Tip of all spines of dorsal fin have cirri, which was in orange red color; an apparent dark spot on upper edge of preopercle which extends dorsally as batches to origin of dorsal fin further it continuous up to soft rays at base; pectoral fin yellowish; there are two orange bands of equal size downwards from orbit to interopercle, anterior band passes through maxilla; caudal fin banded with orange-red spots closely arranged vertically; soft portion of dorsal darker than spinous portion and having yellowish outer edge.

3.2 Remarks

The hawk fishes is found only on coral reefs [17], though the bottom nature of the area where the present sample collected was sandy substratum, however, several occasion isolated small coral rock pieces were recorded in the trawl net catches in the adjacent areas of same depth contour [19,20] revealed movement of this species frequently between short distances from one part of a reef and another, seek refuge in crevices of living coral [3,2].
Day (1873) [15] described *C. bleekeri* with the pectoral ray count of 8+ viii, (7+vi -vii in Day 1875) [16] the lateral-line

scale count as 45-46, (43 in Day 1875) and stated that the pelvic fins reach the anus. Whereas, Randall (1963) [2] described *C. bleekeri* with 43 LL and the pelvic fin did not reach anus. However, Randall (1980) [17] revised the above collections and listed *C. bleekeri* as valid species. Based on the ratio between body depth and longest dorsal spine (2.2.-2.6) three valid species (*C. aureus*, *C. bleekeri*, and *C. calliurus*) were categorised, whereas the ratio is less than 2.2 (i.e. 1.7-2.2) were added in another group of four (*C. aprinus*, *C. serratus*, *C. falco* and *C. oxycephalus*) valid species (Randall 1963) [2]. The present specimen had 2.3 falls within the range of [2]. *C. bleekeri* is evidently very closely related to *C. aureus and C. calliurus* [2]. Day (1975) [16] placed the *C. bleekeri* in the synonymy of *C. aureus*, few specimens had short pelvic fins and not reach the anus and the different color pattern seem to differentiate C. aureus and *C. bleekeri* [17].

The above observations confirmed the present specimen is *Cirrhitchthys bleekeri*, however numbers of branchiostegal rays in the present specimen is only 5, whereas Day (1874, 1875) [15,16] and Randall (1963) [2] reported 6. A slight variation in gill rakers count between the present specimen (12) from west coast of India and other specimen have13-14 from East coast of India [15] and Srilanka [17] was observed. The lateral line scale of the present specimen (41) compared with specimens from East coast of India (45-46) [15] and Srilanka (42-44) [17] revealed a slight variation, whereas *C. calliurus* (41-43) and *C. aureus* (43), which are falling in the reference range of original description of *C. bleekeri* (Table 1). Randall (1980) [17] also postulated that, *C.aureus*, *C.bleekeri*, and *C.calliurus* may be demonstrated eventually as subspecies of one species in continuous distribution from Japan and China to the Red Sea. However, DiBattista *et al* (2015) [14] reported a putative hybrid between *C. calliurus* and *C. oxycephalus* in Arabian Sea, which indicated a probability for the occurrence of putative hybrid amoung the hawkfish species in the west coast of India (Arabian Sea), that could be confirmed only by analysing more samples in future.

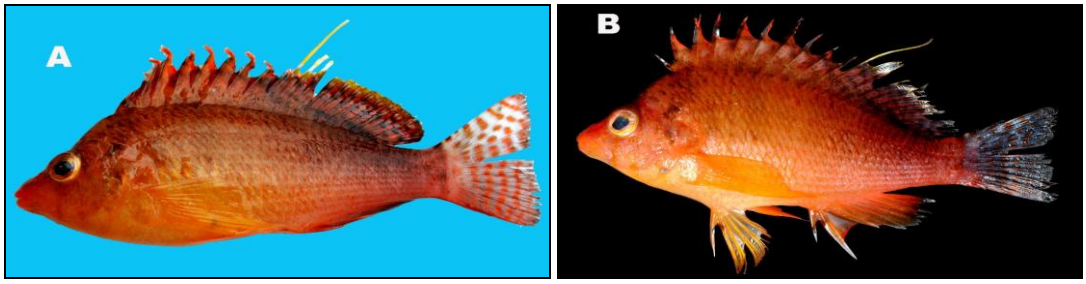

Fig 1: *Cirrhitchthys bleekeri* (74mm TL) fresh specimen (Colour in life) on board (A), after preservation (B).

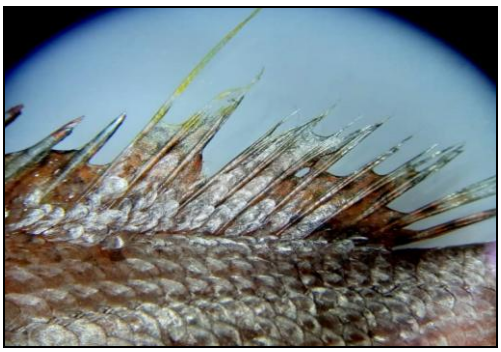

Fig 2: Scales (in single row) on inter-spinous membrane of Dorsal fin

Fig 3: Preopercular serrations (a), Branchiostegal rays (b)

Table 1: Meristic characters of *Cirrhitchthys bleekeri* compared with pertinent literature

Meristic characters	Present specimen *C. bleekeri*	*C. bleekeri* Randal 1980	C. *bleekeri* Randal 1963	*C. calliurus* (Regan 1905)	*C.aureus* (Randall 1963)
Dorsal	X,12	X,12	X, 12-13	x,12	X,12-15
Pectoral fin	14 (i,7,vi)	14 (vii+7) or (8+vi)14		I,6,vii or ii,5,vii	i,7,vi or i,6,vii
Pelvic fin	I,5	I,5			I,5
Anal fin	III,6		3, 6-7		III,6-7
Caudal fin	(v), ii,13, i,(v)				15
Gill Rackers	3+1+8	3/4+10/11		4+1+9/10	6+1+9
Teeth Total	26/26	-	-	-	-
Vertebrae	26	26	26		26
Lateral Line Scale	41	42-44		41-43	43
Scales between LL To Anal Fin	11--12	12	12	10	12
Scales Above Lateral Line	3-4	3-4	4	4-4.5	4

Table 2: Morphometric characters of *Cirrhitchthys bleekeri*

Morphometric Parameters	In mm	% in Standard length	Times in Head length
Total length	74		
Standard length	59		
Head length	19.5		
Head depth	17		
Body depth	22.5	38.1	
Eye Diameter	5	8.5	3.9
Interorbital width	3	5.1	6.5
Predorsal length	19	32.2	1.0
Dorsal fin Base	35	59.3	0.6
Dorsal fin spine height 1-10	0		
1st Dorsal spine height	3	5.1	6.5
2nd Dorsal spine height	7	11.9	2.8
3rd Dorsal spine height	9	15.3	2.2
4th Dorsal spine height	9.5	16.1	2.1
5th Dorsal spine height	9	15.3	2.2
6th Dorsal spine height	10	16.9	2.0
7thDorsal spine height	10	16.9	2.0
8th Dorsal spine height	9.5	16.1	2.1
9th Dorsal spine height	8	13.6	2.4
10th Dorsal spine height	8	13.6	2.4
1st Dorsal soft ray height	19	32.2	1.0
IInd Dorsal soft ray height	11.5	19.5	1.7
Pectoral fin length (Longest Right side)	23	39.0	0.8
Pelvic fin Length	13	22.0	1.5
Anal fin Length	14	23.7	1.4
Anal fin Base	11	18.6	1.8
Caudal fin Length	15	25.4	1.3
Caudal peduncle width	8	13.6	2.4
Upper caudal peduncle length	9	15.3	2.2
Lower caudal peduncle length	12.5	21.2	1.6
Preorbital length	6	10.2	3.3
Post orbital length	10.5	17.8	1.9
Snout to anus	36	61.0	0.5
IST ANAL SPINE	7	11.9	2.8
IIND ANAL SPINE	11.5	19.5	1.7
III ANAL SPINE	10	16.9	2.0
Upper jaw length	7	11.9	2.8

4. Conclusion

Despite *C. bleekeri* was reported from East coast of India [15], which had confusion with the description of *C. aureus* by Day (1875) [16, 17]. The present specimen is a first information from west coast of India with re-description, which was compared with the additional records from East coast of India (Randall 1980) [17] and the present record confirmed the range extension of *C. bleekeri* in the west coast of India. While describing this species, it is reiterated to envisage the probability for putative hybrid amoung the hawk fishes.

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