Biodiversity Journal, 2023,14 (4): 911–917 https://doi.org/10.31396/Biodiv.Jour.2023.14.4.911.917

Biodiversity of Marine Molluscs Assemblage in selected coastal area of Gulf of Mannar, South East coast of India

Hariharan Abirami[1], Gurusamy Chelladurai[2*], Vikrant V. Deshmukh[3] & Hitesh U. Shingadia[4]

[1]PG and Research Department of Biotechnology, Mohamed Sathak College of Arts and Science, Chennai-119, Tamil-Nadu, India
[2]Department of Zoology, G.Venkataswamy Naidu College (Autonomous), Kovilpatti, 628502 Tamil Nadu, India
[3]Department of Zoology, K J Somaiya College of Science & Commerce, Vidyavihar, Mumbai (E) - 400077, India
[4]Department of Zoology, SVKM's Mithibai College (Autonomous), Mumbai 400056, India
*Corresponding author, e-mail: gcd.zoology@gmail.com

ABSTRACT The present study is an attempt to know the diversity of Molluscan species, particularly Gastropods and Bivalves at the selected location of Gulf of Mannar, Tamil Nadu. India. Gastropods and Bivalves species were collected by hand picking method. A total sum of 560 molluscs were collected, among them 42 species of gastropods and 11 species of bivalves were recorded in the selected study area. The maximum density of molluscs was observed in the Tuticorin group of coasts at Therespuram, while in the Rameswaram group of coasts the maximum density was observed in Pamban. Among the two coasts, the gastropods *Xancus pyrum, Babylonia zeylanica, Babylonia spirata, Lambis lambis*, and *Donax faba, Meretrix meretrix* were found dominant during the study period.

KEY WORDS Molluscs species; Gulf of Mannar coasts; Diversity index; Population density.

Received 16.09.2023; accepted 16.10.2023; published online 30.12.2023

INTRODUCTION

Biodiversity encompasses the variety of all life on earth. India has rich biological diversity and is also one of the 12 most diverse countries in the world. India accounts for 7.8% of the recorded species at global level. In this territory, the Gulf of Mannar covers approximately 10,500 sq. km. along 8°35N - 9°25'N latitude and 78°08E - 79°30'E longitude. There are 21 islands, covering an area of 623 ha. The islands are divided in four groups: the Mandapam group, the Keelakarai group, the Vembar group, and the Tuticorin group. There are no permanent inhabitants on these islands, while temporary camping by forest officials and fishermen for a few days is common on some of the islands. The coral reefs are of fringing and patchy types and extend from Rameswaram to Tuticorin, covering a distance of 140 km. Biological resources are life-generated materials and processes that are naturally and sustainably renewable and biodegradable. As such, biological resources fulfil human essential and fundamental needs and play a key role in present and future socio-economic evolution. Therefore, bioresources offer opportunities to improve the quality of life of people and increase the country's economic value. Creating awareness on the importance and implications of bioresources is needed for safeguarding and protecting the most optimal and balanced way of using these bioresources. It is

beneficial not only for the present generation but also future generations for better, healthier, and more peaceful lives on earth.

Marine and coastal ecosystems provide a wide range of important products and services. Fish, crustaceans, and molluscs are major foods. Among these, the molluscs are a soft-bodied, heterogeneous group of animals with 85,000 to 1,000,000 species recorded from various parts of the world. Molluscs are abundant also in the Indian Ocean, they are very adaptive and are an important component of biomass. Molluscs are highly used for food, lime industries, calcium resources in poultry feed, and commercially valuable production such as pearls, decoration material for shell crafts, or for industrial purposes. They are also potential resources for biochemical components and are used for manufacturing drugs. Various body parts of molluscs, and even the entire organism, have been traditionally used as medicine for cancer, inflammation, and other diseases (Kamboj, 1999; Kehinde et al., 2015). In recent years, a significant number of novel metabolites with potent pharmacological properties have been discovered in marine organisms. The first attempt to screen for antimicrobial activity in marine organisms was initiated around the 1950s. Since this time, large numbers of marine organisms have been screened for antimicrobial activity (Shaw et al., 1976). From the 1960s to the 1990s, approximately 300 bioactive marine natural products were filed for patent. Approximately 6,500 bioactive compounds were isolated from marine organisms. Many species of molluscs exhibit bioactive compounds like anti-tumour, anti-leukemic, anti-bacterial, and anti-viral properties that have been reported worldwide (Rajaganapathi et al., 2002).

Though the molluscs sustain regular and very productive fisheries in our waters, only a few bivalves (mussels, clams, and oysters) are now generally eaten. Commercial exploitation accounts for the greater reduction of the molluscan population in nature. Pollution, climate change, and environmental hazards also cause the death of molluscs. The exploitation of these molluscs require urgent control, or numerous species might be threatened with extinction. Indiscriminate fishing from natural beds may lead to the depletion of stocks of most of the molluscs resources.

In conclusion, the marine organisms comprise approximately half of the total biodiversity thus offering an infinite risources and for useful therapeutics. The various taxonomic groups have received attention, resulting in a considerable growth in information (Erwin, 1993; Branch et al., 1994). Despite this, the lack of basic information such as diversity data and species check lists makes it impossible to assess the rate of population loss among marine molluscs.

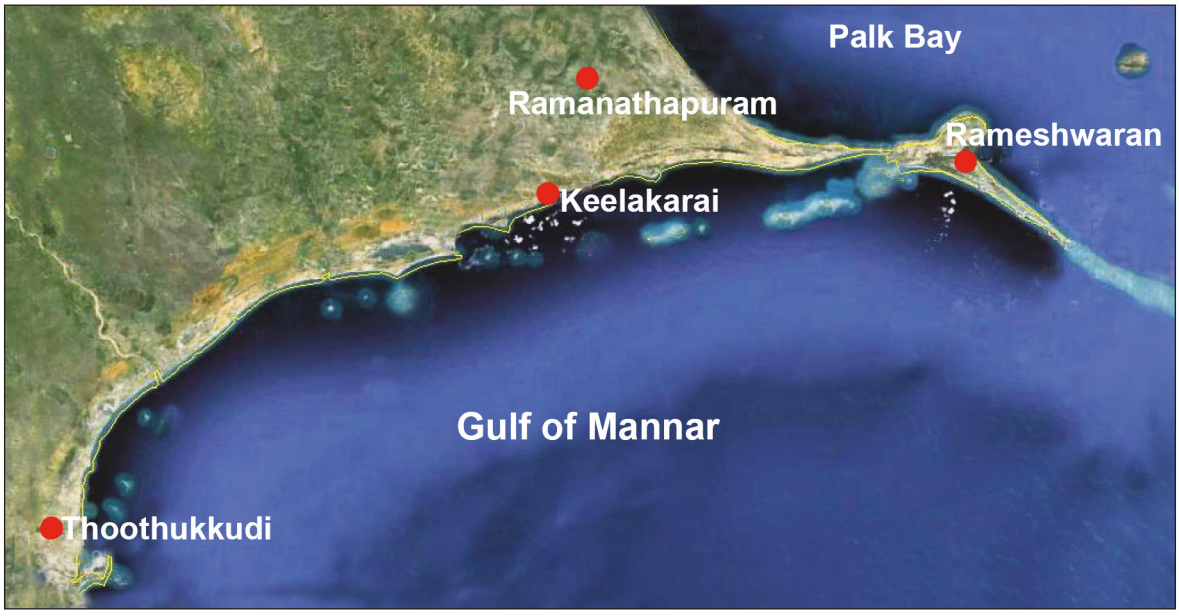

Figure 1. Map showing the study area: Gulf of Mannar, South East Coast of India.

Hence, in the present study, an attempt was made to know the diversity of marine molluscs, particularly gastropods and bivalves, at the Gulf of Mannar, southeast coast of India.

MATERIAL AND METHODS

Study area

The Gastropods and Bivalves Mollusca were collected from rom the Gulf of Mannar coasts in two groups of coasts, namely Tuticorin and Rameshwaram coast (Fig. 1). In Tuticorin coast, Therespuram (8°81'N - 78°16'E), Tharuvaikulam (8°89N - 78°16'E) and Kulasai (9°36'N - 78°05'E). In Rameswaram coasts, Valinokkam (9°22'N - 78°78'E), Pamban (9°28'N - 79°23'E), Mandapam (9°28'N - 79°11'E) from Gulf of Mannar, Southeast coast of India from January 2020 to December 2020.

Collection of species

The Gastropods and Bivalves Mollusca were samplend were collected three times a year. The collected samples were kept in an icebox and transported to the Marine Gastropod Hatchery and Research Laboratory, Kamaraj College, Tuticorin. The samples were rinsed, adhering debris removed, and species sorted out, then transferred to 4% formalin and enumerated group-wise. The preserved organisms were identified by standard keys provided (Adoni et al., 1985). During the study period, *Chicoreus ramosus* (Linnaeus, 1758), *Hemifusus pugilinus* (Born, 1778) and *Xancus pyrum* (Linnaeus, 1767) were found to be dominant and collected in huge quantities, whereas other species were not dominant.

Statistical analysis

The diversity index was calculated using the formula by Shannon & Wiener (1949). Pielou's Evenness Indexes (e) were calculated to be used as an evenness of species by Pielou (1966). Margalef's indexes were used as a measure the species richness using the formula given by Margalef (1958). The ggplot2 software package was used by line diagrams and Box plot (Wickham, 2009).

RESULTS AND DISCUSSION

Monolisha & Patterson-Edward (2005) reported that in the phylum of molluscs, about 3270 species have been reported from India, belonging to 220 families and 591 genera. Among these, bivalves are the most diverse (1200 species), followed by gastropods (190 species). Additionally, in India, until today, 5070 species of Mollusca have been recorded, of which 3370 are from marine habitats (Subba Rao, 1991, 1998). From the available data, it is possible to identify certain areas with rich molluscan diversity. Andaman and Nicobar Islands have a rich molluscan diversity, which includes over 1000 species from the marine region (Subba Rao, 2000). The Gulf of Mannar and Lakshadweep have 428 and 424 species, respectively (Venkataraman et al., 2004). Recently, 1,000,000 metric tonnes of bivalves and nearby 20,000 metric tonnes of gastropods were exploited from Indian waters. Numerous gastropods, bivalves and also some species of cephalopods, are exploited in the Indian marine region (Venkataraman et al., 2015).

In the present research work, about 42 species of gastropods and 11 species of bivalves were recorded from January 2020 to December 2020 (Tables 1, 2; Figs. 2–6). The maximum density of gastropods was observed in Therespuram, Tuticorin, during September 2020, while in the Rameswaram group of coasts, the maximum density was observed in Pamban during May 2020. Among the two coasts, the gastropods *Xancus pyrum* (Linnaeus, 1767), *Babylonia zeylanica* (Bruguière, 1789), *Babylonia spirata* (Linnaeus, 1758), *Lambis lambis* (Linnaeus, 1758), and *Murex trapa* (Röding, 1798), were found dominant during the study period. In the case of bivalvia fauna diversity, the maximum density was recorded in Therespuram of the Tuticorin coasts during September 2020, while in the Rameswaram group of asts, the maximum density was found in Mandapam during September 2020. Among the two coasts, the bivalves group of fauna was identified and followed by *Donax faba* Gmelin, 1791, *Meretrix meretrix* (Linnaeus, 1758), and *Vasticardium assimile* (Reeve, 1844), which were dominant. Monolisha & Patterson-Edward (2005) reported that in the phylum of molluscs, about 3270 species have been reported from India, belonging to 220 families and 591 genera. Among these, bivalves are the most diverse (1200 species), followed by gastropods (190 species).

Sl.No	Gastropod species	Gulf of Mannar					
		Tuticorin group of Coasts			Rameshwaram group of Coasts		
		Therespuram	Tharuvaikulam	Kulasai	Valinokkam	Mandapam	Pamban
1	*Turbinella pyrum*	+	-	+	+	+	+
2	*Chicoreus ramosus*	+	+	+	+	+	+
3	*C. virgineus*	+	+	+	+	+	+
4	*Pleuroploca trapezium*	+	-	+	+	+	+
5	*Harpulina lapponica*	+	+	+	+	+	+
6	*Cymatium perryi*	+	+	+	+	+	+
7	*Lambis lambis*	+	+	+	+	+	+
8	*Conus virgo*	+	+	+	+	+	+
9	*C. abbas*	+	+	+	+	+	+
10	*C. imperialis*	+	-	-	+	+	+
11	*C. textile*	+	-	-	+	+	+
12	*Strombus marginatus*	+	+	+	-	-	+
13	*Babylonia spirata*	+	+	+	+	+	+
14	*Phalium glaucum*	+	+	+	+	+	+
15	*Hemifusus pugilinus*	+	+	+	+	+	+
16	*H. cochlidium*	-	-	-	+	+	+
17	*Haustellum hastellum*	+	+	-	+	+	+
18	*Chicoreus brunneus*	+	-	+	+	+	+
19	*Chicoreus virgineus*	+	+	+	+	+	+
20	*Murex trapa*	+	+	+	+	+	+
21	*Fusinus colus*	-	-	-	+	+	+
22	*Xancus pyrum*	+	+	+	+	+	+
23	*Ancilla castanea*	+	+	+	+	+	+
24	*A. scaphella*	-	+	-	+	+	+
25	*Architectonica perspectiva*	-	+	-	+	-	+
26	*Bulla ampulla*	+	+	-	+	+	+
27	*Bufonaria rana*	+	+	+	+	+	+
28	*Erronea errones*	+	-	+	+	+	+
29	*Naria ocellata*	-	-	-	+	+	+
30	*Erronea onyx*	+	-	+	-	+	+
31	*Monetaria moneta*	+	+	+	+	+	+
32	*Cypraea tigris*	-	+	-	+	+	+
33	*Duplicaria duplicata*	+	+	+	+	+	+
34	*Harpa articularis*	+	+	+	+	+	+
35	*Ficus ficus*	+	+	-	+	+	+
36	*Marmorofusus nicobarius*	+	+	+	+	+	+
37	*Polinices pyriformis*	-	+	-	+	+	+
38	*Trochus radiatus*	+	+	+	+	+	+
39	*Umbonium vestiarium*	+	+	-	+	+	+
40	*Cerithideopsilla cingulata*	+	-	+	-	+	+
41	*Lotoria triangularis*	+	+	-	+	+	+
42	*Babylonia zeylanica*	+	+	+	+	+	+

Table 1. Biodiversity of Gastropod in Gulf of Mannar coasts during January 2020 to December 2020.

S.No	Bivalves species	Gulf of Mannar					
		Tuticorin group of Coasts			Rameshwaram group of Coasts		
		Therespuram	Tharuvaikulam	Kulasai	Valinokkam	Mandapam	Pamban
1	*Anodontia edentula*	+	+	-	+	+	+
2	*Modiolus phillipinarum*	+	-	-	+	+	+
3	*Vasticardium assimile*	+	+	+	-	+	+
4	*Perna viridis*	+	+	+	+	+	+
5	*Meretrix meretrix*	+	+	+	+	+	+
6	*Meretrix casta*	+	+	+	-	+	+
7	*Chama pacifica*	+	+	+	+	+	-
8	*Gastrochaena gigantea*	+	+	+	-	+	-
9	*Marcia opima*	+	+	+	+	+	+
10	*Donax faba*	+	+	+	+	+	+
11	*Latona cuneata*	+	+	+	+	+	+

Table 2. Biodiversity of Bivalves molluscs in Gulf of Mannar coasts during January 2020 to December 2020.

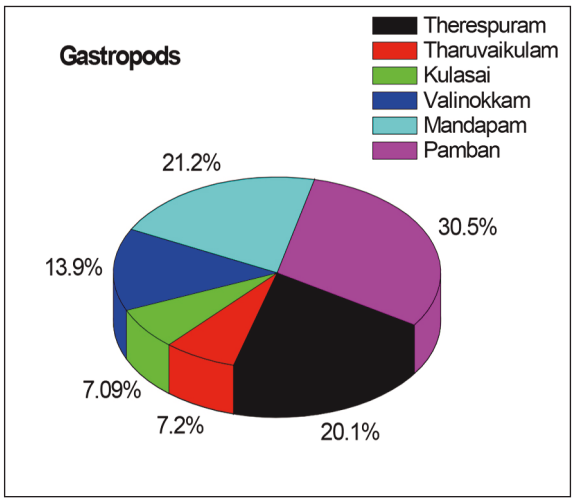

Figure 2. Percentage of Gastropods in Thoothukudi and Ramanathapuram coastal area.

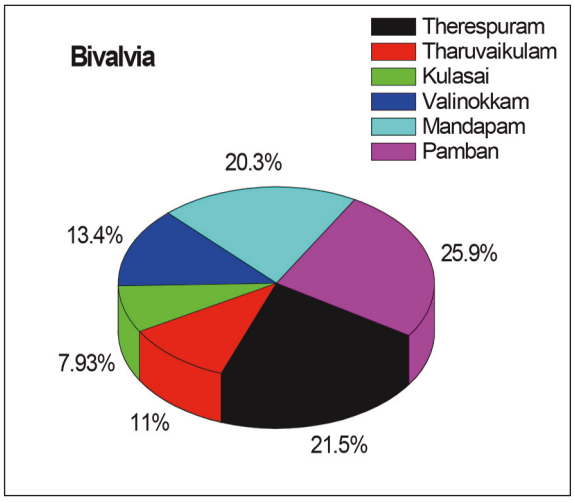

Figure 3. Percentage of Bivalvia in Thoothukudi and Ramanathapuram coastal area.

In the landing centre among gastropods, the maximum recorded species were *Babylonia zeylanica, Xancus pyrum, Babylonia spirata*, and *Lambis lambis,* and the minimum representation was from the species *Umbonium vestiarium* (Linnaeus, 1758), *Polinices pyriformis* (Récluz, 1844), *Naria ocellata* (Linnaeus, 1758), and *Strombus marginatus* Linnaeus, 1758. In Bivalves the most abundant species are *Vasticardium assimile*, *Perna viridis* (Linnaeus, 1758), and *Meretrix meretrix*. The species *Chama pacifica* Broderip, 1835 (= *reflexa*), *Gastrochaena gigantea Gastrochaena gigantea Gastrochaena gigantea* (Deshayes, 1830), and *Perna viridis* contributed the least numbers.

The Shannon diversity (H') index was calculated for gastropod data and showed a minimum (0.918) value during the monsoon and a maximum (3.002) value during the summer season. Margalef

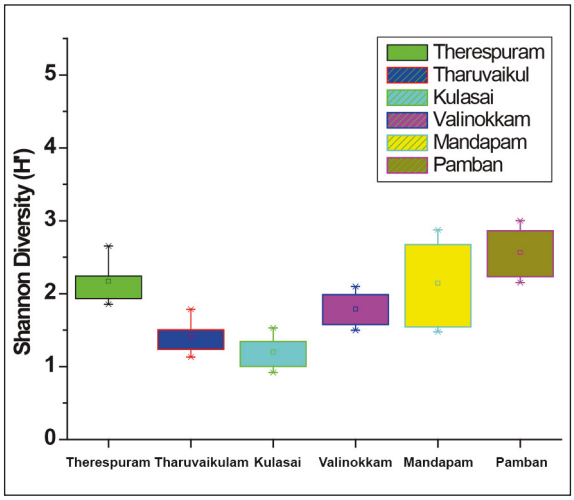

Figure 4. Gastropods and Bivalvia of Shannan diversity in Thoothukudi and Ramanathapuram coastal area.

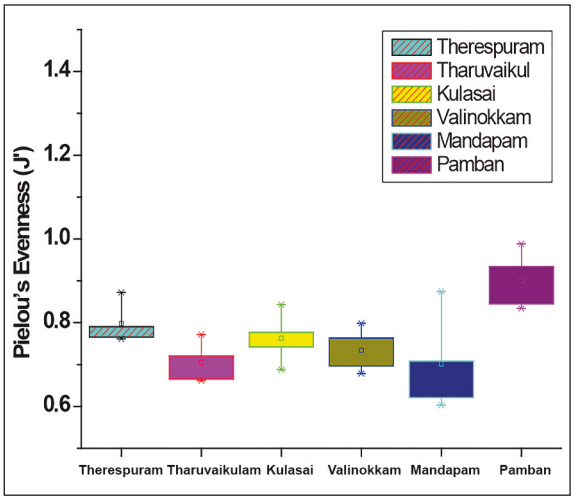

Figure 6. Gastropods and Bivalvia of species evenness in Thoothukudi and Ramanathapuram coastal area.

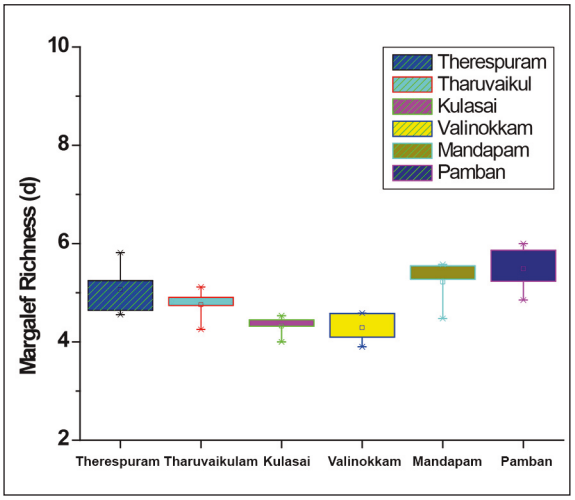

Figure 5. Gastropods and Bivalvia of species richness in Thoothukudi and Ramanathapuram coastal area.

species richness (d) was calculated for gastropod data and showed a lower (3.898) value in the summer and a higher (6.032) value in the pre-monsoon. The maximum diversity and richness of gastropods and bivalves were recorded in this study from Digha and Shankarpur beaches, and the maximum number of bivalves and gastropods were observed from Chandipur coast, followed by Bakkhali coast, mainly *Turricula javana* (Linnaeus, 1767), *Natica tigrina* (Röding, 1798), and *Nassarius stolatus* (Gmelin, 1791) were abundant in Chandipur beach, and *Anadara granosa* (Linnaeus, 1758), *Anadara inaequivalvis* (Bruguière, 1789), *Striarca lactea* (Linnaeus, 1758), *Crassostrea cuttackensis* (Newton & E.A. Smith, 1912), *Crassostrea gryphoides* (Schlotheim, 1820), *Saccostrea cucullata* (Born, 1778), and *Placuna placenta* (Linnaeus, 1758) were available in Bakkhali coast. In Talsari, the number of *Cerithidea cingulata* (Gmelin, 1791) was so high due to estuarine habitat. Thus, the maximum densities of gastropods and bivalves were recorded from Chandipur and Bakkhali rather than the other selected sites (Paul et al., 2014).

Pielou's species evenness (J') was calculated for gastropod data and varied between 0.6613 and 0.9884, with a higher value at Vellar estuary during the pre-monsoon and a lower value in the monsoon. The lowest density was in the month of July because of the monsoon season, when the salinity and temperature dropped. The population density increased steadily from September to reach its maximum in December, during the post-monsoon season. The abundance of molluscs along with changes in the community structure in different types of exploitation may be another reason for the lower number of species recorded compared to earlier workers (Paul et al., 2014).

CONCLUSIONS

The study on marine mollusc species in the Gulf of Mannar (India) indicates a depleting trend in

abundance when compared with the earlier reports. It is imperative to create awareness among the fishing community about the importance of species diversity, and they may be instructed to put commercially 'unimportant' organisms like bivalve molluscs back in the water soon after the fishing operation.

REFERENCES

Adoni A.D., Joshi G., Ghosh K., Chourasia S.K., Vaishya A.K., Yadav M. & Verma H.G., 1985. Work Book on Limnology. Pratibha Publishers, Sagar, India, 216 pp.

Branch E., Mialhe E., Noel D., Boulo V., Morvan A. & Rodriguez J., 1995. Knowledge and research prospects in marine mollusc and crustacean immunology. Aquaculture, 132: 17–32.

Erwin D.H., 1993. The Great Paleozoic Crisis: Life and Death in the Permian. Columbia Univ. Press, New York, 327 pp.

Kamboj V.P., 1999. Bioactive Agent from the Ocean Biota. In: Ocean Science Trends Future Directions, Somayajulu, B.L.K. (Ed.), Indian National Science Academy, New Delhi, India, pp. 197–227.

Kehinde O., Mariam Y., Adebimpe O. & Blessing A., 2015. Traditional utilization and biochemical composition of six mollusc shells in Nigeria. Revista de Biologia Tropical, 63: 459–464. https://doi.org/10.15517/rbt.v63i2.15600

Margalef R., 1958. Temporal succession and spatial heterogeneity in phytoplankton Perspectives in Marine Biology, pp. 323–349.

Monolish S. & Patterson Edward J.K., 2015. Biodiversity of marine molluscs from selected locations of Andhra Pradesh coast, south eastern India. Indian Journal of Geomarine Sciences, 44: 842–855.

Paul P., Panigrahi A.K. & Tripathy B., 2014. A study of marine molluscs with respect to their diversity, relative abundance and species richness in northeast coast of India. Indian Journal of Applied Research, 40: 40–43.

Rajaganapathi J., Prem Anand T. & Edward J.K., 2002. Antibacterial activity of marine molluscs from Portonovo region. Indian Journal of Marine Sciences, 26: 206–208.

Shannon C.E. & Weaver W., 1949. The mathematical theory of communication, University Illinois press, Urbana, I, 11, 117 pp.

Shaw P.D, McClure W., Van O., Blaricom G., Sims J., Fenical W. & Rude J., 1976. Antimicrobial activities from marine organisms. In: Webber H.H. & Ruggieri G.D. (Eds.), Food-drugs from the sea: Proceedings, 1974, Marine Science Center, University of Puerto Rico, Mayaguez, Puerto Rico, November 17–21, 1974, pp. 429–433. Washington DC: Marine Technology Society.

Subba Rao N.V. & Dey A., 2000. Records of the Zoological Survey of India, Occasional Paper No. 187: 1–323.

Subba Rao N.V., 1991. Mollusca in Animal Resources of India. Zoological Survey of India, Calcutta, pp. 125–147.

Venkataraman K., Jeyabaskaran R., Raghuram K.P. & Alfred J.R., 2004. Bibliography and checklist of corals and coral reef associated organisms of India, Records of the Zoological Survey of India, Occasional Paper 226: 1–648.

Venkataraman K. & Raghunathan C., 2015. Coastal and Marine Biodiversity of India. In: Marine faunal diversity in India, Academic Press, pp. 303–348.

Wickham H., 2009. Elegant graphics for data analysis (ggplot2). Springer-Verlag, New York, 213 pp.