VOL.65 NO.02 JULY-DECEMBER 2023 • PRINT ISSN 0025-3146 • ONLINE ISSN 2321-7898

JMBAI

JOURNAL OF THE MARINE BIOLOGICAL ASSOCIATION OF INDIA

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Available online at: www.mbai.org.in doi:10.6024/jmbai.2023.65.2.2429-21

Taxonomic description and range extension of *Sargocentron dorsomaculatum* (Shimizu and Yamakawa, 1979) in the Bay of Bengal, India

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Received: 06 Apr 2023 Revised: 04 Sep 2023
Accepted: 12 Sep 2023 Published: 20 Nov 2023

Short Communication

Abstract

A species of genus *Sargocentron* of the family Holocentridae, *S. dorsomaculatum* (Shimizu and Yamakawa, 1979), has been recorded for the first time from Indian waters. These fishes are very rare, and six specimens of the length range of 111-225 mm TL were collected from the traditional cast net catches of local fish landing centres of Visakhapatnam and Chennai. The present paper provides a detailed description of this species along with biometric characters and a comparative account with a similar species *S. rubrum* (Forsskål, 1775) collected from the same catches. The present study also extends the range of occurrence of this species to the Indian Ocean.

Keywords: *Sargocentron dorsomaculatum, taxonomic description, geographic distribution, Indian Ocean*

Introduction

Fishes belonging to the family Holocentridae (commonly called Squirrel fishes and soldier fishes) are mostly nocturnal, small to medium-sized fishes with large eyes. They are distributed worldwide from tropical to warm shallow temperate waters on coral reefs or rocky bottoms of tide pools to the deeper waters of the continental shelf, a few occurring in depths of 200 m or more (Froese and Pauly, 2023). These fishes are very resilient, able to survive for many days inside traps, as well as in polluted areas (Wyatt, 1983), and are often used as aquarium fishes due to their beautiful, bright red colour. They are frequently caught by artisanal boats fishing with traps, hand lines, and gill nets. Though they have relatively low commercial value, their ecological importance is significant (Robins and Ray, 1986; Sujatha, 2003).

Previous studies of this family include Shimizu and Yamakawa (1979), Smith and Heemstra (1986), Moore (1993), Bacurau and Molina (2004), Dornburg *et al.* (2012) and Nelson *et al.* (2016). Along east coast of India, Sujatha (2003) reported *Sargocentron diadema* (Lacepède, 1802), *S. rubrum* and *S. caudimaculatum* (Ruppell, 1838) from Visakhapatnam waters, while Mogalekar *et al.* (2018) reported *S. caudimaculatum, S. diadema, S. melanospilos* (Bleeker, 1858), *S. praslin* (Lacepède, 1802), *S. punctatissimum* (Cuvier, 1829), *S. rubrum* and *S. spiniferum* (Forsskål, 1775) from Tamil Nadu. Previous studies revealed that to study geographical variation within species, information must be obtained on holotypes and numerous specimens from the entire circum-tropical range, it was felt worthwhile to carry out a taxonomic study of the species represented in this region. The present study provides the first record of *Sargocentron dorsomaculatum* and a detailed taxonomic account of this species from Indian waters. This species has been reported from Japan, the Ryukyu Islands (Masuda *et al.*, 1984; Eguchi and Motomura, 2016), Micronesia and Palau (Randall, 1998), and the Caroline Islands (Fricke *et al.*, 2023). The present study extends the range of distribution of this species from the Western Pacific Ocean to the Indian Ocean.

Material and methods

Biweekly random samples of fish species from traditional and mechanized boat catches were collected from Visakhapatnam fishing harbour and local fish landing centres during the study period September 2015- August 2018. After specimen collection, samples were brought to the laboratory in ice, cleaned, and dried on filter paper. The total length (TL) within 0.01 mm and the weight of the specimens within 0.1 g, respectively, were recorded. Photographs of the specimens were taken in fresh condition. Identification of specimens, along with the measurement of morphometric characters, were performed according to Shimizu and Yamakawa (1979). After taking meristic and morphometric data, specimens were dissected for sex identification. A comparative study of meristic and morphometric characters was also done with closely related species *S. rubrum* from the same catch groups. To identify the influential variables that aid in distinguishing these two species Principal Component Analysis (PCA) for morphometric characters along with the Tukey test was carried out using IBM SPSS (IBM Corp, 2019). Results of the Tukey test only for those characters that became significantly different are given.

Results

Systematics

Order : Holocentriformes
Family : Holocentridae
Genus : *Sargocentron* Fowler, 1904

Sargocentron dorsomaculatum (Shimizu and Yamakawa, 1979)

Adioryx dorsomaculatus Shimizu and Yamakawa, 1979, *Japan. J. Ichthyol.* Vol. 29 (2): 119, figs. 3C, 4A, 5A, 9 (type locality: Ishigaki Island, Ryukyu Islands, Japan).

Material examined

Six specimens 111-225 mm TL (including two females and four males), from Visakhapatnam local fish landing centre, March-April, 2017 and Chennai local fish landing centre, January 2018; Bay of Bengal, east coast, India.

Meristic characters

D. XI, 12-13 (12 in one); P. i, 13; A. IV, 9; V. I, 7; C. V (spinules) +19+ IV (spinules); G.R. 6 +1+ (7-11) = 14-18; L.L.S. 34-35; L.Tr. 2½ + 6½.

Diagnosis

Presence of nostril spinules. Lateral line scales 34-35. Fourth anal spine longer and stouter. Head and body depth less. Palatine teeth in a curved bracket shape. Black blotch on the spinous membrane between the first and third dorsal spines.

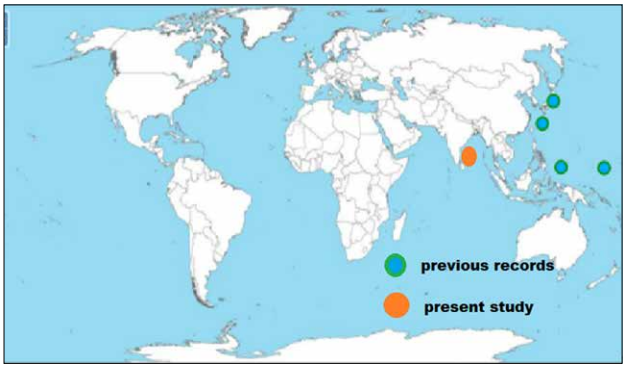

Fig.1. Distribution of *S. dorsomaculatum* in the Indo-Pacific. Blue circles denote the previous records from the west Pacific, orange circle denotes the present record from the Indian Ocean (source: Froese and Pauly, 2023).

Description

Body elongated, rectangular, compressed, and slender. Mouth small, terminal. The maxilla is small and moderately thick posteriorly, not very broad posteriorly. One ridge on the maxilla divides into two posteriorly. Palatine teeth in a curved bracket shape. Snout short. Internasal fossa is elongated and wide, posterior edge reaches ⅓ of orbit. Interorbital narrow. The nasal bone ends into a small spine anteriorly on one or both sides, directed backwards. Lachrymal has a stout spine directed backwards. The posterior edge of the pre-operculum is straight and serrated with strong stout spine at the ventero-posterior angle. Operculum serrated with two small, strong spines- bigger one at the line joining the middle of pupil and the other smaller one at slight angle to it. Dorsal fin originates slightly before the origin of pectoral. Dorsal fin spines long, stout, and pointed, first spine ⅔ of IV spine, which is longest; XI spine smallest, ¼ of first spine. The second dorsal ray longest. Pectoral fin base elevated, upper end slightly convex; origin near operculum. First ray ⅓ of 3rd ray, which is longest ray. Length of the ventral spine equal to the longest dorsal spine and ¾ of second ventral ray, which is longest ray. Anal fin originates after anal pore, below origin of second dorsal fin; III spine stoutest and longest, as long as pectoral fin. IV spine leaner than III, ⅔ of III spine, anterior end very thin. 2nd ray longest; posterior end of anal fin little beyond second dorsal.

Big ctenoid scales on the heavily scaled body and small scales on the cheek in four oblique rows. Single column of seven triangular scales on anterior portion of opercle, rest naked. Interorbital, suborbital, maxilla and pectoral axil naked;

Fig. 2. *S. dorsomaculatum* (166 mm TL)

Fig. 3. *S. rubrum* (168 mm TL)

second dorsal, pectoral, anal bases have smaller scales in two rows and four-five rows on caudal base. Two scales of pelvic fin axil elongate and cover the base of pelvic fin. Lateral line begins from upper edge of orbit and has pored scales, ending at the base of caudal fin.

Colouration

Fresh samples have a reddish-white body. Interorbital dark red, large dark red blotch on opercle; spines of first dorsal red, interspinous membrane white with red band at the base, distal margin dark. A dark blotch in the membrane between the first and third spines. Thick red or black band at the distal margins of membranes of posterior four to five spines. The second dorsal, pectoral, anal and caudal are light red in colour. A black blotch between third anal spine and second anal ray. Pelvic spine and first ray white in colour, distal end of all rays black.

Distribution

This species is very rare in distribution. It was described by Shimizu and Yamakawa (1979) from eight specimens found on Ishigaki Island, Ryukyu Islands, Japan, and later one specimen reported in the revision of Holocentrids of Japan by Eguchi and Motomura (2016). A comparative account of meristic characters of *S. dorsomaculatum* in the present study with previous records is given in Table 1. Randall (1998) reported this species from Palau and Caroline Islands, Oceania. The present study is the first record of *S. dorsomaculatum* from the Bay of Bengal, Indian Ocean.

Discussion

The present species agrees with the description of the holotype by Shimizu and Yamakawa (1979). According to Shimizu and Yamakawa (1979) and Eguchi and Motomura (2016) dorsal soft rays are 12, while during the present study, only a single specimen had 12 rays while all the others had 13 rays. Difference was also observed in the number of caudal rays which were recorded as 21 in both holotypes and paratypes while in the present study, 19 soft rays were present in all the specimens. Shimizu and Yamakawa (1979) also reported fine spinules

Table 1. Comparative account of meristic characters of *S. dorsomaculatum* in the present study with previous records.

Parameters	Present study	Shimizu and Yamakawa (1979)	Eguchi and Motomura (2016)
Total Length (mm)	111-225(n=6)	n=8	n=1
Standard Length (mm)	89-189	138.2- 196.6	172.9
Meristic counts			
Dorsal Fin	XI, 12-13	XI, 13	XI, 13
Pectoral Fin	14	13-14 (14)	14
Anal Fin	IV, 9	IV, 9	IV, 9
Ventral Fin	I, 7	I, 7	-
Caudal Fin	V (spinules) +19+ IV (spinules)	5+1+1+9+8+1+1+4	-
Gill rakers	6+1+(7-11) =14-18	(5-7)+1+(9-11)=(16-18)	6+9=15
Lateral line scales	34-35	32-35 (33)	30

Table 2. Comparison of the frequency distribution of meristic characters of *S. dorsomaculatum* and *S. rubrum*

Dorsal rays									
	12	13	14	N	$\bar{X}$	SD	SE		
S. dorsomaculatum	1	5	-	6	12.83	0.37	0.15		
S. rubrum	2	37	2	41	13	0.31	0.05		
Pectoral rays									
	12	13	14	N	$\bar{X}$	SD	SE		
S. dorsomaculatum	-	-	6	6	-	-	-		
S. rubrum	3	38	-	41	12.93	0.26	0.04		
Anal rays									
	9	10	n	$\bar{X}$	SD	SE			
S. dorsomaculatum	6	-	6	-	-	-			
S. rubrum	36	5	41	9.12	0.33	0.05			
Caudal rays									
	18	19	n	$\bar{X}$	SD	SE			
S. dorsomaculatum	-	6	6	-	-	-			
S. rubrum	27	24	41	18.59	0.49	0.08			
Gill rakers, upper arm									
	5	6	7	n	$\bar{X}$	SD	SE		
S. dorsomaculatum	-	6	-	6	-	-	-		
S. rubrum	26	11	4	41	5.46	0.67	0.10		
Gill rakers, lower arm									
	7	8	9	10	11	N	$\bar{X}$	SD	SE
S. dorsomaculatum	1	-	1	1	3	6	9.83	1.46	0.60
S. rubrum	-	4	15	20	2	41	9.49	0.74	0.12
Gill rakers, Total									
	14	15	16	17	18	N	$\bar{X}$	SD	SE
S. dorsomaculatum	1	-	1	1	3	6	16.83	1.46	0.60
S. rubrum	-	10	24	6	1	41	15.95	0.70	0.11
Lateral line scales									
	34	35	36	n	$\bar{X}$	SD	SE		
S. dorsomaculatum	4	2	-	6	34.33	0.47	0.19		
S. rubrum	3	11	27	41	18.59	0.49	0.08		

present at the base of the caudal fin as soft rays, while the base of these spinules resembles that of anal spines. According to Froese and Pauly (2023), the largest recorded size for this species is 197 mm SL (Standard Length), while in the present study, it is 181 mm SL.

This species closely resembles *S. rubrum* in the presence of suborbital spine, serrations on the orbital margin, number of soft dorsal rays in the range of 12-13 (12-14 in *rubrum*), pectoral rays 13 in number (12-13 in *rubrum*) and scales in the lateral line are in the range of 34-35 (34-36 in *rubrum*). Differences from *S. rubrum* are the presence of nostril spinules and black blotch on the spinous membrane between the first and third dorsal spines in the present species. Spines of the first dorsal are red, interspinous membrane white with a red band at the base, the distal margin is dark in *dorsomaculatum*, while in *S. rubrum* spines of the first dorsal are whitish-red, with the interspinous membrane red in the margins and white in the middle.

The dissimilarities between the two species based on principal component analysis (PCA) are marked with an '*' in Table 3 along with the comparison of morphometric characters of both

Table 3. Comparison of morphometric data of *S. dorsomaculatum* and *S. rubrum*

Parameters	*S. dorsomaculatum*		*S. rubrum*	
	MIN-MAX	MEAN ± SD	MIN-MAX	MEAN ± SD
Total Length (mm)	111-225(n=6)		93-226(n=41)	
Standard Length (mm)	89-189		79-187	
In percentage standard length (%SL)				
Caudal Peduncle Length	13.48-15.00	14.46 ± 0.49	14.79-18.60	16.64 ± 0.88
Caudal Peduncle Depth	9.09-10.57	9.93 ± 0.56	8.39-14.07	11.28 ± 1.12
Pre Dorsal Length*	34.15-35.00	34.53 ± 0.30	33.90-39.61	37.20 ± 1.16
Pre Pectoral Length*	32.58-35.24	34.29 ± 0.85	35.00-38.96	36.90 ± 1.21
Pre Anal Length*	72.36-73.57	72.86 ± 0.48	75.63-79.86	78.35 ± 1.17
Pre Ventral Length	35.96-37.40	36.68 ± 0.54	37.25-41.98	39.77 ± 1.34
I Dorsal I Spine Height	11.43-12.70	12.04 ± 0.47	11.26-13.77	12.68 ± 0.77
I Dorsal IV Spine Height	17.98-19.51	18.61 ± 0.63	18.18-20.98	19.99 ± 0.75
II Dorsal Fin Height*	17.14-20.33	19.01 ± 0.95	21.05-23.84	22.25 ± 0.79
Pectoral Fin Height*	22.47-23.81	23.30 ± 0.50	25.00-27.81	25.84 ± 0.76
Anal Fin I Spine Height	2.25-2.86	2.58 ± 0.23	2.08-2.97	2.60 ± 0.24
Anal Fin II Spine Height	5.29-6.50	5.84 ± 0.47	6.10-7.94	7.06 ± 0.53
Anal Fin III Spine Height*	20.00-22.76	21.25 ± 0.95	22.03-24.82	23.49 ± 0.91
Anal Fin IV Spine Height	15.00-16.93	16.17 ± 0.66	13.33-15.77	14.74 ± 0.55
Anal Fin Ray Height*	21.35-23.81	22.37 ± 0.98	19.17-22.75	21.34 ± 1.04
Ventral Fin Spine Height*	17.89-18.79	18.31 ± 0.34	17.02-19.64	18.55 ± 0.64
Ventral Fin Ray Height*	24.39-25.00	24.76 ± 0.19	24.03-26.96	25.29 ± 0.93
I Dorsal Fin Base*	43.57-44.72	43.91 ± 0.38	47.06-49.19	48.09 ± 0.64
II Dorsal Fin Base	14.29-16.93	15.52 ± 1.02	13.29-15.45	14.36 ± 0.62
Pectoral Fin Base	5.29-6.74	6.06 ± 0.59	5.56-7.62	6.35 ± 0.54
Anal Fin Base	16.19-16.93	16.50 ± 0.29	14.97-19.64	17.02 ± 0.96
Ventral Fin Base	5.00-5.82	5.55 ± 0.27	5.07-6.50	5.83 ± 0.34
Head Length*	35.00-36.59	35.65 ± 0.27	35.59-39.61	37.63 ± 1.17
Head Width	17.14-18.79	17.99 ± 0.60	17.22-19.82	19.05 ± 0.57
Head Depth*	25.40-26.83	25.83 ± 0.48	30.00-31.98	30.93 ± 0.61
Body Depth*	35.98-37.86	36.68 ± 0.63	38.01-42.86	40.40 ± 1.40
Body Width	20.00-21.14	20.52 ± 0.44	19.21-21.99	20.83± 0.75
In percentage head length (% HL)				
Eye Diameter	31.11-32.76	32.09 ± 0.66	30.00-33.33	31.72 ± 1.05
Inter-Orbital Length	20.00-21.88	20.86 ± 0.67	20.10-21.88	20.90 ± 0.62
Pre Orbital Length*	17.24-18.92	18.12 ± 0.61	20.10-22.73	21.20 ± 0.76
Post Orbital Length	46.88-48.98	48.12 ± 0.85	48.08-51.16	49.74 ± 0.85
Snout Length	12.50-14.71	13.69 ± 0.70	12.50-14.75	13.20 ± 0.57
Upper Jaw Length	37.50-38.78	38.01 ± 0.41	39.06-40.98	39.99 ± 0.51
Upper Jaw Width	15.52-16.33	15.90 ± 0.34	15.10-17.50	16.12 ± 0.76
Lower Jaw Length	31.11-32.76	32.09 ± 0.66	25.10-27.66	26.02 ± 0.84

* Characters that were significant in PCA done for *S. dorsomaculatum* and *S. rubrum*

Table 4. Results of the Tukey test (only for characters that became significantly different) for morphometric characters between two species of genus *Sargocentron*

Characters	F value	P
Body depth	12.668	P<0.001
Body width	9.832	P<0.001
Predorsal distance	16.660	P<0.001
Prepectoral distance	26.660	P<0.001
Preanal distance	20.482	P<0.001
First dorsal 4th spine length	9.531	P<0.001
Second dorsal ray length	9.129	P<0.001
Pectoral length	12.318	P<0.001
Anal 1st spine length	12.391	P<0.001
Anal 3rd spine length	19.194	P<0.001
Anal ray length	54.931	P<0.001
Ventral spine length	14.413	P<0.001
First dorsal base	36.424	P<0.001
Head length	33.408	P<0.001
Head depth	18.331	P<0.001
Preorbital distance	18.322	P<0.001

species. Results of the Tukey test ($p<0.001$) only for those characters that became significantly different from morphometric characters are given in Table 4. These are the characters that became significantly different with PCA, thus confirming that the above characters aid in differentiating the two species of genus *Sargocentron*.

Acknowledgements

The authors are thankful to the Head of the Department of Marine Living Resources, Andhra University for providing facilities to carry out this research work. The first and third Authors are also grateful to the Ministry of Earth Sciences (MoES)-Centre for Marine Living Resources and Ecology (CMLRE), Kochi for providing financial support to carry out this research under ITIS project. The second author is thankful to the University Grants Commission (UGC), New Delhi for the Post-Doctoral Fellowship.

References

Bacurau, T. O. F. and W. F. Molina. 2004. Karyotypic diversification in two Atlantic species of Holocentridae (Pisces, Beryciformes). *Caryologia*., 57 (3): 300-304.

Dornburg, A., J. A. Moore, R. Webster, D. L. Warren, M. C. Brandley, T. L. Iglesias, P. C. Wainwright and T. J. Near. 2012. Molecular phylogenetics of squirrelfishes and soldierfishes (Teleostei: Beryciformes: Holocentridae): Reconciling more than 100 years of taxonomic confusion. *Mol. Phylogenet. Evol.,* 65: 727-738.

Eguchi, K. and H. Motomura. 2016. Holocentrid fishes of the Ryukyu Islands, Japan. Nature of Kagoshima., 42: 57-112.

Fricke, R., W. N. Eschmeyer and R. Van der Laan. 2023. Eschmeyer's Catalog of Fishes:Genera, Species, References (http://research archive Calacademy.org/ research/ichthyology/ catalog/fish catmain.asp.) Electronic version accessed. 02.01.2023.

Froese, R. and D. Pauly. 2023. FishBase. World Wide Web electronic publication. www.fishbase.org. Electronic version accessed 16/03/2023.

IBM Corp. Released. 2019. IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp.

Masuda, H., K. Amaoka, C. Araga, T. Uyeno and T. Yoshino. 1984. The fishes of the Japanese Archipelago. Tokai University Press, Tokyo, Japan. 1: 437 pp.

Mogalekar, H. S., J. Canciyal, D. S. Patadia and C. Sudhan. 2018. Marine and estuarine fish fauna of Tamil Nadu, India. *Proc. Int. Acad. Ecol. Environ Sci.*, 8 (4): 231-271.

Moore, J. A. 1993. Phylogeny of the Trachichthyiformes (Teleostei: Percomorpha). *Bull. Mar. Sci.*, 52: 114-136.

Nelson, J. S., T. C. Grande and M. V. H. Wilson. 2016. Fishes of the World, 5th ed. John Wiley & Sons, Inc., Hoboken, New Jersey, 752 pp.

Randall, J. E. 1998. Revision of the Indo-Pacific squirrelfishes (Beryciformes: Holocentridae: Holocentrinae) of the genus *Sargocentron*, with descriptions of four new species. *Indo-Pac. Fish.*, 27:105 pp.

Robins, C. R. and G. C. Ray. 1986. A Field Guide to Atlantic Coast Fishes of North America. Boston: Houghton Mifflin Company. 354 pp.

Shimizu, T. and T. Yamakawa. 1979. Review of the Squirrelfishes (Subfamily Holocentrinae: Order Beryciformes) of Japan, with a description of a new species. *Jap. J. Ichthyol.*, 26 (2): 109-147.

Smith, M. M. and P. C. Heemstra. 1986. Smith's Sea Fishes. J. L. B. Institute of Ichthyology, Grahamstown, 1047 pp.

Sujatha, K. 2003. Finfishes, valuable as aquarium fish from Visakhapatnam, east coast of India. Indian Association of Aquatic Biologists (IAAB) Publication No.7, 82 pp.

Wyatt, J. R. 1983. The biology, ecology and bionomics of the squirrelfishes, Holocentridae. In: Munro, J. L. (ed) Caribbean coral reef fishery resources. *ICLARM Stud. Rev.* 7, p 50-58.