



STATE BIODIVERSITY STRATEGY AND ACTION PLAN (SBSAP) FOR KERALA

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3.3.5 Biodiversity of bivalves (Invertebrata: Mollusca)

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Introduction

Bivalves constitute an important component of many benthic ecological habitats. They are adapted to withstand the frequent physical and chemical changes characteristic of the marine aquatic ecosystems and

as a result, they form an integral part of the benthic community structure. In estuaries, intertidal zones and near shore coastal areas of Kerala, they are well distributed. Geological history records of Kerala have indicated several transgressions and regressions of the sea along the coast resulting in many standstills during the Pleistocene and Holocene periods. The coastal plains of Kerala are probably of the late Pleistocene and alluvial origin. Recently, Pillai *et al.* (1999) have collected 14 species of bivalves along with other mollusca and Scleractinian corals about 8 km from Cochin from a well cutting at a depth of 8 km. The fauna found in the collections are also found in the extant fauna of the seas around India, indicating a somewhat stability in the marine Biodiversity.

Literature pertaining to the occurrence, distribution and diversity of bivalves are limited. Based on the shell collections (both live and dead), Preston (1916) and Cheriyan (1968) have described 36 species belonging to 24 genera in 15 families of Class Pelecypoda. In the 70's, research was targeted at the habitat associations of bivalves (Ansell *et al.*, 1972; Appukuttan, 1973). A review of the literature on the work done on bivalve resources of Kerala clearly indicates that this resource has been investigated by researchers more for understanding their role as an indicator species of pollution than their role in ecological communities. Based on the observations on the shells landed by trawlers and those collected from the coastal areas, 71 species of bivalves belonging to 48 genera of 24 families have already been listed as given in Table 3.16.

Ecological diversity

Bivalves in estuaries, intertidal zones and the subtidal continental shelf area have adaptive characters to suite the particular habitat. All the three groups of bivalves viz., clams, mussels and oysters, have well defined distribution pattern in the coastal regions of Kerala.

Estuarine resources

In Kerala, there are about 41 west flowing rivers that discharge into 30 estuaries, which open into the sea through perennial or seasonal outlets across bar mouths. In the estuaries, the clams are the dominant bivalves and they show zonation based on salinity profile of the estuary. The typical zonation pattern of clams in some of the lakes in Kerala is presented here. For instance, in the Vembanad Lake, there exists a homogenic population of *Sunetta scripta* near the bar mouth region where the salinity is fairly constant. About 2 to 3 km from the bar mouth where the salinity does not go below 15 ppt, a mixed (heterogenic) population of *Meritrix casta* and *Paphia malabarica* occurs. Similarly, throughout the estuarine region where fresh water conditions prevail during the monsoon period, a homogenic population of *Villorita*

cyprinoidea has been noticed (Kripa and Joseph, 1993). In addition to these dominant species, there also occur other clams like *Modiolus* sp. and *Musculus* spp. in regions where the salinity does not fall below 5 ppt. The Bivalve resources of Kerala is given in Table 3.17.

Table 3.17 Bivalve resources of Kerala

	Family	Genus	Species	Reference
1	Nuculanidae	<i>Nuculana</i>	<i>mauritiana</i> (Sowerby)	Cheriyian, P.V. 1968
2	Arcidae	<i>Arca</i>	<i>lateralis</i> Reeve	Cheriyian P.V. 1968
3		<i>Arca</i>	<i>inequivalvis</i> Bruguiere	Cheriyian, P.V. 1968
4		<i>Arca</i>	<i>tortuosa</i> Linne	Cheriyian, P.V. 1968
5		<i>Arca</i>	<i>indica</i> Gmelin	Cheriyian, P.V. 1968
6	Mytilidae	<i>Modiolus</i>	<i>striatulus</i> (Hanley)	Cheriyian, P.V. 1968
7		<i>Modiolus</i>	<i>undulatus</i> (Dunker)	Cheriyian, P.V. 1968
8		<i>Modiolus</i>	<i>tulipa</i> (Lamarck)	Cheriyian, P.V. 1968
9		<i>Branchyodontes</i>		*
10		<i>Septifer</i>		*
11		<i>Musculus</i>	<i>senhausia</i> (Benson)	Shiny, S. 1991
12		<i>Perna</i>	<i>virides</i>	Kuriakose, 1980
13		<i>Perna</i>	<i>indica</i>	Kuriakose, 1980
14		<i>Lithophaga</i>	<i>nigra</i> (d Orbnigny)	Appukuttan, 1973
15	Pteriidae	<i>Pteria</i>		*
16		<i>Pinctada</i>	<i>fucata</i>	* Achary, G.P.K
17		<i>Pinctada</i>	<i>sugilata</i>	* Achary, G.P.K
18		<i>Pinctada</i>	<i>anomoides</i>	*
19		<i>Pinctada</i>	<i>margaritefera</i>	* Achary, G.P.K
20		<i>Pinctada</i>	<i>atropupuria</i>	*
21	Pinnidae	<i>Pinna</i>		*
22	Pectinidae	<i>Pecten</i>	<i>tranquebaricus</i> Gmelin	Cheriyian, P.V. 1968
23		<i>Spondylus</i>		*
24	Limidae	<i>Lima</i>		*
25	Anomiidae	<i>Placenta</i>	<i>placenta</i>	*
26	Ostreidae	<i>Crassostrea</i>	<i>madrasensis</i>	Rao, K.S.1987
27		<i>Saccoctrea</i>	<i>cucullta</i> (Born)	Rao, K.S.1987
28	Crassatellidae	<i>Crasstella</i>		*
29	Carditidae	<i>Cardita</i>		*
30		<i>Beguina</i>		*
31	Lucinidae	<i>Lucina</i>	<i>ovum</i> Reeve	Cheriyian, P.V. 1968
32	Erycinidae	<i>Galeoma</i>		*
33		<i>Scintella</i>		*
34	Chamidae	<i>Chama</i>		*
35		<i>Cardium</i>		*
36	Veneridae	<i>Dosinia</i>	<i>modesta</i> (Sowerby)	Cheriyian, P.V. 1968
37		<i>Dosinia</i>	<i>cretacea</i> (Reeve)	Cheriyian, P.V. 1968
38		<i>Dosinia</i>	<i>trigona</i> (Reeve)	Cheriyian, 1968

(Table 3.17 contd.)

39		<i>Dosinia</i>	<i>histrion</i> (Gmelin)	Cheriyān, P.V. 1968
40		<i>Meretrix</i>	<i>casta</i> (Chemnitz)	Cheriyān, P.V. 1968
41		<i>Meretrix</i>	<i>ovum</i> Deshayes	Cheriyān, P.V. 1968
42		<i>Venus</i>	<i>imbricata</i> Sowerby	Cheriyān, P.V. 1968
43		<i>Venerupis</i>	<i>macrophylla</i> Deshayes	Cheriyān, P.V. 1968
44		<i>Paphia</i>	<i>marmorata</i> (Reeve)	Cheriyān, P.V. 1968
45		<i>Paphia</i>	<i>malabarica</i> (Chemnitz)	Cheriyān, P.V. 1968
46		<i>Catylisia</i>	<i>opima</i> (Gmelin)	Cheriyān, P.V. 1968
47		<i>Circe</i>	<i>scripta</i> (Linne.)	Cheriyān, P.V. 1968
48		<i>Chione</i>	<i>tiara</i> (Dillwyn)	Cheriyān, P.V. 1968
49		<i>Pitar</i>		*
51		<i>Gafararium</i>		*
52		<i>Sunetta</i>	<i>scripta</i>	
53	Corbiculidae	<i>Villorita</i>	<i>cyprinoides</i> (Gray)	Cheriyān, P.V. 1968
54		<i>Geloina</i>	<i>bengalensis</i>	*
55	Mactridae	<i>Standella</i>	<i>pellucida</i>	Cheriyān, P.V. 1968
56	Donacidae	<i>Donax</i>	<i>spiculum</i> Reeve	Cheriyān, P.V. 1968
57		<i>Donax</i>	<i>incarnatus</i>	Ansell <i>et al.</i> 1972
58		<i>Donax</i>	<i>scortum</i>	*
59		<i>Donax</i>	<i>faba</i>	*
60	Psammobiidae	<i>Gari</i>	<i>psammobia ameythystus</i>	Cheriyān, P.V. 1968
61	Semelidae	<i>Theora</i>	<i>opalina</i> (Hinds)	Cheriyān, P.V. 1968
62	Tellinidae	<i>Tellina</i>	<i>rhodon</i> Hanley	Cheriyān, P.V. 1968
63		<i>Tellina</i>	<i>pinguis</i> Hanley	Cheriyān, P.V. 1968
64	Solenidae	<i>Solen</i>	<i>lamarckii</i> Deshayes	Cheriyān, P.V. 1968
65			<i>aquaedulcoris</i> (Ghosh)	Cheriyān, P.V. 1968
66	Gastrachaemidae	<i>Gastrachaena</i>	<i>gigantea</i> (Deshayes)	Appukuttan, K.K. 1973
67	Pholadidae	Pholas		Cheriyān, P.V. 1968
68		<i>Martesia</i>	<i>striata</i> (Linne.)	Cheriyān, P.V. 1968
69		<i>Pholas</i>	<i>orientalis</i> Gmelin	Cheriyān, P.V. 1968
70		<i>Jouannetia</i>	<i>cumingii</i> (Sowerby)	Appukuttan, K.K. 1973
71		<i>Jouannetia</i>	<i>globosa</i> (Quoy and Gaimard)	Appukuttan, K.K. 1973

* Personal observation / observation by Dr.K.K.Appukuttan, Head, MFD, CMFRI.

In Ashtamudi Lake and Chettuva estuaries also such zonation is evident, but dense populations of *Sunetta scripta* as observed in Vemanad Lake are absent. Species diversity has been found to be more in the Ashtamudi lake where in the estuarine beds other bivalves like *Anadara granosa*, *Arca spp.*, *Marcia opima* are seen along with oysters *Crassostrea madrasensis* and *Saccostrea cucullata* and the mussel *Perna virides*. The density of clams and the area inhabited by each group is determined mainly by the tidal influx and the nature of the estuarine substratum such as clayey, sandy or muddy. With regard to oysters, there are two main species viz., *Crassostrea madrasensis* and *Saccostrea cucullata* found in the upper intertidal communities. These two species also show a clear distribution/ zonation. *Saccostrea cucullata* forms more than 80% in the marine region of the estuary whereas the dominance of this species towards the interior declines slowly and in the upper reaches *Crassostrea madrasensis* forms homogenic populations. (Kripa and Salih, 1999).

The marine mussels had formed single species populations with green mussel in northern Kerala and brown mussel in southern Kerala. The distribution of brown mussel, which was restricted from southern parts of Tamil Nadu upto Kollam, has been found to extend upto Azhikode near Kochi (Appukuttan *et al.*, 2001). Similarly mixed populations were observed in southern Kerala near Vizhinjam where only the brown mussel was reported.

Bivalve resources of inter tidal shores

Along the Kerala coast, rocky and sandy shores are common. In addition to this, in areas where sea erosion is common during monsoon, granite boulders have been placed to prevent the destruction to the coastal areas. The bivalve resources in these areas are typical representatives of the tropical intertidal region. In such areas, the mussels *Perna viridis* and *P. indica* are commonly found. In the northern and southern regions of the State, mussel beds are perennial while in central Kerala, especially in locations having artificial sea walls, the mussel beds usually get destroyed as the sea recedes after monsoon. Oysters are also common in these regions but their contribution to the community is negligible. In Southern Kerala, especially near Vizhinjam, a rich bivalve resource with several species of Pteridae like *Pteria penuin*, *Pinctada fucata*, *P. sugillata* have been observed. Such species diversity is not seen in the rocky shores of northern Kerala. Similarly, on the sandy beaches *Donax* sp. is the main clam although other bivalves like *Arca*, *Sunetta*, *Gafraruim* are also common. Such species diversity based on habitat structure is seen along the coastal region.

Continental shelf

In the upper continental shelf where the substratum is hard, the mussels *Perna virides* or *Perna indica* are the dominant resource. In the soft bottom areas, other marine clams are known to occur (Table 1). These are landed by the trawlers as by-catch and are usually discarded as trash. Immediately after monsoon, huge quantities of dead shells of these stenohaline species accumulate near the sandy shores where they are fished and utilized as raw material for lime shell industry.

Information on the bivalves occurring in the hard bank near Kollam, and in the coral patches near Vizhinjam is scanty. Appukuttan (1973) has reported on the occurrence of four species of coral boring bivalves of three genera from Kollam area. Targeted faunal study about the resource of Cochin Harbour region has been done by Cheriyan (1968). Detailed information on the bivalve resource of shelf region of Kerala is not available.

Morphological diversity

In order to withstand the adverse physical / chemical / environmental conditions, bivalves inhabiting the estuaries as well as in sandy and rocky inter tidal zones have developed remarkable morphological features. The common feature of bivalves is the two shells and a soft body enclosed within a mantle. To facilitate burrowing and for circulating water, species like *Paphia malabarica* have well developed siphon and foot. The density of this species was found to be more than 1200 individuals per sq.m. indicating that they lay one above the other. In the same estuary, certain other species like *Meritrix casta* and *Villorita cyprinoides* have much lower density with less than 500 individuals per sq.m. also occur. In these species, the siphon and foot show reduction. Such variations have been observed in the clams of estuarine region as well.

In rocky areas also bivalves are the dominant species because of their special adaptations for attachment. In the sandy beaches of central Kerala where there is considerable erosion during monsoon and the intertidal beach area diminishes the zonation compresses during monsoon. In such locations, *Donax incarnates* exhibit strong tidal migration. Ansell *et al.* (1972) has observed that *D. incarnates* was able to keep pace with this erosion and formed a permanent element of the beach fauna. *D. spiculum* occurred only sporadically in the same beach.

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Genetic diversity

Though different species of bivalves' co exist, they remain as reproductively isolated populations. However, recently in addition to green and brown mussel, a third variety with light green colour periostracum and shell characteristics similar to brown mussel has been observed in the heterogeneous mussel populations in Kollam area. It is presumed that this is a hybrid of the green and brown mussel.

Conclusions

In Kerala, faunistic studies related to the bivalve resources have been negligible. The Central Marine Fisheries Research Institute, Cochin has been conducting a detailed survey of the estuaries with special emphasis on resource utilization and biology of the major species. The other research Institutes and Fisheries Colleges have given emphasis to pollution and bioaccumulation studies. A review of the literature on bivalve fauna has clearly indicated the need for quantitative and qualitative assessment of the resources. Recent studies have indicated that the estuarine area of Kerala has reduced from 2426km². to 652 km². due to serious alterations during the past 150 years through reclamation for agriculture and human settlement. This habitat shrinkage also calls for the need to keep record of the richness of the bivalve fauna of the State.