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Marine Gastropoda diversity and Statistical analysis of Raigad district, along the Coast of India

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Abstract
The diversity and taxonomical study of gastropod molluscs from, rocky substrata, sandy beach, and muddy habitat were studied according to Shannon Wiener Diversity Index, during October 2010 to September 2011. The productive molluscan fauna in prevalence of different habitats of selected study sites of Raigad district coast, so a wide chance of research to further explore on the possibility of ecological value and there conservation.

Keywords: diversity, gastropod, Amba creek Raigad district coast

1. Introduction

In India the marine molluscs are recorded from the diverse habitats. They occur in different habitats such as mangroves, coral reef, rocky coasts, sandy beaches, sea grass beds and also at greater depth in the sea, they are more diverse and abundant in the rocky intertidal zone along the coast, sandy stones, inter tidal flats, mangrove areas [1]. Mangroves are one of the biologically diverse ecosystems in the world, rich in organic matter and nutrients and support very large biomass of flora and fauna [2]. The gastropods are collected extensively for local consumption. Mangrove roots & lower parts of trunks provide substrate for oysters, mussels and gastropods. Because these animals are filter feeders, they are confined to microhabitats below mean high water and are usually only abundant in areas adjacent to open water [3]. An oysters, mussels and clams serve the nutritional needs of the coastal population they are good source of minerals, protein, and glycogen and easily digestible compared to other animal food [4]. In India, till today, 5,070 species of molluscs have been recorded of which, 3,370 are from marine habitats [5]. The gastropods such as sacred chank, *Trochus, Turbo* are exploited from the Indian marine region [6]. The present papers investigate the diversity of gastropod molluscs of mangrove, rocky coasts, and sandy beach from selected study localities of Raigad district coast.

2. Materials and Methods: 2.1 Site-IAwaas: (Lat. 18°46.068”N and Long. 072°51.817’E). The open fine sandy shore, about 15-20m area opens during the low tide, in dense climbing mangrove plant *Ipomoea pes-caprae* (L.) Sweet. Spread on shore, village is about 30-40m away from high tide mark on the northern side, due nearest village domestic water discharged.

2.2. Site-II Sasvane: (Lat. 18°47.159” N Long. 072°51.760”E). The combination of open sandy beach and rocky shore, about 40-50m rocky area exposed during low tide,in dense climbing mangrove plant *Ipomoea pes-caprae* (L.) Sweet., spread on shore, village is about 50-60m away from high tide mark on the northern side, due nearest village domestic water discharged, on rocks lot of oysters bed were found, during low tide many people use to take out oysters for the eating purpose, due to nearest village there is domestic discharge occurrence.Mangrove: *Ipomoea pes-caprae*.

2.3. Site-III Kolgaon: (Lat. 18°48.197” N and Long. 072°52.660” E). The open fine sandy beach tidal zone, about 10-20m sandy area exposed during low tide, about 30-40m town is on southern side from the high water mark, due to nearest village there is domestic discharged.
Note: especially on this beach during the low tide, on the mid water mark, nearby one km *Hemifusus cochlidium* species were spread hundred in numbers.

2.4. Site-IV Mandva: (Lat. 18°48.324” N and Long. 072°52.967” E). The open fine sandy beach, about 10-20m sandy area exposed during low tide, in the sandy beach some rocks were present, in scattered small mangrove trees of *Bruguiera sexangula* (Lour.) Poir., were present, about 20-30m town on southern side from the high tide mark, due to nearest town there is domestic discharged, fishing activities is going on by boat. Mangrove:*Bruguiera sexangula*.

2.5. Site-V Kopropli: (Lat. 18°47.669”N and Long. 072°54.305”E). The soft muddy region, there is exposed inter-tidal mudflatabout 20-30m during low tide, some rocks and boulders were present, one gastropod species *Cerithidea cingulata* (Gmelin, 1791) were present dominantly, there is no any nearest village because of that no domestic water discharged, no fishing activities.

2.6. Live animals collected by handpicking including mangrove associated gastropod species during low tide. Five quadrates of nylon rope each 1-m² was prepared, randomly at each locality just over the bed. Twice in each season post-monsoon, winter and summer October 2010 to September 2011. Soon after fishing, they were brought to the laboratory and the shells were brushed to clean the fouling biomass and mud. They were then stocked in filtered seawater pumped in the laboratory from the localities for observation then animal preserved in 70% alcohol for taxonomical identification of morphological characters of typical animal, especially, lunal, umbo, and operculum. Internal parts teeth. The shells were identified from Zoological Survey of India, Kolkata. Also using the following references: Annotated checklist of Indian Marine Molluscs (Cephalopoda, Bivalve and Scaphopoda) Part-1 Ramakrishna and A. Dey. Occasional Paper no. 320, ZSI -2010. Guidance of Dr.Sherly Slack, Australia.

3. Results

3.1. The systematic list of molluscan fauna recorded in the Raigad district coast throughout the study period is listed in tables no 3. 19 species, 12 families, from 05 Orders recorded, Order Archaeogastropoda belongs to two families like-Trochidae belongs to one species, Neritidae belongs to three species. Order Mesogastropoda belongs to two families like-Potamididae belongs to one species, Turritellidae belongs to three species, While Order Neogastropoda belongs to six families like-Buccinidae belongs to one species. Nassariidae belongs three species.Melongenidae-1, Mitridae belongs to one species, Olividae belongs to one species, Conidae belongs to one species, Total eight species from the order. Order Basommatophora belongs one family Ellobiidae belongs one species. And Order Systellommatophora belongs one family Onchidiidae belonging two species. It is an indicates much more diversity on rocky habitats. The order Neogastropoda is dominantly 08 species recorded. The gastropods are playing a vital role in the homeostasis. The study sites have rich gastropod diversity. According Shannon diversity index (H) = 1.493 while Evenness is the 0.927.

According to Shannon Wiener Diversity Index

Table 1: Calculation according to Shannon Wiener Diversity Index.

No. of sample	pi=sample/sum	ln (pi)	pi*ln (pi)
09	0.257	-1.358	-0.349
06	0.171	-1.766	-0.301
06	0.171	-1.766	-0.301
05	0.142	-1.951	-0.277
09	0.257	-1.358	-0.349
Sum=41			Sum = -1.577

H= 1.577
H_{max}= ln (N) = ln (5)=1.609
Evenness = H/H_{max} = 1.577/1.609 =0.980
Result: Shannon diversity index (H) = 1.577
Evenness = 0.980

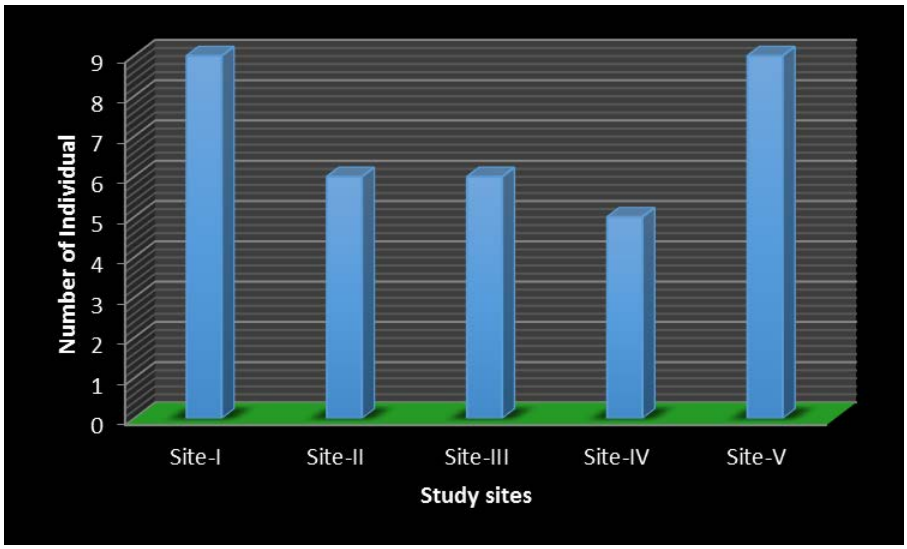

Fig 1: According to localities occurrence of gastropods on Raigad coast.

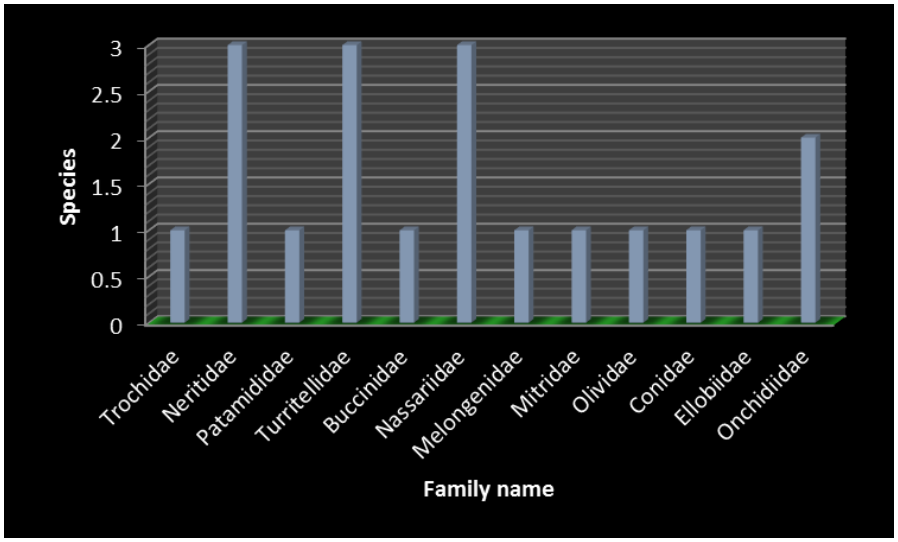

Fig 2: According to family occurrence of gastropods on Raigad coast.

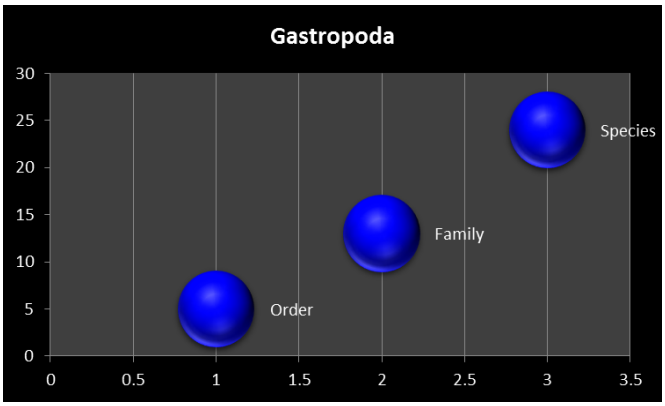

Fig 3: Taxonomical Identification of class gastropoda on Raigad coast**.**

3.2 The value of marine gastropod is very high in the ecosystem, the gastropod species were found higher at study site I and II probably due to muddy habitat differences. The *cerithidae cingulata* species were densely beds occurred on the mud banks, mud flats, sandy muddy area swamps, prop-roots and pneumatophores. According to figure no 2 family Neritidae, Nassariidae and Turritellidae found more diversity. The SCUBA one is the important tool used for this study, if needed with the help of SCUBA equipment use to dive underwater vertically and horizontally from the various kinds of zones of the Sea for to collect alive species.

4. Discussion

4.1. The diversity of gastropods molluscs at five localities of Raigad district coast varies significantly. The pulmonate snail *Cassidula nucleus* has been studied from Pichavaram mangroves [8]. The *Nerita (Dostia) crepidularia* in vellar estuary mangroves, its having a variety of habitats mangroves plant on the stems, intertidal mudflat during the high tide time animals moving to plant stem after that during low tide time animals moving to mud flats [9]. The lowest density was in the month of July because of monsoon season. In monsoon, due to self-dilution of the body fluid, the sensitive molluscs were unable to adjust the fluctuating osmotic balance quickly hence their mortality was high. After the month July because of adjustment, the mortality rate of molluscs decreased gradually. As a result, density of molluscs increased. It also understood that in the month of July, the salinity and temperature dropped down which made the condition adverse for the molluscs [10]. The population density was at its peak in the month of November during post monsoon period. It is clearly noticed by many research workers that the post monsoon period is the most favorable time for the new inflow of molluscan species. The mangroves support high density of every type of molluscan species especially, *Telescopium, Potamides, Natica, Nerita,* and *Littorina* and *oysters*. The *Littorina sp*. was densely found on the trunks, pneumatophores as well as on stilt roots of mangrove plants. It is good harvesting place for variety of molluscan species [7].

4.2. The gastropods are generally benthos organism and they are regularly used as bio-indicators of aquatic healthy. These species can produce a billion of larvae in the form of planktons that sustains the biotic population & they have an essential role in food chain, & energy flow. The observation of these species populations in mangrove ecosystem is important to evaluate their condition [11]. In the region of *Nerita (Dostia) crepidularia*, *Littorina sp*, *Cerithidea sp*, were observed to the mud banks, mudflats, mangrove forest, sandy muddy area swamps, prop-roots and pneumatophores. *Telescopium telescopium* were found in the mud flats of mangroves plants.

4.3. The Molluscs can reach high biomass in mangroves ecosystem because of high primary production within the food web, as predators, herbivores, detritivores & filter feeders. The numerical abundance & biomass of molluscs can be equally impressive. The numerous investigation of mangroves associated molluscs in the world wide, The 39 gastropods species recorded from Australian mangroves [12]. The total account 23 molluscs species from the mangrove forest in Hong Kong [13]. The 44 species of Sematan mangrove forest of Malaysia recorded [14]. A total account of Sundarban 56 species of molluscs 31 gastropods & 25 bivalves recorded [15]. The 12 bivalve & 13 gastropods mangrove associated at Ratnagiri recorded [16].The 39 gastropods from 15 families recorded from Raigad district coast [17]. Gastropods are typically one of the dominant and most conspicuous macrofauna in mangrove systems, and occupy wide range of ecological niches.

5. Conclusion

The underwater and coastal diversity of gastropod molluscs from selected five study sites of Raigad district coast varies significantly. At the study site I & II have greater diversity & commercial value importance. The total number & type of molluscs probably is influenced by their habitat & geographical condition, probably have suitable habitat to support rich diversity, also commercial & ecological molluscan importance. The order Neogastropoda has more diversity as well as dominantly with six families and eight species recorded. Note: especially on the site no. 3 means at Kolgaon beach during the low tide at the time of evening, on the mid water mark, on the muddy habitat, nearby1 km along the coastline, alive species Hemifusus cochlidium **(**Linnaeus 1758) were spread hundred in numbers. The gastropods have a significant ecological role to play in the mangrove ecosystems, also rocky habitats is suitable especially for gastropods. It is necessary to taxonomical study and the diversity of the group of threatened ecosystems. There is an urgent need conservation & sustainable utilization of gastropod molluscan species.

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