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Diversity of Bivalve and Gastropod Molluscs in Mangrove ecosystem from selected sites of Raigad district, Maharashtra, West coast of India.

Khade S.N. and U.H.Mane

Centre for Coastal and Marine Biodiversity, Dr. Babasaheb Ambedkar Marathwada University, Bhatye, Ratnagiri, India.

Abstract
Diversity of Bivalve and Gastropod Molluscs from mangrove habitat was studied. 37% bivalves while 63% gastropods were recorded during October 2008 to September 2009. The numbers of molluscs was comprised of bivalve species namely *Crassostrea cattuckensis, Saccostrea cucullata, Anadara granosa, Polymesoda maxima, Meretrix meretrix,* and gastropods *Cerithium cingulata,Telescopium telescopium, Littorina scabra Nodilittorina melanostoma* were abundant. These localities has productive molluscan fauna so a wide chance of research to further explore on the possibility of ecological value and there conservation.

Keywords: Bivalve, gastropod, diversity, mangrove, Raigad coast.

INTRODUCTION

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 [1]. Edible species of oysters, mussels, cockles, and gastropods are collected extensively for local consumption. Mangrove roots and lower parts of trunks provide substrate for oysters and mussels. 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. The blood clam, *Anadara granosa* and other cockles can be found in large numbers in mudflats on mangrove strands, where it lies partially buried in the sediment [2]. The total number of mangrove inhabiting faunal species in Indian mangroves is 3,111 which include prawns, crabs and molluscs, fish, fish parasites, insects, reptiles, amphibian and mammals [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]. 8 species of oysters, 2 species of mussels, 17 species of clams, 6 species of pearl oysters, 4 species of giant clams, 1 species of window pane oyster and other gastropods such as Sacred chank, *Trochus*, *Turbo* as well as 15 species of cephalopods are exploited from the Indian marine region [6]. The present papers investigate the diversity of bivalve and gastropod molluscs of mangrove ecosystem in selected study area of Raigad district coast.

MATERIALS AND METHODS

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*Corresponding Author

Khade S.N
Centre for Coastal and Marine Biodiversity, Dr. Babasaheb Ambedkar Marathwada University, Bhatye, Ratnagiri, India.

Email: khadesn@gmail.com

Study area was divided in four localities *viz*. Turbadi: (Lat. 18°14.469"North and Long. 073°01.156"East). The backwater soft muddy regions, there is exposed inter-tidal mudflat about 40-50m during low tide, in dense large mangroves trees were present like *Rhizophora mucronata* (Lamarck), *Ceriops tagal* (Perr.) (Robinson), *Avicennia alba* Blume. The locality is about 100-150 m away from the village on the western side, there was one small natural protected jetty on the rock basement for the landing fish catch, during second survey whole muddy platform fulfill by stones granules and brick of Pisces, domestic water discharged occurred.

Waral: (Lat. 18°12.111"North and Long. 073°03.176" East). The back water soft muddy region, there is exposed inter-tidal mudflat about 5-10m during low tide, the locality is on eastern side away from the village about 150-200m, so there was domestic discharge occurred, in dense large mangroves trees were present like *Avicennia alba* Blume, and *Sonneatia alba* J.Smith.

Mendadi: (Lat. 18°11.036" North and Long. 073°02.999" East). The back water swamp muddy region, there was exposed inter-tidal mudflat about 40-50m during low tide, the locality about 10-15m away from the village on the southern side, dense large mangroves trees *Sonneratia alba* J. C. Smith were dominant, oysters were present on the black rocks, the village is attached to the locality due to there was domestic discharged occurred.

Pabhara: (Lat. 18°09.617" North and Long. 073°05.804" East). The back water soft muddy region, there is exposed inter-tidal mudflat about 5-10m during low tide, on western side far away from the village the locality is about 100-150m, in dense small mangroves trees *Sonneatia alba* J.Smith., were present with pebbles in the soft mud, due to the nearest village there was domestic discharge occurred.

Live animals collected by handpicking including mangrove associated bivalve and gastropod species. 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 2008 to September 2009. Localities viz. Turbadi (Muddy region), Waral (Muddy region), Mendadi (Muddy region), and Pabhara (Muddy region). 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 estuary for observation then animal preserved in 70% alcohol for taxonomical identification of external structure of typical shells, especially, lunal, umbo, and operculum. Internal parts teeth, adductor muscles, & hinged. 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.

RESULTS

The species number of bivalve was recorded higher 9 species (from 5 families); 37% than gastropod (15 species (from 6 families); 63% in Raigad district coast. i.e. given respectively bivalves and gastropods in (Tables 1). The data presented on diversity of ecological importance molluscs from muddy (creek) habitats. Bivalve species found higher at locality Turbadi 09 bivalve species and 15 gastropod species, at locality Waral 07 bivalve species and 13 gastropod species found, while Mendadi 08 bivalve species and 13 gastropod species recorded, and at locality Pabhara 4 bivalve species and 12 gastropod species were recorded during study period. Because of the monsoon season fisher can't go off sea with their boat for fishing, so in these conditions oysters *Crassostrea catuckensis* & *Saccostrea cucullata* while clams viz. *Anadara granosa, Arca granosa* Mussels viz. *Perna viridis* bivalves and gastropods play a vital role as food in common people those are living on the coastal region.

According to "fig.1". Locality Turbadi has much both bivalve species and gastropod species diversity recorded as compared the other three localities. The second locality at Waral has large swampy region with mangroves due to this reason oysters found in high density and also oysters are very useful for local people viz. edible and commercial. The locality Mendadi has dense large mangroves trees *Sonneratia alba* J. C. Smith were dominant therefore locality was second highest species diversity recorded during study period. The locality Waral has also beds of *Crassostrea catuckensis* & *Saccostrea cucullata* recorded and the locality Pabhara dense mangrove area with rich bivalves and gastropods diversity given in "table 1". The onchidium and slugs were noticed in the Akshi creek, Raigad district by [7].

Table 1. Bivalve and Gastropod mollusc occurrence during study period from selected sites of Raigad coast.

Families	Species	1	2	3	4
Bivalves					
Mytilidae	*Perna viridis* (Linnaeus, 1758)	•	•	•	•
	Modiolus metacalfei (Hanley)	•	•	•	•
Veneridae	*Marcia opima* (Gmelin)	•	-	-	-
	Meretrix meretrix (Linnaeus, 1758)	•	-	•	-
Corbiculidae	*Polymesoda maxima* (Lamarck, 1818)	•	•	•	-
Ostridae	*Crassostrea cattuckensis* (Newton & Smith, 1912)	•	•	•	•
	Saccostrea cucullata (Born, 1778)	•	•	•	•
Arcidae	*Arca granosa* (Lamarck)	•	•	•	•
	Anadara granosa (Linnaeus, 1758)	•	•	•	•
Gastropods					
Neritidae	*Nerita chameleon* (Linnaeus, 1758)	•	-	-	-
	Dostia violacea (Gmelin)	•	•	•	•
	Clithon reticularis (Benson)	•	•	•	•
	Nerita plaospria (Anton, 1839)	•	•	•	•
	Nodilittorina vidua (Gould, 1859)	•	-	-	-
Littorinidae	*Littorina scabra* (Linnaeus, 1758)	•	•	•	•
	Littoria undulata (Gray,1839)	•	•	•	•
	N melanostoma (Gray,1839)	•	•	•	•
Potamididae	*Telescopium telescopium* (Linnaeus, 1758)	•	•	•	-
	Cerithidea cingulata (Gmelin, 1791)	•	•	•	•
Nassriidae	*Nassarius olivaceins* (Bruguier, 1798)	•	•	•	•
	Nassarius jacsonianus (Quoy & Gaimard, 1833)	•	•	•	•
Ellobiidae	*Cassidula nucleus* (Gmelin, 1791)	•	•	•	•
Onchidiidae	*Onchidium tenerum* (Stoliczka, 1869)	•	•	•	•
	Onchidium tigrinum (Stoliczka, 1869)	•	•	•	•

Note: 1- Turbadi, 2- Waral, 3- Mendadi, 4- Pabhara; for presence species (•), (-) absence.

Table 2. Check list of bivalve species at four localities of Raigad coast.

ORDER	FAMILY	NAME OF THE SPECIES
MYTILOIDA	MYTILIDAE	1. *Perna viridis* (Linnaeus, 1758)
		2.*Modiolus metacalfei* (Hanley)
VENEROIDA	VENERIDAE	3.*Marcia opima* (Gmelin)
		4.*Meretrix meretrix* (Linnaeus, 1758)
VENEROIDA	CORBICULIDAE	5.*Polymesoda maxima* (Lamarck, 1818)
OSTREOIDA	OSTRIDAE	6.*Crassostrea cattuckensis* (Newton & Smith, 1912)
		7.*Saccostrea cucullata* (Born, 1778)
ARCOIDA	ARCIDAE	8.*Arca granosa* (Lamarck)
		9.*Anadara granosa* (Linnaeus, 1758)

Table 3. Check list of gastropod species at four localities of Raigad coast.

ORDER	FAMILY	Name of the species
ARCHAEOGASTROPODA	NERITIDAE	01.*Nerita chameleon* (Linnaeus, 1758)
		02.*Dostia violacea* (Gmelin)
		03.*Clithon reticularis* (Benson)
		04. *Nerita plaospria* (Anton, 1839)
		05. *Nodilittorina vidua* (Gould, 1859)
MESOGASTROPODA	LITTORINIDAE	06. *Littorina scabra* (Linnaeus, 1758)
		07. *Littoria undulata* (Gray,1839)
		08. *N melanostoma* (Gray,1839)
MESOGASTROPODA	POTAMIDIDAE	09. *Telescopium telescopium* (Linnaeus, 1758)
		10.*Cerithidea cingulata* (Gmelin, 1791)
MESOGASTROPODA	NASSRIIDAE	11.*Nassarius olivaceins* (Bruguier, 1798)
		12.*Nassarius jacsonianus* (Quoy & Gaimard, 1833)
BASOMMATOPHORA	ELLOBIIDAE	13.*Cassidula nucleus* (Gmelin, 1791)
SYSTELLOMMATOPHORA	ONCHIDIIDAE	14.*Onchidium tenerum* (Stoliczka, 1869)
		15.*Onchidium tigrinum* (Stoliczka, 1869)

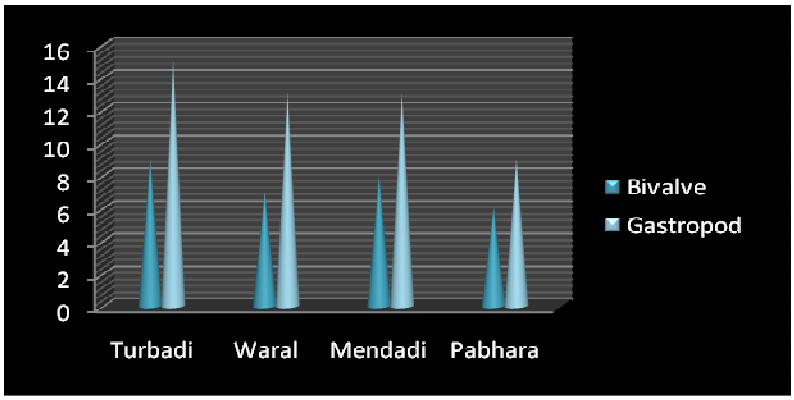

Fig 1. Molluscan species recorded during study period at four sites.

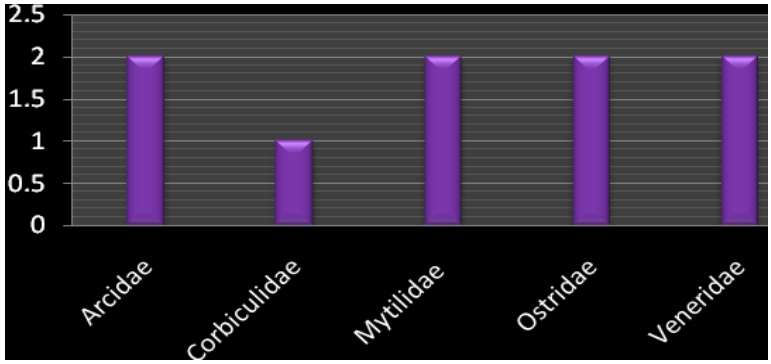

Fig 2. Family wise distribution of bivalve species from study sites.

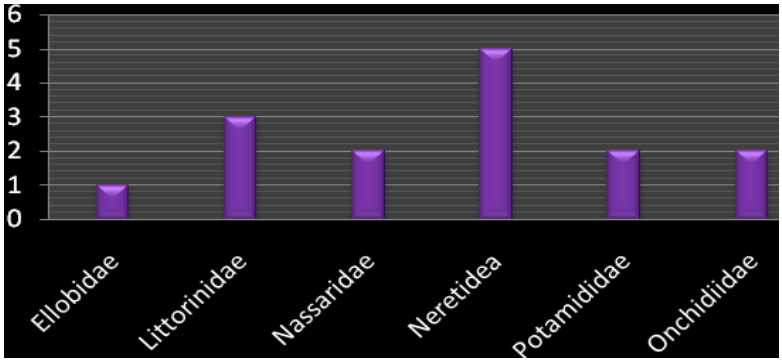

Fig 3. Families wise distribution of gastropod species from study sites.

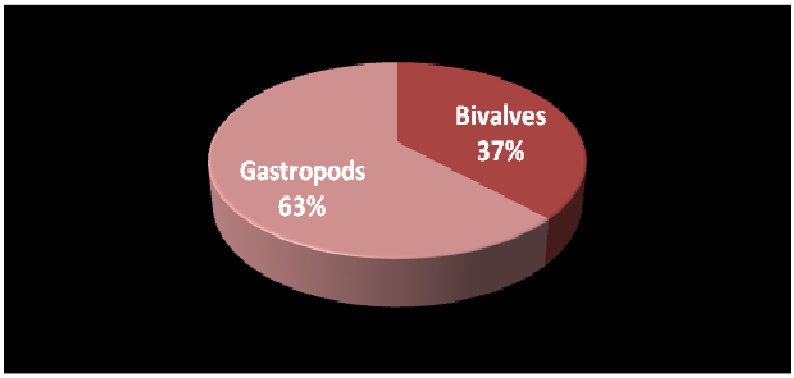

Fig 4. In percentage molluscan species recorded at four study sites.

DISCUSSION

The diversity of bivalves and gastropods molluscs at four localities of Raigad district coast varies significantly. During the study period 63% gastropod species and 37% bivalve species recorded on selected localities of Raigad district coast (given in figure no 1.). The unique characteristics of these marine ecosystems are the shallowness of the creeks, the relatively high temperature, high oxygen content, low wave energy and the semi-enclosed nature of the habitat. Decomposed material of the plant litter from August onwards is an important component of nutrient cycling in wetlands and it harbours a large number of diverse species [7]. 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 [8]. The population density was at its peak in the month of November 2009 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].

Gastropods and Bivalves are generally benthos organism and they are regularly used as bio-indicators of aquatic healthy. Gastropods and Bivalves can produce a billion of larvae in the form of planktons that sustains the biotic population and they have a role in food chain. The observation of Gastropods and Bivalves populations in mangrove ecosystem is important to evaluate their condition [9]. In Malaysia some of marine bivalve such as *Anadara granosa* is being cultured for commercialization. In Sarawak mangrove forest covered 173,792 ha of the land which is suitable for molluscan habitat [10]. 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. The bivalves in favor of the more active and therefore more conspicuous mangrove, with chemo-symbiotic associations have also been reported [11]. The assemblage of oysters were to occur on the mud banks, mud flats, mangrove forest, sandy muddy area swamps, prop-roots and pneumatophores and mussel were found attached to wherever hard substratum is available such as prop-roots and pneumatophores and oysters beds [12].

Mangroves are providing rich faunal resources from macro faunal communities to microbial diversity. Molluscs can reach high biomass in mangroves ecosystem because of high primary production within the food web, as predators, herbivores, detritivores and filter feeders. The numerical abundance and biomass of molluscs can be equally impressive [13]. The numerous investigation of mangroves associated molluscs in the world wide, 39 species of gastropods in as Australian mangrove [14]. 28 species in the Chinese mangrove [15]. 23 molluscs species from the mangrove forest in Hong Kong [16]. 29 species of bivalves from the mangrove root systems on the Atlantic coast of Colombia and Wood-boring bivalves are also common in the mangrove forest [17]. In general, numerous surveys of Indian mangrove molluscs were reported by [18]. A total account of Sundarban 56 species of molluscs including 31 gastropods and 25 bivalves [19]. 12 species of bivalve and 13 species of gastropod mangrove associated molluscs at Ratnagiri, Maharashtra, India [20].

CONCLUSION

There was a considerable difference within the study localities. High species diversity was found in a certain locality it was due to the presence of higher number of different species. The present study revealed that all recorded molluscs are indigenous species at Turbadi have greater commercial value and biodiversity importance. The total number and type of molluscs probably is influenced by their habitat and geographical condition. Turbadi and Mendadi probably have suitable habitat to support large number of edible, commercial and ecological molluscan diversity.

The gastropods have a significant ecological role to play in the mangrove ecosystems. However very little information is available on the gastropod biodiversity of mangroves. Hence it is necessary to document the biodiversity of the group of threatened ecosystems. There in urgent need conservation and sustainable utilization of mouscan species.

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REFERENCES

[1] Pawar R. Prabhakar, 2012. Molluscan Diversity in Mangrove Ecosystem of Uran (Raigad), Navi Mumbai, Maharashtra, West coast of India. *Bull. Environ. Pharmacol. Life Sci*. Vol. 1(6), 55-59.

[2] Macintosh, D.J. and E. C. Ashton. 2002. A review of mangrove biodiversity conservation and management. Final Report 10/06/2002. *Centre for Tropical Ecosystems Research, University of Aarhus, Denmark.*

[3] Kathiresan, K. and S.Z. Quasim, 2005. Biodiversity in Mangrove ecosystems, Hindustan Publishers, New Delhi.

[4] G. D. Suryavanshi, A.M.Shaikh and U.H.Mane. 2012. Impact of Zink on protein content of oyster *Crassostrea cattuckensis* from Ratnagiri coast, Department of zoology, Yogeshwari Mahavidyalaya, Ambajogai, Dist. Beed-431517. *J. Ecotoxicol. Envriron. Monit.* 22. (4), 323-328, Palani Paramount Publications- Printed in India.

[5] Subba Rao, N. V., 1991. *Mollusca in Animal Resources of India* (Zoological Survey of India, Calcutta)**,** 125-147.

[6] Venkataraman, K. and M. Wafar, 2005. Coastal and marine biodiversity of India. *Ind.J.Mar.Sci.,*34 (1) **:** 57-75.

[7] Thakur S., Yeragi S.G. and Yeragi S.S. 2012. Population Density and Biomass of Organisms in the Mangrove Region of Akshi Creek, Alibag Taluka,Raigad District Maharashtra. International Day for Marine Biological Diversity, Marine Biodiversity.

[8] Patole,V.M. 2010. Ecology and biodiversity Mangroves in Mochemad Estuary of Vengurla, South Konkan, Maharashtra. Ph.D. Thesis, University of Mumbai.

[9] Dewiyanti Irma, Karina Sofuatuddin. 2012.Diversity of Gastropods and Bivalves in mangrove ecosystem rehabilitation areas in Aceh Besar and Banda Aceh districts, Indonesia. Aquaculture, Aquarium, Conservation & Legislation *International Journal of the Bioflux Society*.

[10] Paul C.P.K. 2012. Management of Mangrove Forest of Sarawak. (Online). *Wetland* 10 pdf.

[11] Lebata, J.H.L. and J.H.Primavera. 2011. Gill structure, anatomy and habitat of Anodontia edentula: evidence of symbiosis. *Journal of shellfish Research*, 20 (3):1273-1278.

[12] Suresh M., S.Arularasan and K. Ponnusamy. 2012. Distribution of molluscan fauna in the artificial mangroves of Pazhayar back water canal, Southeast Coast of India. Advanced in Applied Science Research, 3 (3):1795-1798.

[13] Sasekumar, A, 1974.The Marine flora and fauna of Hong Kong and Southern China II. *J. Anim. Ecol,* 43: 51-69.

[14] Camilleri,*J.* Ecosystem ecology, 1992. A Derivative of Encyclopedia of Ecology. *Mar.Bio,* , 114 (1): 139-145.

[15] Jiang J.X. and R.G. Li. 1995. Mangrove ecosystem in China. *Hydrobiologia,* 295:213-220.

[16] Wells F.E. 1986. Distribution of marine invertebrates in a Hong Kong mangrove, with emphasis on molluscs. 1990. In: Morton, B.S. (Ed.), *Proceedings of the Second International Marine Biological Workshop*: The marine Flora and Fauna of Hong Kong and Southern China, Hong Kong University Press, Hong Kong, 783-793.

[17] Alvarez- Leon, R. 1983. Mangrove ecosystems of Colombia. Conservation and sustainable utilization of mangrove forests in Latin America and Africa Region. ITTO/ISME Project PDI, 14/90, Yokohama, Japan. 75-113.

[18] Venkatesan, V.,C.Kalidas, U.Pariyappanal, Zacharia, and S. Rajagopal, 2010. Distribution of Molluscan fauna in the Karangad estuarine mangroves, South East Coast of India. *AES Bioflux,* 2(2): 113-119.

[19] Anirudha Dey, 2006. *Handbook on Mangrove Associate Molluscs of Sundarbans*: 1-96. (Zool. Surv.India, Kolkata).

[20] Khade S.N. and Mane U.H. 2012. Diversity of edible Bivalve and Gastropod Molluscs from Ratnagiri, Maharashtra. *IJSPER,* Vol. (8)1-4.