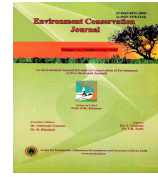




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First record of a mottled spine foot, *Siganus fuscescens* (Houttuyn, 1782), from the Gulf of Mannar, India

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ABSTRACT

The present study documents the first occurrence of *Siganus fuscescens*, known as the mottled spine foot, within the inshore waters of Vaan Island (latitude 8°73 N, longitude 78°16 E) and New Fishing Harbor (latitude 8°84 N, longitude 78°22 E), which are located in the Gulf of Mannar region. The species, commonly referred to as rabbitfishes, was captured by bottom-set gill nets deployed in reef-associated areas of the Gulf of Mannar at a depth of approximately 2–3 m. Furthermore, detailed analyses of the morphometric and meristic characteristics of the specimens were conducted using established taxonomic keys. A comprehensive discussion is also presented, elucidating the distribution patterns of *Siganus* species within the Gulf of Mannar region.

Introduction

In the Gulf of Mannar and Palk Bay region, two commercially significant Siganid species, *S. canaliculatus* and *S. javus*, are frequently cultivated (Varghese *et al.*, 2017). Studies by Varghese *et al.* (2011) and Murugan and Namboorthri (2012) have identified 15 common *Siganus* species in Indian waters, including *S. canaliculatus*, *S. javus*, *S. lineatus*, *S. stellatus*, and *S. vermiculatus*. Within the Gulf of Mannar region, four of these species (*S. canaliculatus*, *S. javus*, *S. lineatus*, and *S. vermiculatus*) have been reported (Varghese *et al.*, 2017; Jaikumar, 2012). A single accepted genus, *Siganus*, encompasses a total of twenty-nine species worldwide, as recorded by Horton *et al.* in 2022. The rich ecosystem of the Gulf of Mannar, which supports diverse marine life, includes the *Siganus* genus. Ramkumar and Murugan (2018) documented

the presence of *Siganus stellatus* (brown-spotted spine foot) in the waters surrounding the Andaman Islands, the Lakshadweep Islands, and the Gulf of Mannar. Notably, there is no information yet regarding the occurrence of *S. fuscescens* in Gulf of Mannar waters. The emergence of this species in various regions over the past decades has posed new challenges (Knowlton, 1993; Miya & Nishida, 1997; Zolkaply *et al.*, 2021). The identification of *Siganus* species relies on factors such as color patterns, snout shape, body depth, and caudal fin shape (Anam *et al.*, 2020). *Siganus fuscescens* is predominantly found in estuarine and intertidal areas of the Indo-Pacific and Mediterranean regions (Froese and Pauly 2021; Macusi *et al.*, 2023). While *Siganus* fishes constitute approximately 25 to 30 % of reef-associated fish landings, they represent only a small

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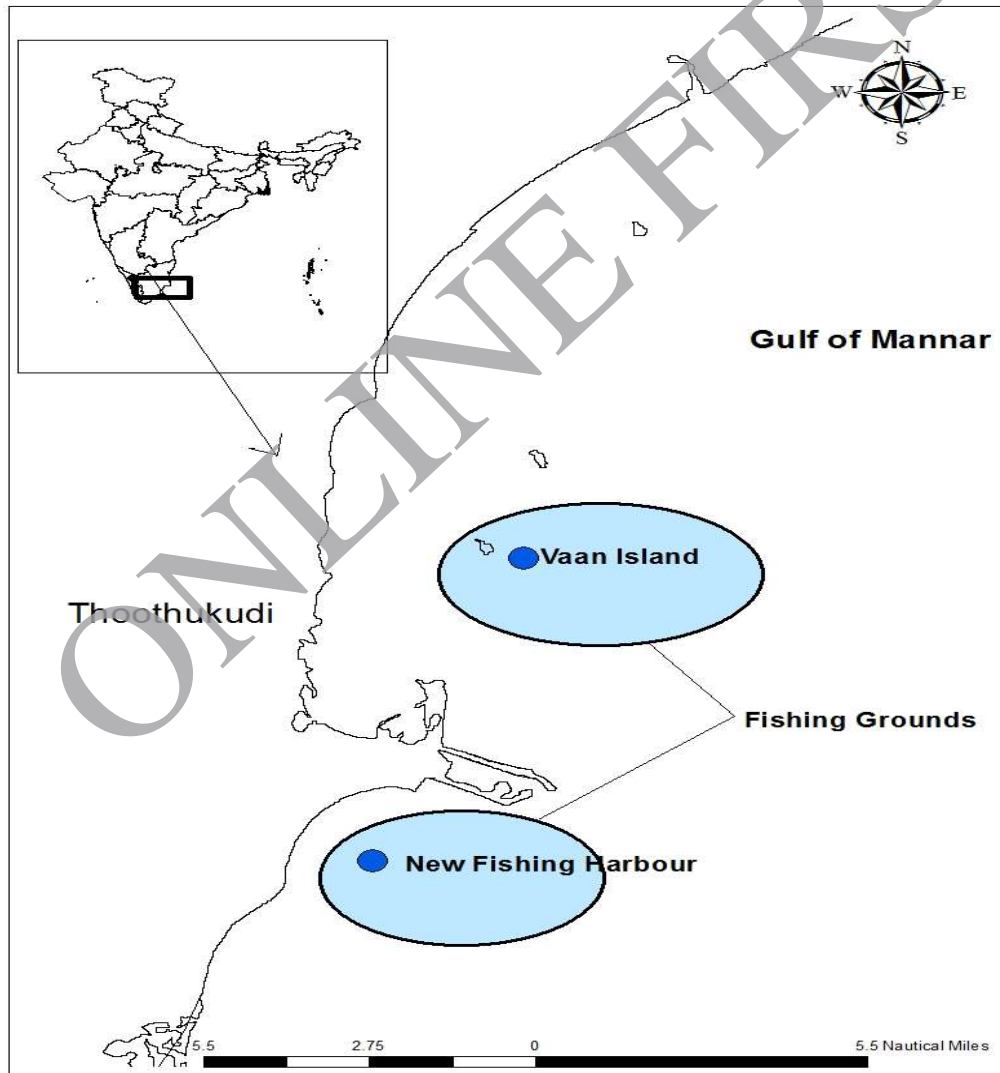
portion of catches using gear such as bottom trawl nets, set gill nets, and trammel nets (Murugan and Durgekar 2008).

Material and Methods

Specimens of *S. fuscescens* were collected from the inshore waters of Vaan Island (latitude 8°73 N, longitude 78°16 E) and New Fishing Harbor (latitude 8°84 N, longitude 78°22 E) in the Gulf of Mannar region (Fig. 1). The fisherfolks from the native locations of Vaan Island and New Fishing Harbor operate a bottom-set gillnet known as Maya

Valai at a depth of one to five meters. It has a mesh size that ranges from 60 to 80 mm and is made of white monofilament netting. The setting of this gill net is carried out during the night or early hours. The collected specimens from the fish landing centers were photographed to record their body color under fresh conditions and then preserved for further analysis. According to established techniques, morphometric and meristic studies were performed on these specimens (Barik *et al.*, 2020). FAO species identification tools were used for the identification of the family Siganidae (Woodland, 1983).

Fig. 1. Map indicating the location of the *S. fuscescens* specimen collection



Results and Discussion

The seagrass beds of *Sargassum wightii*, *Sargassum ilicifolium*, *Enhalus acoroides*, and *Thalassia hemprichi* are prominent in the Gulf of Mannar. These seagrass beds are home to a large number of fishes, and siganids are the dominant species. In the present study, the collected *S. fuscescens* (Fig. 2) were brown or olive green dorsally and silver ventrally, frequently with brown stripes or bands below the origin of the lateral line. Close observation and taxonomical identification of the present specimen revealed that it is oval in shape, laterally compressed, deep or thin, covered with tiny scales, and cheeks are rarely scaleless. Each jaw has a single row of closely spaced teeth. The dorsal fin had a spine that protruded forward, followed by 13 powerful spines associated with venom glands

(Kiriake *et al.*, 2017) and 10 soft rays that were positioned on the nape at various angles (Table 1).



Fig. 2. Fresh specimens of *S. fuscescens* (Houttuyn, 1782)

Table 1. Meristic characters of *S. fuscescens*

Meristic characters	Specimen 1	Specimen 2	Specimen 3
Dorsal spines	XIII	XIII	XIII
Dorsal soft rays	10	10	10
Anal spines	VII	VII	VII
Anal soft rays	9	9	9
Pelvic spines	II	II	II
Pelvic soft rays	3	3	3
Pectoral soft rays	15	15	15

The head is slightly to clearly concave above the eye; some specimens have a convex, arched, and blunt snout, while others have a more gently curved, pointed snout and an anterior nostril with a short flap. The forward-projected spine in front of the dorsal fin and caudal fin is almost completely emarginate in the specimens. The dorsal fin consists of 13 strong venomous spines and 10 soft rays: anal spines (7), anal soft rays (9), pelvic spines (2), pelvic soft rays (3), and pectoral soft rays (15). Body covered with minute cycloid scales; cheeks with scale present in some specimens; scattered scales appear from the lower half to two-thirds; 16–21 rows of scales were present between the base of the first dorsal-fin spine and the lateral line. Some specimens were plain brown with bars on the outer rays of the caudal fin and no signs of spots or mottling. A low head-to-body ratio was found in this study, which appears to be typical for this species based on relative measurements of the morphometric

parameters of the individuals. Lower relative percentages are also observed in the basal lengths of the pectoral fin, pelvic fin, and caudal fin. However, the proportionate percentages observed for the examined specimens with greater dorsal fin bases and somewhat large eye diameters are depicted in Table 2. The peculiarity of siganids, i.e., body types with an oval, deep, laterally compressed shape, was mathematically verified by the relative proportion of their morphometric characteristics (Table 2). Woodland (1997) reported a maximum length of 400 mm and an average length of 250 mm in *S. fuscescens* in the western Pacific region. The length of the present specimens of *S. fuscescens* was 135–155 mm, with an average length of 144 mm (Table 2 and Fig. 2), which is smaller than that in the earlier literature. Other Siganid species caught from this region include *S. canaliculatus* (max. length: 250 mm), *S. javus* (max. length: 355 mm), and *S. lineatus* (max. length: 380 mm), which are larger than

Table 2. Proportional measurements (%) of the morphometric characteristics of three specimens of *S. fuscescens* from the Gulf of Mannar

Morphometric characteristics	Measurements (mm)			Ratios (%)		
	Specimen 1	Specimen 2	Specimen 3	Specimen 1	Specimen 2	Specimen 3
Total length (TL)	142	135	120	---	---	---
Standard length (SL)	115	105	96	80.9 % of TL	77.7 % of TL	80.0 % of TL
Forked length (FL)	132	130	115	92.9 % of TL	96.2 % of TL	95.8 % of TL
Caudal fin length (CL)	36	25	20	25.3 % of TL	18.5 % of TL	16.6 % of TL
Caudal peduncle length (CPL)	15	10	08	10.5 % of TL	7.4 % of TL	6.6 % of TL
Dorsal fin base (DB)	105	80	75	73.9 % of TL	59.2 % of TL	66.6 % of TL
Anal fin base (AB)	55	45	33	38.7 % of TL	33.3 % of TL	27.5 % of TL
Pelvic fin length (PL)	25	20	18	17.6 % of TL	14.8 % of TL	15.0 % of TL
Pelvic fin base (PB)	15	10	10	10.56 % of TL	7.4 % of TL	8.3 % of TL
Pectoral fin length (PL)	35	25	20	24.6 % of TL	18.5 % of TL	16.6 % of TL
Pectoral fin base (PB)	22	15	12	15.4 % of TL	11.1 % of TL	10.0 % of TL
Head length (HL)	35	30	28	24.64 % of TL	22.2 % of TL	23.3 % of TL
Snout length (SNL)	12	10	08	34.2 % of HL	33.3 % of HL	28.5 % of HL
Eye diameter (ED)	15	10	10	42.8 % of HL	33.3 % of HL	35.7 % of HL
Body depth (BD)	55	45	35	38.7 % of TL	33.3 % of TL	29.1 % of TL
Head depth (HD)	45	35	32	81.8 % of BD	77.7 % of BD	91.4 % of BD
Caudal peduncle depth (CPD)	15	10	10	27.2 % of BD	22.2 % of BD	28.5 % of BD

S. fuscescens. Mottled spine feet are well known in reef habitats and are found on reefs in the Red Sea and Caribbean islands at depths of 1 meter. (Lieske and Collins, 1994). Current observations indicate that although *Siganus* species are found in reef areas and rocky substrate areas, they may occur at different depths (Parawansa *et al.*, 2020). Further studies of reef-related fish groups and on-site studies in areas of the Gulf of Mannar may indicate reasons for their distribution both regionally and in coastal waters (Sudo *et al.*, 2022). Previous studies have

confirmed that *S. fuscescens* was found in both the east and west coasts of India (Saha *et al.*, 2020), but detailed research and studies are needed along the southeastern coast of India to determine its distribution, movement, or dependence, if any of these extremely popular domestic fish species are located in the transboundary waters of both countries. As per the literature pertaining to the Zoological Survey of India, approximately 15 species of *Siganid* fish have been discovered in Indian waters, *viz.*, *S. canaliculatus*, *S. lineatus*, *S.*

vermiculatus, *S. guttatus*, *S. javus*, *S. stellatus*, *S. spinus*, *S. virgatus*, *S. magnificus*, *S. labyrinthodes*, *S. corallinus*, *S. argenteus*, and *S. puelloides* (Fischer and Bianchi, 1984; Rajan, 2003; Ramakrishna *et al.*, 2010), which is against the 30 species reported in the world (Woodland, 1997). *S. javus*, *S. canaliculatus*, *S. lineatus*, *S. vermiculatus*, and *S. stellatus* are the most common species found in the genus *Siganus* in India (Jaikumar, 2012). De Bruin (1995) reported the distribution of eight Siganid species from the Sri Lankan part of the Gulf of Mannar.

Conclusion

The present study provides a detailed examination and taxonomical identification of *S. fuscescens* specimens and highlights variations in snout shape, head concavity, and other morphometric parameters among the specimens. Compared with those in the previous literature, the specimens of *S. fuscescens* in the Gulf of Mannar exhibit a smaller size range (135–155 mm), indicating potential regional variations. Further research and on-site studies are recommended to understand the reasons for their distribution and behavior in the Gulf of Mannar.

References

- Anam, R. O., Mwatete, C. M., & Wambiji, N. (2020). Morphological and meristic characters of six rabbitfish species (Family: Siganidae) in Kenya. *Western Indian Ocean Journal of Marine Science*, 19(2), 89-103.
- Barik, T. K., Swain, S. N., Sahu, B., Tripathy, B., & Acharya, U. R. (2020). Morphological and molecular evidence supports the first occurrence of two fishes, *Siganus sutor* (Valenciennes, 1835) and *Seriolina nigrofasciata* (Rüppell, 1829) (Actinopterygii: Perciformes), from marine waters of the Odisha coast, Bay of Bengal, India. *Acta Oceanologica Sinica*, 39, 26-35.
- De Bruin, G. H. P., Russell, B. C., & Bogusch, A. (1995). *FAO species identification field guide for fishery purposes. The marine fishery resources of Sri Lanka*. FAO.
- Fischer, W., Bianchi, G., (Ed.), (1984). *FAO Species identification sheets for Fishery purposes. Western Indian Ocean. (Fishing Area 51)*. Rome: Danish International Development Agency (DANIDA)/Food and Agricultural Organization of the United Nations (FAO). Vols. 1 - 6.
- Froese, R., & Pauly, D., eds. (2021). *Species of Siganus* in FishBase. June 2021 version.
- Horton, T., Kroh, A., Ahyong, S. (2022) *World Register of Marine Species*. VLIZ. <https://www.marinespecies.org>. Accessed 12 July 2022.
- Jaikumar, M. (2012). A review on biology and aquaculture potential of rabbit fish in Tamil Nadu (*Siganus canaliculatus*). *International Journal of Plant, Animal and Environmental Sciences*, 2(2), 57-64.
- Kiriake, A., Ishizaki, S., Nagashima, Y., & Shiomi, K. (2017). Occurrence of a stonefish toxin-like toxin in the venom of the rabbitfish *Siganus fuscescens*. *Toxicon*, 140, 139-146.
- Knowlton, N. (1993). Sibling species in the sea. *Annual review of ecology and systematics*, 24(1), 189-216.
- Lieske, E., & Myers, R. (1994). *Collins pocket guide. Coral reef fishes. Indo-Pacific & Caribbean including the Red Sea*. Harper Collins Publishers, 400.
- Macusi, E. D., Masagnay, N. T., & Nallos, I. M. (2023). Effects of fish herbivory on seagrass meadows of Guang-guang, Mati City, Philippines. *Marine & Fishery Sciences (MAFIS)*, 36(3), 1-14.
- Miya, M., & Nishida, M. (1997). Speciation in the open ocean. *Nature*, 389(6653), 803-804.

- Murugan, A., & Durgekar, R. (2008). Status of fisheries in Tamil Nadu, India: A snapshot of present and long-term trends. K. Shanker, N. Namboothiri *Beyond the tsunami: social, ecological and policy analyses of coastal and marine systems on the mainland coast of India. Posttsunami Environment Initiative Report submitted to the United Nations Development Programme. UNDP/UNTRS, Chennai and ATREE, Bangalore, India*, 118-178.
- Murugan, A., & Namboothri, N. (2012). Finfishes of Gulf of Mannar-A Field Identification Guide. *Published by Dakshin Foundation Bengaluru*, 72-84.
- Parawansa, B. S., Ali, S. A., Nessa, N., Rappe, R. A., & Indar, Y. N. (2020). Biological analysis of adult rabbitfish (*Siganus guttatus* bloch, 1787) in seagrass and coral reef ecosystems at laikang bay, takalar regency. In *IOP Conference Series: Earth and Environmental Science* (Vol. 473, No. 1, p. 012006). IOP Publishing.
- Rajan, P. T. (2003). *field guide to marine food fishes of Andaman and Nicobar Islands*. Zoological Survey of India. pp. 1 - 260.
- Ramakrishna, T. I., Sreeraj, C. R., Raghunathan, C., Raghuraman, R., Rajan, P. T., & Yogesh Kumar, J. S. (2010). An account of additions to the Ichthyofauna of Andaman and Nicobar Islands. *Records of Zoological Survey of India*, 326, 1-40.
- Ramkumar, B. and Murugan, A. (2018). Occurrence and characteristics of the brown-spotted spine foot *Siganus stellatus* (Forsskål, 1775) from Gulf of Mannar, Southeast coast of India. *Indian Journal of Geo Marine Sciences*, 47(02), pp.390-394.
- Saha, S., Shamsunnahar, S. S., Sarker, A., & Ahsan, K. (2020). First distributional record of sixteen Coral Associated fish species from Saint Martin's Island, Bangladesh. *Bangladesh J. Zool*, 48(2), 263-288.
- Sudo, K., Maehara, S., Nakaoka, M., & Fujii, M. (2022). Predicting future shifts in the distribution of tropicalization indicator fish that affect coastal ecosystem services of Japan. *Frontiers in Built Environment*, 7, 788700.
- Varghese, M., Manisseri, M. K., Ramamoorthy, N., Geetha, P. M., Thomas, V. J., & Gandhi, A. (2011). Coral reef fishes of Gulf of Mannar, SE of India. *Fishing Chimes*, 31(1), 38-40.
- Varghese, M., Ranjith, L., & Joshi, K. K. (2017). Diversity of reef fishes in trap fishery at Keelakarai, Gulf of Mannar, south-east coast of India. *Indian Journal of Fisheries*, 64(1), 23-30.
- Woodland, D. (1997). Siganidae Spinefoots, rabbitfishes. *FAO identification guide for fishery purposes. The Western Central Pacific*, 3627-3650.
- Woodland, D.J. (1983). Family: Siganidae, In: *FAO Species Identification Sheets for Fishery Purposes, Fishing Area, 51 (W. Indian Ocean)*, Fischer, W. and Bianchi, G. (Eds), prepared by FAO, Rome, Italy (Pages variable).
- Zolkaply, S. Z., Do, T. D., Asaduzzaman, M., Seah, Y. G., Hurwood, D., & Wong, L. L. (2021). Evolutionary history and taxonomic reappraisal of coral reef rabbitfishes (Siganidae): Patterns of lineage diversification and speciation. *Biology*, 10(11), 1109.
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