



E-ISSN: 2320-7078

P-ISSN: 2349-6800

JEZS 2016; 4(4): 722-725

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Received: 08-05-2016

Accepted: 09-06-2016

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Underwater-coastal diversity of edible bivalve of Revas (Raigad), coast of India

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Abstract

Underwater and coastal diversity of edible bivalve molluscs was studied twice in each season monsoon, post monsoon, winter and summer July 2010 to June 2011 with the help of SCUBA diving by DM. At each locality diversity and number of species were collected from Nagaon, Kegaon, open sea and local markets too. The selected localities of Raigad district coast is a wide chance of research to further explore both on the possibility of commercial value and ecosystem conservation.

Keywords: Diversity, edible bivalve, Revas, coast of India

1. Introduction

The marine bivalve molluscs resources of India clams are widely distributed and abundant, the form subsistence fisheries all along the Indian coast and fished by men, women and children from the intertidal region to about 4m depth, they are handpicked. These organisms usually inhabit bottom substrates for at least part of their life cycle. Several species of Veneridae family clams that occur along the coast of Maharashtra *Placenta placenta* one is important point of view as food. It contributes about 80% to the total production of clams landed annually mainly from Kalbadevi (Shirgaon creek) and (Kajali Bhatye creek) estuaries along Ratnagiri coast, Maharashtra ^[1]. Bivalve provides an important source of protein for human besides fish, it can be found in many parts of the world such as marine, brackish, fresh and terrestrial areas. The marine bivalves consist various species that use for many purposes besides their nutritional source ^[2]. Amongst several marine living resources the shell fishes play a vital role in India's economy of their popularity is increasing due to their delicious food value. The bivalves such as oysters, mussels and clams serve the nutritional needs of the coastal population. They are good source of minerals, protein and glycogen and are easily digestible compared to other animal foods ^[3]. The present paper investigates the underwater and coastal diversity of edible bivalve molluscs in rocky shore, sandy beach, muddy areas, selected localities at Raigad district coast, Maharashtra.

2. Materials and Methods

2.1. Revas: (Lat. 18°49.801" North and Long. 072°56.801" East). The estuary swampy muddy region, the big Amba river after coming from the western ghat meets to the Arabian sea at Revas, there is exposed inter-tidal mud flat about 10-20 m during low tide, on the both side of the border of the creek, in dense small and large mangrove trees of *Avicennia marina* var. *acutissima* Stapf & Moldenke ex Moldenke, *Avicennia marina* (Forsk.) Vierh., *Avicennia officinalis* L., *Avicennia alba* Blume, *Acanthus ilicifolius* L., *Aegiceras corniculatum* (L.) Blanco, *Sonneratia alba* J. Smith, *Rhizophora mucronata* (Lamarck), *Ceriops tagal* (Perr.) (Robinson), at the intertidal zone there was cement constructed jetty, peoples can go easily approximately within an half hour from Revas to karanja (Uran) by boat, so many people used to go by this way, there is no domestic discharged.

2.1.1 Mangrove: *Avicennia marina* var. *Avicennia marina*, *Avicennia officinalis*, *Avicennia alba*, *Acanthus ilicifolius* L., *Aegiceras corniculatum*, *Sonneratia alba*, *Rhizophora mucronata*, *Ceriops tagal*.

2.2 Dharamtar: (Lat. 18°41.795" North and Long. 072°01.754" East). The creek soft muddy region, there is exposed inter-tidal mudflat about 5-10m during low tide, there is steel industry about 200-300m on the eastern side from the high tide mark, fishing activities going on, in dense small and large mangroves tress of *Acanthus ilicifolius* L., *Sonneratia alba* J. Smith,

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Rhizophora mucronata (Lamarck), *Ceriops tagal* (Perr.) (Robinson), *Excoecaria agallocha* L., *Avicennia alba* Blume, *Avicennia officinalis* L. were present on the both side.

2.2.1 Mangrove: *Acanthus ilicifolius* L., *Sonneratia alba*, *Rhizophora mucronata*, *Ceriops tagal*, *Excoecaria agallocha* L., *Avicennia alba*, *Avicennia officinalis* L.

2.3 Dadar: (Lat. 18°48.857" North and Long. 073°01.475" East). The creek muddy region, there is exposed inter-tidal mud flat about 5-10m during low tide, about 30-40m far away on the southern side there were 3 houses from the high tide mark, in dense large mangrove trees of *Avicennia marina* (Forsk.) Vierh., *Sonneratia alba* J. Smith were present, locality just on the eastern side of the cement constructed bridge, there is domestic discharged, due to fishing activities there is oil discharged.

Mangroves: *Avicennia marina*, *Sonneratia alba*.

2.4 Pirawadi: (Lat. 18°51.267" North and Long. 072°55.088" East). The rocky open shore, about 10-20m black rocky area opens during low tide, small rounded black pebbles were present above high water mark, on the northern side far away from the high tide mark village is about 50-60m, in scattered small mangroves trees of *Bruguiera sexangula* (Lour.) Poir. were recorded, due to nearest village there is domestic water discharged.

Mangrove: *Bruguiera sexangula*.

2.5. Karanja: (Lat. 18°50.791" North and Long. 072°56.990" East). The rocky open shore, about 10-20m crumbly rocky area open during low tide, pebbles were present above high tide mark, on the northern side far away from the high water mark village is about 10m, there was one cement constructed jetty for the purpose landing of the fish catch, also from Karanja to Revas we can get by passenger boat, due to nearest village there is domestic water discharged, due to fishing activities oil discharged.

2.6 Live animals were collected twice in each season monsoon, post monsoon, winter and summer July 2010 to June 2011. Also Self Content Underwater Breathing Apparatus (SCUBA) diving kit used by Dive Master for underwater collection, from some selected localities of Raigad district coast such as Revas, Dharamtar, Dadar, Pirawadi, and Karanja, where as 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 scars. 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 [4].

3. Results

The systematic list of molluscan fauna recorded in the Raigad district coast throughout the study period is listed in table no 1. 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. Among study localities they belongs 8 species 8 genera, 4 families and 4 orders. Like Order ARCOIDA belonging one family Arcidae belongs one species *Arca granosa*, Order MYTILOIDA belonging family Mytilidae belongs two species. Order VENEROIDA belongs two families belongs four species. Order STREOIDA belongs one family Ostridae belongs two species. The present data is on five different habitats like rocky shore, sandy coast, muddy, swampy with mangrove associated species. According figure no.1. The six species from Revas, two species from Dharamtar, four species from Dadar, five species from Pirawadi while four species from Karanja recorded. According to table no. 1. The Shannon Wiener Diversity index calculation (H) is 1.552, while evenness is 0.964 calculated.

According to Shannon Wiener Diversity Index

Table 1: Showing the Shannon Wiener diversity Index of study localities.

No. of sample	pi=sample/sum	ln (pi)	pi*ln (pi)
06	0.287	-1.248	-0.358
02	0.095	-2.353	-0.223
04	0.190	-1.660	-0.315
05	0.238	-1.435	-0.341
04	0.190	-1.660	-0.315
sum=21			Sum = -1.552

H= 1.552

H_{max}= ln(N) = ln(5)=1.609

Evenness = H/H_{max} = 1.552/1.609 =0.964

Result: Shannon diversity index (H) = 1.552

Evenness = 0.964

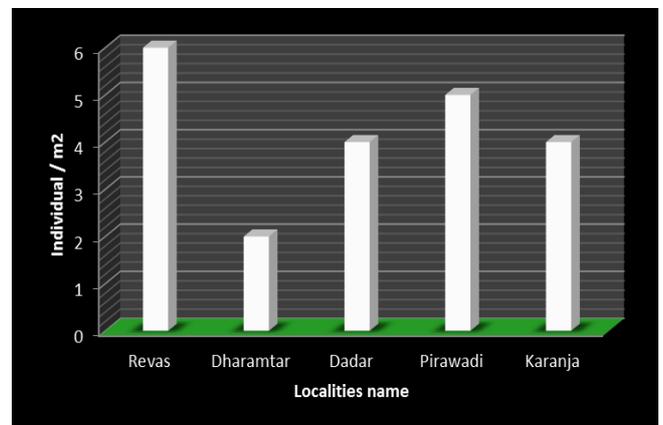


Fig 1: Bivalve species according to localities on the coast of Raigad district.

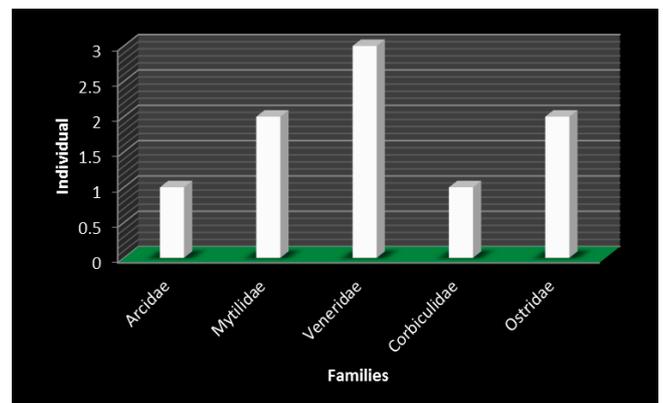


Fig 2: Bivalve species according to families on the coast of Raigad district.

The value of edible marine bivalve is very high as a marine food for those people are living on the coastline, because in the entire monsoon season fishing boats are not able to go offshore for fishing, due to the rough Sea, therefore all fishing is stopped, that time all fisherman community dependent on bivalves and then they use to use the bivalves as a main food, not only monsoon season throughout the year people use to used bivalve as palatable testy food like oysters. The bivalve species were found higher at Revas probably due to muddy habitat differences. The oysters were to occur on the mud banks, mud flats, sandy muddy area swamps, prop-roots and pneumatophores.

4. Discussion

The relatively high temperature, high oxygen content, low wave energy and the semi-enclosed nature are gives high food availability to the species. 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^[5]. 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^[6]. The observation of Bivalves populations in ecosystem is important to evaluate their condition^[7]. 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^[8]. Studies on mangrove associated molluscan fauna of various Indian peninsular estuaries viz. Godavari and Krishna estuaries^[9], Mahanadi estuary^[10]. The bivalves are active and therefore it is more conspicuous, with mangrove chemo-symbiotic associations have also been reported^[11]. The assemblage of oysters were to occur on the mud banks, mud flats, 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]. *Crassostrea cattuckensis* of medium (88.99 mm shell length) size from Bhatye estuary at Ratnagiri were collected in monsoon winter and summer seasons^[13]. The numerical abundance and biomass of molluscs can be equally impressive^[14]. The number of 23 molluscan species recorded from the mangrove forest from Hong Kong^[15]. The number of 29 species of bivalves recorded from the mangrove root systems on the Atlantic coast of Colombia & Wood-boring bivalves are also common in the mangrove forest^[16]. The 25 species of molluscs (13 gastropods and 12 bivalves) were recorded from Krangad estuary, South East Coast of India.^[17] A total account of Sundarban 56 species of molluscs including 31 gastropods and 25 bivalves recorded^[18]. The number of 12 bivalves mangrove associated recorded at Ratnagiri, Maharashtra, India^[19]. A total account of 19 bivalve's from 9 families recorded from selected sites of Raigad district Coast^[20].

5. Conclusion: The underwater and coastal diversity of edible molluscs at five localities of Raigad district coast varies significantly. According to figure no. 2 there 8 species 8 genus from 5 families from four order. The present study revealed that all recorded molluscs are indigenous species of Revas creek localities have greater commercial value and

biodiversity importance. The total number and type of edible molluscs probably is influenced by habitat and geographical condition. Dharamtar creek and Dadar creek probably have suitable habitat to support large number of edible molluscs diversity. The oysters (*S. cucullata* and *C. cattuckensis*) were found attached whenever is hard substrata. *Perna viridis* was found underwater attached to rocky substrata in the river at the Pirawad and Karanja localities. So, there is urgent need to conservation and sustainable utilization of bivalve species for ecosystem and socioeconomic development.

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