VOL.67 NO.02 JULY-DECEMBER 2025 • PRINT ISSN 0025-3146 • ONLINE ISSN 2321-7898

JMBAI

JOURNAL OF THE MARINE BIOLOGICAL ASSOCIATION OF INDIA

ESTD.1958

MBAI

Marine Biological Association of India

सी एम एफ आर आइ

CMFRI

Available online at: https://www.mbai.org.in/jmbai
doi:10.6024/jmbai.2025.67.2.2626-12

Habitat heterogeneity determines structural characteristics of gastropod communities in the intertidal zones of Sakthikulangara Coast, Kerala

D. Dhanyaraj[1*], S. Soumyath[1], P. Kiran[2] and R. Krishna Priya[3]
[1]Sree Narayana College, Kollam-691 001, Kerala, India.
[2]BJM Government College, Chavara, Kollam- 691 583, Kerala, India.
[3]All Saints' College Thiruvananthapuram -695 007, Kerala, India.

*Correspondence e-mail: dhanuraj6@gmail.com
ORCiD: https://orcid.org/0009-0000-6244-123X

Received: 19 August 2025 Revised: 01 December 2025
Accepted: 02 December 2025 Published: 09 December 2025

Short Communication

Abstract

An evaluation of intertidal gastropod biodiversity along the Sakthikulangara coast, Kollam district, Kerala, was conducted from January to June 2025. A total of 50 gastropods belonging to 27 families and 8 orders were recorded. The Neogastropoda were the most dominant order with 23 species, followed by the Littorinimorpha (15), Cycloneritida (5), Trochida (3) and the remaining 4 orders with 1 species. Shannon-Weiner index showed the highest value of 2.117 in the (rocky area), followed by the station 3 sandy (1.807) and the station 2 muddy area (1.702). The Margalef species richness values were 2.158 for the rocky zone, 1.87 for the sandy shore and 1.67 for the muddy zone. Pielou's evenness index showed a high value of 0.987 in the rocky zone, indicating a more even distribution of species and comparatively lower values of 0.6052 in the muddy zone and 0.7893 in the sandy zone, indicating less even distribution of species in the muddy zone.

Keywords: *Biodiversity, intertidal gastropod, species diversity, Shannon-Weiner index, species richness*

Introduction

The intertidal zone exemplifies the ever-changing boundary where land and ocean interact with one another. The vertical distribution of species assemblages in intertidal habitats is influenced by their competition for space and their capacity to endure different levels of sunlight and water exposure during tidal changes. The lower intertidal zone is mainly underwater, becoming visible only during the lowest spring tides. It shifts into the central intertidal area, which is underwater during all high tides and revealed at low tides. The upper intertidal is underwater during the spring high tides but stays uncovered otherwise. The interaction between coastal landforms and tidal movements leads to intricate invertebrate communities suited to various habitats, reacting to environmental variations like temperature, salinity, exposure to air, and pH fluctuations (Sukumaran *et al.,* 2021).

The intertidal region represents the dynamic interface where the land and sea mutually influence each other. Species assemblage in the intertidal habitat is distributed vertically, depending on their ability to compete for space, with predators and their ability to survive in varying degrees of exposure to sunlight and water during tidal cycles. The lower intertidal region remains mostly submerged, becoming exposed only during the lowest spring tides. It transitions into the middle intertidal region, which is submerged at all high tides and exposed at low tides. The upper intertidal is submerged during the spring high tides but remains exposed otherwise. This interplay between shore topography and tidal cycles creates complex invertebrate assemblages adapted to diverse niches, responding to environmental gradients such as temperature, salinity, subaerial exposure and changes in pH (Sukumaran *et al.,* 2021).

Phylum Mollusca, the second largest in the animal kingdom next to Arthropoda in terms of the number of species, form one of the major and biodiverse marine invertebrate taxa (Bouchet and Strong, 2010). Gastropods form the most species-rich and diverse class in the phylum Mollusca (Pechenik, 2016). Many edible species of Gastropods are abundantly found in intertidal regions of rocky shores. Gastropods are ecologically and economically important for the coastal area and their existence influences the microecological condition of an ecosystem (Ramanibai and Govindan, 2018., Puryono and Suryanti, 2019). The intertidal region, a zone of interaction between sea, land, and atmosphere, is one of the most interesting divisions of marine ecosystem, as it is daily covered and uncovered by flooding and ebbing tides. Among marine systems, rocky intertidal shores are considered as one of the most thermally variable and stressful environments .In these environments, intertidal species have to cope with physical and chemical stresses which intensity depends on the interaction of four major environmental gradients: the vertical gradient (*i.e.* "tidal" gradient), the horizontal gradient (*i.e.* exposure to waves), the sediment particle size gradient, and the marine-freshwater gradient of salinity (Raffaelli and Hawkins, 1996). These gradients, together with species interactions, lead to a zonation in the distribution of intertidal rocky shores species (Raffaelli and Hawkins, 1996; Little *et al.*, 2009). Organisms found on rocky shores are facing intense physicochemical conditions during tidal changes from upper to lower intertidal zones. This includes regular exposure to air during low tide as well as differences in environmental parameters such as temperature, salinity, pH, and oxygen that occur perpendicular to the shore (Chappuis *et al.,* 2014). Despite these challenges, resilient and resistant organisms such as algae, lichens, barnacles, and molluscs are commonly found in such environments. Among the diversity of Intertidal areas, the molluscs are a highly successful animal group in terms of ecological adaptation, and they are found in nearly all habitats, ranging from deepest ocean trenches to the intertidal zone, freshwater and land, where they occupy a wide range of habitats.

Rocky shore biodiversity studies from Indian coasts are very less, except for a few related to the ecology and distribution of individual species or on algal and invertebrate communities (Rao and Sreeramulu, 1970; Ravinesh and Bijukumar, 2013; Baiju *et al.,* 2023). The recent diversity study associated with gastropod communities along the Kerala coast include those of Ravinesh and Biju Kumar (2013); Sary *et al.* (2013, 2014), Anu *et al.* (2017), Ravinesh *et al.* (2021) and Baiju *et al.* (2023). Although most of these studies provided an account of the taxonomical composition and distribution of gastropods from Indian waters, none of them provided details on gastropod assemblage patterns and/or the potential influence of habitat heterogeneity on them. Therefore, the present study aims to describe the role of habitat heterogeneity on structural properties of intertidal gastropods along the Sakthikulangara Coast. The exploitation of these species is nowadays increasing rapidly along the Southeast coast of India. Over the past decades, the opercula and shells of both gastropods and bivalves have been fetching a good value, but only recently has attention been drawn to the value of their meat. The demand for meat is mainly from exporters, and it has now become an additional source of income for the fishers. However, it is important to study these gastropods and bivalves because of their role in the seafood trade. The knowledge of these resources will be useful for the proper management and conservation of these valuable gastropods. These may have excellent opportunities in the aquaculture industry in future.

The present study aims to describe the role of habitat heterogeneity on structural properties of intertidal gastropods along the intertidal Sakthikulangra coast. We hypothesised that location-specific differences in the habitat would determine spatial patterns of abundance, diversity of intertidal gastropod assemblages along this coastal environment.

Material and methods

Study area

Kollam, a key maritime district of Kerala, has a coastline measuring 37.3 km. The fishery industry in this district is supported by both public and private sector companies. Sakthikulangara (08° 55′ N, 76° 32′ E), a fishing harbour located at the entrance of the Ashtamudi backwaters approximately 9 km north of Kollam city, was selected as the primary sampling location for this research, as most trawlers in Kerala operate from this region (Fig. 1). The coastline features a mix of rocky foundations and sandy areas and experiences intense wave activity. The shoreline can be divided into various zones based on substrate type. The coastal regions include intertidal zones

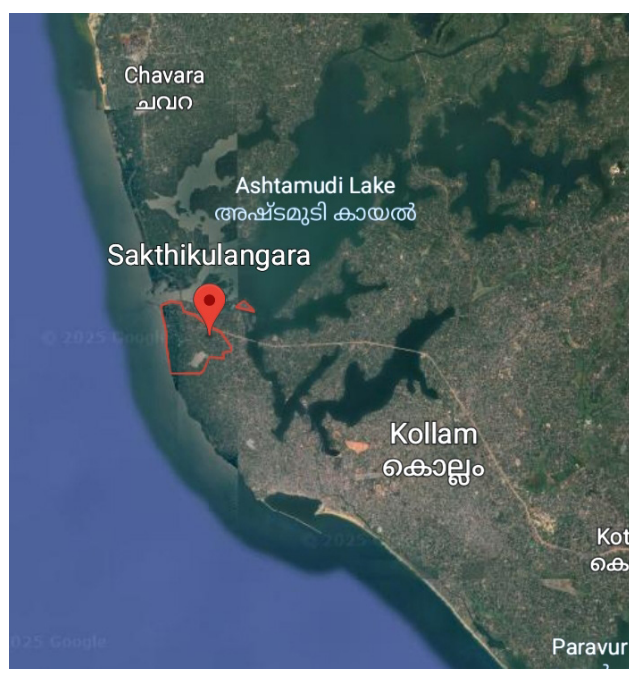

Fig. 1. Map showing the location of the study sites off Sakthikulangara

such as sandy, muddy, and rocky shores. This coast typically experiences a tropical climate characterised by hot and humid weather, with annual temperatures ranging from 18 °C to 36 °C. In this study, three locations were examined: Site 1 features a rocky substrate with sand covering parts of the supralittoral zone. This site has no freshwater sources other than rainfall. The sedimentary rocks at the high-water line are coated with microalgae, which support a large population of gastropods that feed on them. Site 2 is a muddy area that experiences waterlogging during high tides, and Site 3 is a sandy area also used for waste disposal from fishing activities. These sites were randomly chosen as sampling locations.

Methodology

Gastropod samples were gathered from the coastal area of Sakthikulangara from January 2025 to June 2025. A quadrat of 0.25 m^2 was laid along the range on the intertidal region with an ordinary stretch (Once in month). Thirty quadrats (10 quadrats in each intertidal zone) were laid in a crisscross way at the upward intertidal zones to cover the best uncovered domain. Local shell collectors and professional divers from coastal areas also assisted in gathering shells. In the lab, the shells underwent cleaning, washing, and a gentle acid treatment to eliminate periostracum and were then dried. Images were captured individually for the specimens and operculum (if available) with Canon G15 and Nikon D90 digital cameras. The collected shells were meticulously arranged in individual bottles, each labelled with the species name, family, order, collection location, date, and collector's name. The quantities of shells for each species gathered from various collection locations were also noted for the purpose of calculating the diversity indices. The shells were identified to the species level using standard keys and published works (Apte, 2012; Robin, 2008; Rao, 2003) along with online resources (WORMS, Indo-Pacific Molluscan Database, and Bio Search).

Data analyses

Univariate diversity metrics (*e.g.*, species richness, Margalef's diversity, Pielou's evenness, and Shannon-Wiener diversity index) along with non-parametric multivariate statistical methods examining spatiotemporal patterns in gastropod distribution were performed as outlined in the PRIMER v6.1 statistical software (Hammer *et al.,* 2001).

Results and discussion

A total of 50 gastropods belonging to 27 families and 8 orders were recorded at Sakthikulangara. Neogastropoda that exhibited maximal abundance constituted 46% of the total gastropod population, followed by Littorinimorpha (30%), Cycloneritida (10%), Trochida (6%), Heterobranchia, Dentaliida and Seguenziida (2%) (Fig. 2). Order Neogastropoda harboured the highest number of species (23) categorised under eight families; almost 46% of the species collected were from this species-rich order. Neogastropods are carnivorous and prefer diversity in dietary and eating behaviours compared to other classes of Gastropoda (Taufik *et al.,* 2017). The availability of preferred food sources, depending on the type of molluscs, is an important factor

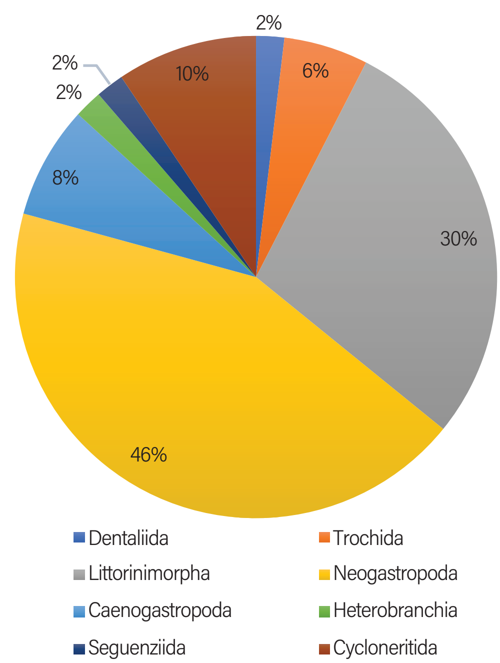

Fig. 2. Percentage representation of various orders of class Gastropoda along the rocky shores of Sakthikulangara coast

that influences the density of a particular species (Islami, 2012). Neogastropoda dominates benthic environments and exhibits maximum diversity in the tropical seas (Bouchet *et al.,* 2002; Ponder and Warén, 1988). Neogastropods are active predators and are mostly carnivorous, evidenced by an elongate siphonal canal, terminally shifted mouth, and well-developed proboscis. The high diversity of Neogastropods along the Kerala coast was proved in the present study by 121 species belonging to 8 superfamilies and 24 families. Order Littorinimorpha stood next in species diversity, represented by fifteen species belonging to nine families and contributing to 30% of the total diversity. Categorisation of species into common, rare, and uncommon based on the number of specimens obtained showed that 36 species (72%) were of common occurrence, 5 species were uncommon (10%), and 9 species were rare (18%) (Table 1 and Fig. 3).

For analysing the alpha diversity of the three zones, diversity indices like the Shannon-Weiner diversity index, Margalef

Table 1. Species composition and occurrence of intertidal marine gastropods in the Sakthikulangara coast

Family	Species	Site 1	Site 2	Site 3	Abundance
Dentaliidae	*Dentalium vernedei*	-	+	+	Rare
	Trochus radiatus	+	_	_	Common
Trochidae	*Umbonium vestarium*	_	_	+	Common
	Trochus	+	-	+	Rare
Rostellariidae	Tibia curta	_	+	+	Common
Turritellidae	*Turritella acutangular*	+	+	-	Common
	Turritella attenuata	-	+	_	Common
Conidae	*Conus inscriptus*	+	+	_	Common
	Connus amadis	+	_	_	Uncommon
Naticidae	*Natica lineata*	-	+	+	Common
	Pollinices mammilla	-	-	+	Common
Olividae	*Oliva gibbosa*	-	+	+	Common
Babyloniidae	*Babylonia zeylanica*	+	-	+	Common
Turridae	*Lophiotoma indica*	-	+	+	Common
	Unedogemmula indica	+	_	_	Common
	Rapana rapiformis	_	-	+	Common
	Murex trapa	+	-	-	Common
	Thais bufo	+	+	+	Common
	Vokesimurex malabaricus	_	_	+	Rare
Muricidae	*Murex carbonnieri*	+	-	_	Rare
	Chiroreus ramosus	_	+	+	Rare
	Murex virigineus	+	_	_	Common
	Rapana rapiformis	_	_	+	Common
	Lataxiena solenosteiroides	_	+	+	Common
Tonnidae	*Tonna dolium*	-	-	+	Common
Turbinellidae	*Turbinella pyrum*	-	-	+	Common
Olividae	*Oliva oliva*	_	+	_	Common
	Agaronia gibbosa				Common
Mitridae	*Mitra mitra*	+	+	+	Common
Clavatulidae	*Turricula javana*	+	_	+	Common
	Turricula javana	+	+	+	Uncommon
Cypraeidae	*Naria*	_	+	+	Rare
Potamididae	*Terebralia palustris*	_	+	+	Common
Naticidae	*Notocochils gualtriana*	_	+	+	Common
	Natika spedica	_	_	+	Common
Cassidae	*Semicassis ditturna*	_	_	+	Rare
Architectonicidae	*Architectonica*	_	+	+	Rare
Chilodontidae	*Euchlus asper*	+	_	_	Uncommon
Ficidae	*Ficus variegata*	_	_	+	Uncommon
Haripdae	*Harpa major*	+	_	_	Common
Turritellidae	*Bufonaria echinata*	+	_	_	Uncommon
	Lotoria perryi	+	+	+	Common
Ranellidae	*Cymatium perryi*	_	+	+	Rare
Neritidae	*Nerita litterata*	+	+	_	Common
	Nerita plicata	+	+	_	Common
Littorinidae	*Echinolittorina malaccana*	+	+	_	Common
	Littoraria undulata	+	+	+	Common
	Littoraria intermedia	+	+	+	Common
Columbellidae	*Pyrene flava*	_	+	+	Common
Epitonidae	*Acrilla acuminata*	-	+	+	Common

+= Present,-= absent

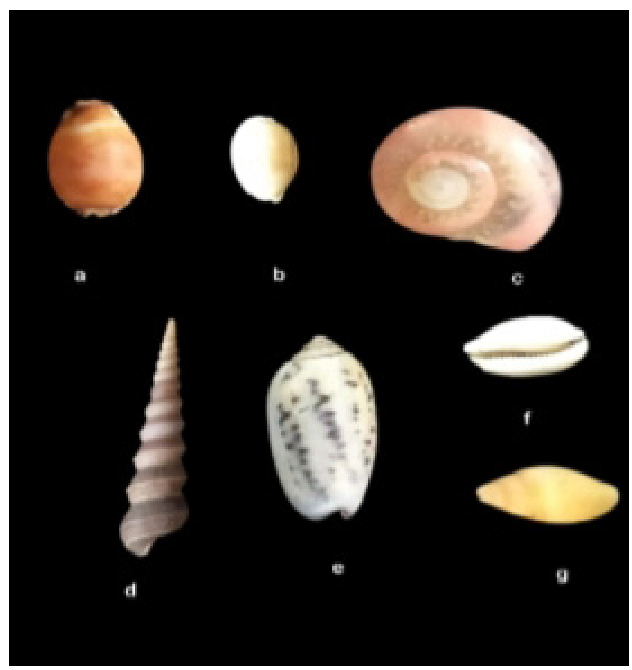

Fig. 3. Gastropod species a. *Naria* sp., b. *Bullia melanoides,* c.*Umbonium vestarium,* d. *Turritella* sp., e.*Oliva Oliva,* f. *Cypraea chinesis,* g. *Mitra* sp.

richness index, Simpson dominance index, and Pielou's evenness index were calculated (Table 2). The Shannon Weiner index showed the highest value of 2.117 in station 1, followed by station 3 (1.807) and station 2 (1.702). The Margalef species richness values were 2.158 for the rocky zone, 1.87 for the sandy shore, and 1.67 for the muddy zone. Pielou's evenness index showed a high value of 0.987 in the rocky zone, indicating more even distribution of species, and comparatively lower

Table 2. Diversity indices of Gastropod species

Stations	Margalef richness (d)	Pielous evenness (J')	Shannon diversity (H)	Simpson's dominance (I)
Station 1	2.158	0.987	2.117	0.16
Station 2	1.67	0.6053	1.720	0.2837
Station 3	1.897	0.7893	1.807	0.2544

values of 0.6052 in the muddy zone and 0.7893 in the sandy zone, indicating less even distribution of species in the muddy zone (Table 3). The mean abundance (N) was higher at Site. 3 (10.66 ind./m^2) followed by Site. 1 (8.33 ind./m^2), followed by Site. 2 (7.66 ind./m^2).

Two principal components (PC1 and PC2) represent the majority of the variance in the data, while other principal components are negligible. PC1 and PC2 account for 96.839% and 2.1197% of the total variance, respectively. The eigenvalues of PC1 and PC2 are 3.9894 and 0.0115, respectively. PC1 is highly influenced by the number of taxa, while PC2 is influenced by the Margalef species richness index (0.59786). The evenness index and Shannon diversity index are very closely related to each other (Fig. 4).

Habitat complexity appears to be a significant factor for gastropod growth and survival, as this study makes clear. By combining coralline turfs with and without sediment, Olabarria and Chapman (2001) experimentally tested this idea on *Eatonina rubrilabiata*. They found that the presence of sediment increased growth rates while the absence of sediment increased mortality. Additionally, we have observed habitat specificity among some gastropod species in this investigation. *Nassarius globossus,* the taxonomic species with the highest numbers during the study, was widely distributed in the sandy substratum that was covered in pebbles at Site 3, but was not present at all in other places. Given that habitat complexity has a significant impact on gastropod diversity and abundance, discrepancies in habitat structure may be the cause of this limited distribution. According to Tan and Clements (2008), the Neritidae, a family of herbivorous, euryhaline snails that typically live in the middle to upper intertidal zones, dominated the Site. A. and Site. C sites. These two sites share a lot of similarities in their habitat structure, which is also evident in the species composition and patterns of the gastropod assemblage. Because the rocky substratum at these sites encourages healthy macroalgal growth, a variety of associated mobile animals, such as fish, macrofauna, and meiofauna, can find food and habitat there. As herbivores, Neritidae flourish in these conditions. These results are consistent with what Miloslavich *et al.* (2013) observed, that the herbivore gastropods' predominance occurs in areas with greater macroalgal biomass.

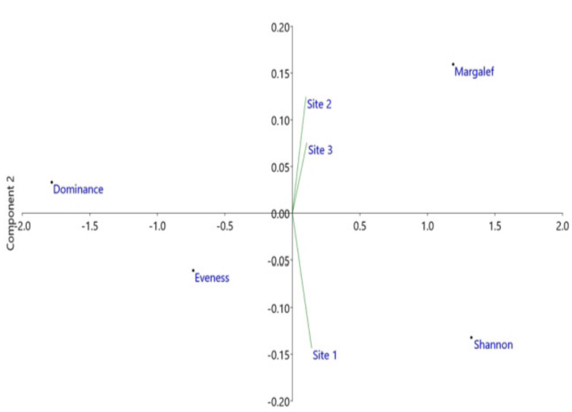

Fig. 4. Biplot of diversity indices

Temperature, shoreline steepness, tidal range, protection level, wave frequency, and electrical conductivity all affect the type and quantity of biotas found in rocky environments (Tikader *et al.,* 1986; D'Souza *et al*., 2022). According to Prasanna and Ramesh (2018), anthropogenic pressures from urbanisation, tourism, recreational activities, runoff from sewage dumping, and shell collectors can seriously threaten the diversity of rocky habitats that currently exist. Small invertebrates, plankton, and algae are among the marine organisms that can find a variety of food sources on rocky shorelines. Because of this, there is a diverse food web, with many species depending on one another for sustenance. Plankton, algae, and small invertebrates are among the many marine organisms that rely on rocky shorelines as food sources. Because of this, there is a diverse food web, with many species depending on one another for sustenance. The diversity of crustaceans, algae, sponges, echinoderms, and Ascidians are all studied. Variations in temperature, steepness of shores, tidal range, amount of protection, wave frequency and electrical conductivity also regulate the kind and number of biotas associated with rocky habitats (Tikader *et al.,* 1986; D'Souza *et al.,* 2022). Anthropogenic pressures due to sewage dumping, urbanisation, tourism, recreational activities, runoffs and shell collectors can pose a serious threat to the existing diversity of rocky habitats (Prasanna and Ramesh, 2018). Rocky shores provide a variety of food sources for marine organisms, including algae, plankton, and small invertebrates. This supports a diverse food web, with many species relying on other species for food. Rocky shores provide a wide variety of food sources for marine organisms, including algae, plankton, and small invertebrates. This supports a diverse food web, with many species relying on other species for food. The study areas' diversity of algae, sponges, crustaceans, and echinoderms and Ascidians (Ravinesh and Biju Kumar, 2013, Anu *et al.,* 2017) and overall, the combination of physical diversity, food availability, connectivity, adaptation, and environmental stability makes rocky shores highly diverse in these regions. The rich gastropod diversity of the rocky patches along the Sakthikulangra coastline sheds light on the potential for in-depth taxonomic studies. The varying physicochemical parameters prevailing in the ecosystem, coupled with high productivity, can be the reason for the highly diverse species patterns observed in the study.

Conclusion

The present study reveals that habitat complexity is one of the major but not sole variables for describing the assemblages of gastropods. Diversity and richness of gastropods were higher at structurally complex habitats. The study also reveals gastropod assemblages and their preferred habitat. Family Natticidae preferred soft bottom habitat and was abundant at Site C and altogether absent from other locations. Whereas Neritidae and Muricidae were found at almost all the locations. These data on Sakthikulangra coastal molluscan diversity provide fundamental ecological information about its dynamics along the coast.

Acknowledgements

The authors are thankful to Dr Ravaneesh, R., Scientist, Centre for Marine Living Resources and Ecology, Ministry of Earth Sciences, Kochi, for the support for species identification of the study

Authors contributions

Conceptualisation: DRD, KP; Methodology: KR, SO; Writing Original Draft: DRD; Supervision: KP.

Data availability

The data are available and can be requested from the corresponding author

Conflict of interest

The authors declare that they have no conflict of financial or non-financial interests that could have influenced the outcome or interpretation of the results.

Ethical statement

The study does not include activities that require ethical approval or involve protected organisms/ human subjects/the collection of sensitive samples/ protected environments.

Funding

No funding was received for the study.

Publisher's note

The views and claims presented in this article are solely those of the authors and do not necessarily reflect the positions of the publisher, editors, or reviewers. The publisher does not endorse or guarantee any claims made by the authors or those citing this article.

Reference

Anu, S., R. Ravinesh, V. B. Shijith and A. Biju Kumar. 2017. Biodiversity associated with the mussel beds of Vizhinjam coast, Kerala, India, *J. Aquat. Biol. Fish.,* 5: 36-53.

Apte, D. 2012. Field Guide to the Marine Life of India. Stusa Mudra Pvt. Ltd., Mumbai, 502 pp.

Baiju, P. T., M. P. Prabhakaran, C. H. Ajas Miraj, J. Kiran and F. G. Benno Pereira. 2023. Opisthobranch (Mollusca: Gastropoda) Fauna of Rocky Reef Ecosystems of Kerala Coast, India. *Braz. J. Aquat. Sci. Technol.,* 27 (1): 18-25.

Bouchet, P. and E. E. Strong. 2010. Historical name bearing types in marine molluscs: An impediment to biodiversity studies? *Systema Naturae,* 250: 63-74.

Bouchet, P., P. Lozouet, P. Maestrati and V. Heros. 2002. Assessing the magnitude of species richness in tropical marine environments: excep-tionally high numbers of molluscs at a New Caledonia site. *Biol. J. Linn. Soc.,* 75: 421-436.

Chappuis E., M. Terradas M. E. Cefali and E. Ballesteros. 2014. Vertical zonation is the main distribution pattern of littoral assemblages on rocky shores at a regional scale. *Estuar. Coastal and Shelf Science,* 147:113-122.

D'Souza, S. L., N. D'Souza and K. Shenoy. 2022. Molluscan diversity of coastal Karnataka, India and role of physicochemical parameters on their diversity. *J. Coast. Conserv.,* https://doi.org/10.1007/s11852-021-00849-w

Hammer, Ø., D. A. T. Harper and P. D. Ryan. 2001. PAST: Paleontological Statistics Software Package for Education and Data Analysis. *Palaeontol. Electr.,* 4 (1): 9 pp

Islami, M. M. 2012. Studi kepadatan dan keragaman moluska di pesisir pulau Nusalaut, Maluku. Oseanologi dan Limnologi di Indonesia, 38 (3): 293-305.

Little, A. G., S. C. Lougheed and C. D. Moyes. 2010. Evolutionary affinity of billfishes (Xiphiidae and Istiophoridae) and flatfishes (Plueronectiformes): independent and trans-subordinal origins of endothermy in teleost fishes. *Mol. Phyl. Evol.,* 56: 897-904.

Miloslavich, P., J. J. Cruz-Motta, E. Klein, K. Iken and V. Weinberger. 2013. Large-Scale Spatial Distribution Patterns of Gastropod Assemblages in Rocky Shores, *PLoS ONE,* 8 (8): 1-13.

Olabarria, C. and M. G. Chapman. 2001. Comparison of patterns of spatial variation of microgastropods between two contrasting intertidal habitats. *Mar. Ecol. Prog. Ser.,* 220: 201 – 211.

Pechenik, J. A. 2016. Biology of invertebrates. Seventh edition, McGraw Hill Education, New York, USA, 606 pp.

Ponder, W. F. and A. Warén. 1988. Classifi cation of the Caenogastropoda and Heterostropha-a list of the family-group names and higher taxa. In Prosobranch Phylogeny. Edited by W. F. Ponder. *Malacological Review Suppl.* 4: 288-328.

Puryono, S. and S. Suryanti. 2019. Gastropod diversity in mangrove forests of Mojo village, Ulujami district, Pemalang Regency, Indonesia, *J. Ecol. Eng.,* 20 (1): 165-173.

Raffaelli, D. and S. J. Hawkins. 1996. Intertidal Ecology, Chapman and Hall, London, 356 pp.

Rao, S. N. V. 2003. Indian Seashells (Part-I): Polyplacopora and Gastropoda. Occ Paper. *Rec Zool Surv India,* 19: 2-416.

Rao, U. M. and T. Sreeramulu. 1970. An annotated list of marine algae of Vishakapatnam (India). *Botanical Journal of the Linnean Society.,* 63: 23-45.

Ramanibai, R. and S. Govindan. 2018. Mollusc diversity at pulicat Lagoon (India). *Transylvanian Review of Systematical and Ecological Research.* 20. 10.1515/trser-2018-0003.

Ravinesh, R. and R. Bijukumar. 2013. Comparison of intertidal biodiversity associated with natural rocky shore and sea wall: A case study from the Kerala coast, India. *Indian J. Mar. Sci.,* 42 (2): 223-235.

Ravinesh, R., A. Biju Kumar and V. L. Anjana. 2021. Diversity and distribution of molluscan fauna of Asthamudi estuary, Kerala, India. Wetlands Ecology and Management, 29 (5): 745-765.

Robin, A. 2008. Encyclopedia of Marine Gastropods. Conch Books, place of publctn, 480 pp.

Sary, P. S., P. R. B. Kiran, N. K. Balasubramanian and A. Bijukumar. 2014. Diversity of Cone Snails (Mollusca: Conidae) along Kerala Coast. *J. Aquat. Biol. Fish.,* 2: 619–622.

Sary, P. S., P. R. B. Kiran and A. Bijukumar. 2013. Diversity of Gastropod Shells (Mollusca: Gastropoda) of Vizhinjam Bay, Southwest Coast of India. Proc. Multidisciplinary national Seminar, November 4-6, 2013, P. M. Sayeed Calicut University Centre, Androth, 39-41 pp.

Sukumaran, S., T. Vijapure, J. Mulik and H. Ridha. 2021. Marine Macrobenthos of NorthWest India-Reviewing the Known and Unknown. *In Frontiers in Marine Science,* 8 (671245). Frontiers Media S.A. doi:10.3389/fmars.2021.67124

Tan, S. K. and R. Clements. 2008. Taxonomy and Distribution of the Neritidae (Mollusca: Gastropoda) in Singapore, *Zool. Stud.,* 47 (4): 481-494.

Taufik Adhi Prasetya, Fitria Kurnia Nazira, Irkhamna Noviyani Khusna Millaty, Wildan Gayuh Zulfikar, Fitri Ainun Nazara, Trijoko. 2017. Molluscan diversity (Gastropoda: Neogastropoda) in the intertidal zone of Nguyahan Beach, Gunungkidul, Yogyakarta, Indonesia. *Ocean Life.* 1 (2): 55-60.

Tikader, B. K., A. Daniel and N. V. Subba Rao. 1986. Sea Shore Animals of Andaman and Nicobar Islands. *Zoological Survey of India Special Publications,* 13: 188 pp.