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Diversity of Bivalve and Gastropod, Molluscs of some localities from Raigad district, Maharashtra, west coast of India.

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Abstract
Diversity of bivalve and gastropod molluscs from mangrove habitat, rocky substrata, sandy beach, and muddy habitat was studied. 22% bivalves while 78% gastropods were recorded during October 2010 to September 2011. The numbers of molluscs was comprised of bivalve species namely *Crassostrea cattuckensis, Saccostrea cucullata, Anadara granosa, Meretrix meretrix,* and gastropods *Planaxis sulcatus, Littorina scabra, Dostia violacea, Cerithium cingulata,Telescopium telescopium, Nodilittorina melanostoma and Casidula nucleus* were dominant, The productive molluscan fauna in prevalence of different habitats so a wide chance of research to further explore on the possibility of ecological value and there conservation.

Keywords: Bivalve, gastropod, diversity, mangrove, rocky habitat, Raigad district coast.

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]. 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 [3]. 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 [4]. 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 [5]. In India, till today, 5,070 species of molluscs have been recorded of which, 3,370 are from marine habitats [6]. 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 [7]. The present papers investigate the diversity of bivalve and gastropod molluscs of mangrove, rocky coasts, and sandy beach from selected study localities of Raigad district coast.

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MATERIALS AND METHODS

Study area was divided in four localities *viz*.

1. Harihareshwar: (Lat. 17°59.568" North and Long. 073°01.187" East). The rocky shore, about 05m area exposed during the low tide, along hill there is one rocks flat platform, in the rocks pits gastropods diversity were more than bivalve species, village about ½ kms on the north-eastern side from the high tide mark, by one small canal domestic discharge occurrence from the village which is meets to the sea beside study localities.

2. Lada: (Lat. 18°01.686" North and Long. 073°01.752" East). The backwater muddy region, there is exposed inter-tidal mudflat about 20 m during low tide, sea water flows is circular shape (3 side land and 1 side influx of sea water), in scatter large mangrove trees of *Sonneatia alba* J.Smith, *Ceriops tagal* (Perr.) (Robinson). Aprox - 2km area occupies by oysters beds spread over on the boulders, no domestic water discharged.

3. Shrivardhan: (Lat. 18°02.556" North and Long. 073°00.598" East). The open fine sandy beach, north and south side rocks were present; tide influx result in deposit of sand in rock crevices, intertidal shore was about 15m. Due to close situation of this village to sea with convenient travel by road and fine sandy beach they are attracted and there is direct domestic discharge to the sea.

4. Jivanabander: (Lat. 18°03.062" North and Long. 072°59.944" East). The rocky shore (surf beaten), about 05-10 m intertidal area exposed during low tide, village is about 60-70m far away from high tide mark on the eastern side, fishing activity is going on by boat, there one cement constructed jetty for the purpose of landing the fish catch, there is domestic discharge occurrence.

Live animals collected by handpicking including mangrove

associated bivalve and 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. Localities viz. Harihareshwar (Rocky area), Lada (Muddy region), Shrivardhan (Sandy beach), and Jivanabander (Rocky area). 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, 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 14 species from 6 families and 4 orders; 22% than gastropod (49 species from 15 families and 5 orders; 78% in selected localities of Raigad district coast. i.e. given respectively bivalves and gastropods in (Table 1). The data presented on diversity of ecological importance molluscs from muddy-mangrove, rocky and sandy habitats. Bivalve species found higher locality at Lada 08 bivalve species and 12 gastropod species, at locality at Jivanabander 06 bivalve species and 30 gastropod species found, while at Harihareshwar 05 bivalve species and 22 gastropod species recorded, and locality at Shrivardhan 3 bivalve species and 3 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,* 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". 14 species belonging 6 families of bivalves recorded it is indicating for bivalve species muddy as well as mangrove habitats has more diversity, family Ostridae, Arcidae, Mytilidae, Veneridae dominated.

According to "fig. 2". 49 species belonging 15 families of gastropods recorded from these four localities this is indicates much more diversity on rocky habitats. The onchidiidae families with 2 species found in muddy habitats. Also onchidium and slugs were noticed in the Akshi creek, Raigad district by [8].

According to "fig.3". Locality Jivanabander has much both bivalve species and gastropod species diversity recorded as compared the other three localities. The second locality at Lada 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 "table 1".

Table 1. Bivalve and Gastropod mollusc occurrence from study sites of Raigad district coast.

Families	Species	1	2	3	4
Bivalves					
Arcidae	1. *Arca granosa* (Lamarck)	-	•	-	-
	2. *Anadara granosa* (Linnaeus, 1758)	-	•	-	-
Mytilidae	3. *Perna viridis* (Linnaeus, 1758)	•	•	-	•
	4. *Modiolus metacalfei* (Hanley)	•	-	-	•
Veneridae	5. *Gafrarium divaricatum* (Gmelin)	•	-	-	•
	6. *Meretrix meretrix* (Linnaeus, 1758)	-	•	-	-
	7.*Marcia opima* (Gmelin)	-	•	-	-
	8. *Dosinia Prostata* (Linnaeus)	-	-	-	•
Donacidae	9. *Donax incarnatus* (Gmelin)	-	-	•	-
	10.*Donax cuneatus* (Linnaeus)	-	-	•	-
	11.*Donax scortum* (Linnaeus)	-	-	•	-
Ostridae	12.*Crassostrea cattuckensis* (Newton & Smith, 1912)	•	•	-	•
	13. *Saccostrea cucullata* (Born, 1778)	•	•	-	•
Corbiculidae	14. *Polymesoda maxima* (Lamarck, 1818)	-	•	-	-
Gastropods					
Trochidae	1. *Trochus radiatus* (Gmelin)	•	-	-	•
	2. *Coliostoma speciosa* (A. Adams, 1854)	-	-	-	•
	3. *Euchelus atratus* (Gmelin, 1791)	-	-	-	•
	4. *Umbonium vestarium* (Linnaeus)	-	-	•	-
Turbinidae	5. *Turbo brunneus* (Roeding)	•	-	-	•
	6. *Astralium semicastata* (P.Fischer, 1880)	-	-	-	•

Neritidae	7. *Nerita albicilla* (Linnaeus, 1758)	•	-	-	•
	8. *Nerita oryzarum* (Recluz, 1841)	•	-	-	•
	9. *Nerita squmulata* (Le Guillous, 1841)	-	-	-	•
	10. *Nerita planspria* (Anton, 1839)	•	-	-	•
	11. *Nerita grayana* (Recluz, 1843)	•	-	-	•
	12. *Nerita chameleon* (Linnaeus, 1758)	•	-	-	•
	13. *Clithon meticularis* (Benson)	-	•	-	-
	14. *Clithon smithi*	-	•	-	-
	15. *Dostia violacea* (Gmelin)	-	•	-	-
Nassariidae	16. *Nassarius stulatus* (Gmelin, 1791)	-	•	-	-
	17. *Nassarius pullus* (Linnaeus, 1758)	-	•	-	-
	18. *Nassarius jacsonianus* (Quoy & Gaimard, 1833)	-	•	-	-
	19. *Nassarius vittatus* (Linnaeus, 1767)	-	•	-	-
Patellidae	20. *Cellana radiata* (Born, 1778)	•	-	-	•
Littorinidae (Gray, 1840)	21. *Littorina scabra* (Linnaeus, 1758)	-	•	-	-
	22. *Littoria undulata* (Gray, 1839)	-	•	-	-
	23. *Nodilittorina melanostoma* (Gray, 1839)	•	-	-	•
	24. *Nodilittorina vidua* (Gould, 1859)	•	-	-	•
Planaxidae	25. *Planaxis sulcatus* (Born, 1780)	•	-	-	•
	26.*Planaxis nicobarica*	•	-	-	-
	27. *Planaxis sp*	•	-	-	-
Cerithiidae	28. *Clypeomorous betilliraeformis* (Habe & Kosuge, 1966)	-	-	-	•
	29. *Clypeomorous bitasciata* (Sowerby, 1855)	-	-	-	•
	30. *Cerithium traillii* (Sowerby, 1855)	•	-	-	•
	31. *Cerithium* spp	•	-	-	•
	32. *Cerithium gennesi* (Fischer and Vignal, 1901)	-	-	-	•
	33. *Cerithium bifaciata* (Sowerby, 1855)	-	-	-	•
	34. *Cerithium* sp	-	-	-	•
Ranellidae	35. *Gyranium natator* (Roeding, 1798)	•	-	-	•
Muricidae	36. *Thais blanfordi* (Melvill, 1893)	-	-	-	•
	37. *Thais lacera* (Born, 1778)	•	-	-	•
	38. *Thais tissoti* (Petit, 1852)	•	-	-	•
	39. *Morula nodicostata* (Pease, 1868)	•	-	-	•
	40. *Morula granulata* (Duclos, 1832)	-	-	-	•
	41. *Morula marginatra* (Blanville, 1832)	•	-	-	-
	42. *Thais hippocastanum* (Linnaeus, 1758)	•	-	-	-
	43. *Mancinella bufo*		-	-	•
Buccinidae	44. *Engina zea* (Melvill)	•	-	-	•
Turritellidae	45. *Turritella duplicata* (Linnaeus, 1758)	-	-	•	-
Mitridae	46. *Vexillum ebenus*	-	-	•	-
Ellobiidae	47. *Cassidula nucleus* (Gmelin, 1791)	-	•	-	-
Onchidiidae	48. *Onchidium tenerum* (Stoliczka, 1869)	-	•	-	-
	49. *Onchidium tigrinum* (Stoliczka, 1869)	-	•	-	-

Note: 1: Harihareshwar, 2: Lada, 3: Shrivardhan , 4: Jivanabander; presence of species (•), (-) absence of species.

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

Class	Family	Harihareshwar	Lada	Shrivardhan	Jivanabander	Total
Bivalve	06	05	08	03	06	14
Gastropod	15	22	12	03	30	49

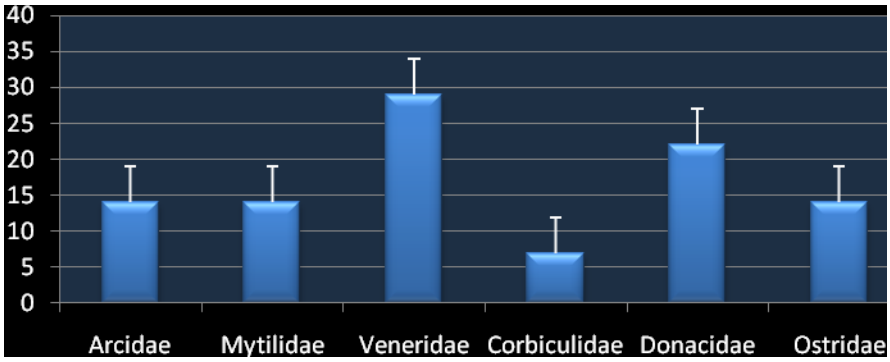

Fig 1. Showing distribution of families of bivalve species in % from selected study sites.

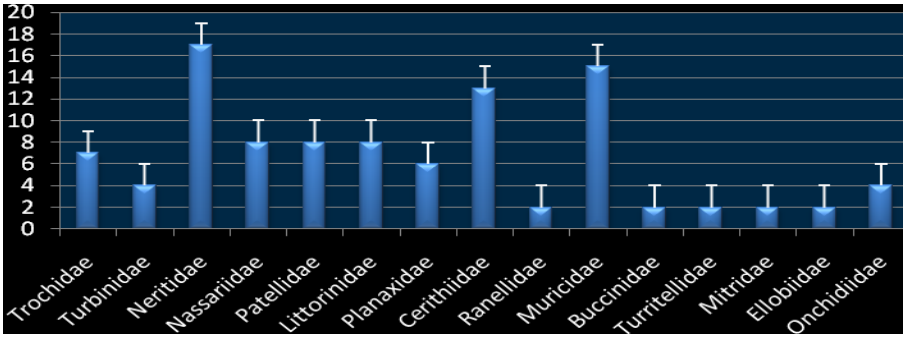

Fig 2. Showing distribution of families of gastropod species in % from selected study sites.

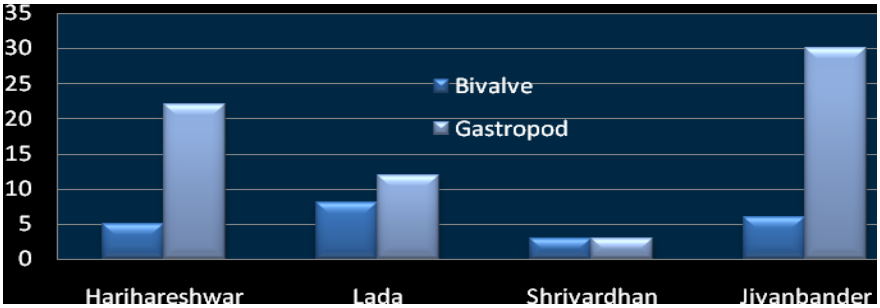

Fig 3. Showing distribution of bivalves & gastropods from selected study sites.

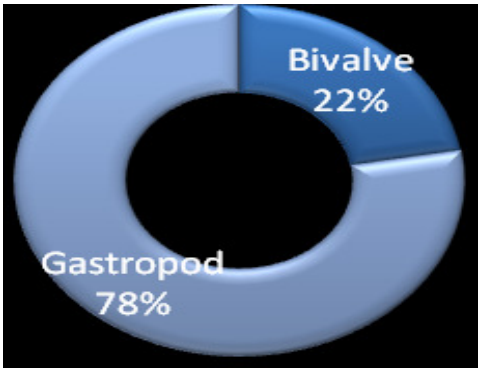

Fig 4. In percentage molluscan species recorded at four study sites.

DISCUSSION

The diversity of bivalves and gastropods molluscs at four localities of Raigad district coast varies significantly. During the study period 78% gastropod species and 22% 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 selected localities, 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 [8]. 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 [9]. 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 [8].

Molluscan communities are good indicators of localized conditions [10], 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 [11]. 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 [12.]. 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 [13]. 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 [14].

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 [15]. The numerous investigation of mangroves associated molluscs in the world wide, 39 species of gastropods in as Australian mangrove [16]. 28 species in the Chinese mangrove [17]. 23 molluscs species from the mangrove forest in Hong Kong [18]. 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 [19]. In general, numerous surveys of Indian mangrove molluscs were reported by [20]. A total account of Sundarban 56 species of molluscs including 31 gastropods and 25 bivalves [21]. 12 species of bivalve and 13 species of gastropod mangrove associated molluscs at Ratnagiri, Maharashtra, India [22] and the total 19 bivalves belongs 9 families while 39 gastropods belongs 15 families from selected sites of Raigad district coast [23].

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 Lada and Jivnabander have greater commercial value and biodiversity importance. The total number and type of molluscs probably is influenced by their habitat and geographical condition. Harihareshwar and Lada 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, also rocky habitats is suitable especially for gastropods. 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 molluscan species.

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REFERENCES

[1] Ramakrishna and A. Dey. Annotated checklist of Indian Marine Molluscs (Cephalopoda, Bivalve and Scaphopoda) Part-1. *Rec.Zool.Surv.India*, Occ. Paper no., 320:1-357. (Published by the Director, *Zool.Surv.India,* Kolkata).

[2] 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.

[3] 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.*

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

[5] 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.

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

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

[8] 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.

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

[10] Rajendra G. Mavinkurve, Sandhya P. Shanbhag and N.A.Madhyastha. Non-Marine Molluscs of Western Ghats: A Status review. *Zoos' Print Journal* 19 (12):1708-1711.

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

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

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

[14] 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.

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

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

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

[18] Wells F.E. 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, 1986, Hong Kong University Press, Hong Kong, 783-793.

[19] 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.

[20] 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.

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

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

[23] Khade S.N. and Mane U.H. 2012. Diversity of Bivalve and Gastropod Molluscs from selected localities of Raigad district, Maharashtra, West coast of India. *World Journal of Science and Technology* 2 (6): 35-41.