

ZONATION OF MOLLUSCAN ASSEMBLAGE AT KAVARATTI ATOLL (LACCADIVES)

P. N. NAMBOODIRI AND P. SIVADAS

Regional Centre, National Institute of Oceanography, Cochin-682 018

ABSTRACT

Four major biomorphological zones were identified on Kavaratti Atoll for molluscan assemblage. While 45 species were found in the intertidal rocky shore, the inner reef platform had 28, the lagoon floor 19 and the intertidal sandy beach only one. It was observed that functionally similar but unrelated species lived together in the same habitat. The species were grouped according to their dietary habits.

INTRODUCTION

Important contributions on coralline ecology have come from Tulcar, Malagasy (Pichon, 1964; Pichon, 1967; Plante, 1964; Derijard, 1965; Thomassin, 1969). Similar investigations have been carried out at Mauritius (Baissac, Lupet and Michel, 1962; Hodgkin and Michel, 1963), Maldives and Chagos (Kohn, 1968) and Aldabra (Taylor, 1971). Gardiner (1906) has given an account of the fauna of Maldives and Laccadive Archipelago. However, the information available about the zonation pattern of molluscan assemblage in coralline environment is too limited to attempt any ecological generalization (Taylor, 1971). This paper provides a preliminary account on the zonal distribution of molluscs on Kavaratti atoll.

MATERIAL AND METHODS

The classification of the zones followed here is broadly based on the procedure given by Taylor (1971). Four major biomorphological zones have been dealt with in the present study, viz. (1) sandy beach, (2) lagoon floor, (3) intertidal rocky shore and (4) inner reef platform (Fig. 1). These zones have different ecological conditions and are described separately. Observations were made both during high and low tides. Benthos were collected from selected stations using "Peterson's Grab". The samples were sorted and the specimens identified, classified and grouped according to their habits and habitat.

RESULTS

Zonation

1. *Sandy beach*: This zone lies on the western side of island and extends upto a distance of about 6-7 m during the lowest low tide. The beach is composed of sand grains of coralline origin. This zone is protected from severe wave action and the fury of monsoon by an extensive coral reef. Decaying *Thalassia* sp. and *Cymodocea* sp. are seen washed ashore and buried in sand.

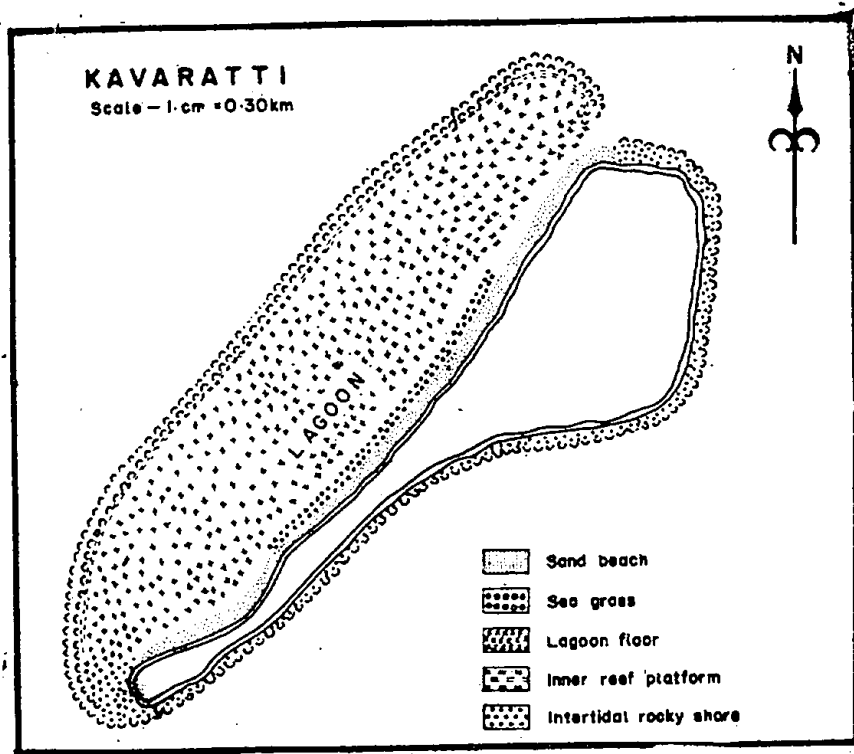


Fig. 1. Major biomorphological zones on Kavaratti Atoll.

2. *Lagoon floor*: This zone comprises the entire lagoon floor and has scattered live corals and grass bed consisting of *Thalassia* and *Cymodocea* species which extends from the eulittoral to the sublittoral zones. The rest of the area has fine to coarse coral sand and a occasionally large coral boulder.

3. *Intertidal rocky shore*: An area with hard substratum at the eastern side of the island, including parts of northern and southern points. The littoral and sublittoral zones of this area are rocky with coral boulders and live corals.

4. *Inner reef platform*: This zone is on the lagoon side of the reef and is partly exposed during the low tide and gets protected from the heavy swells. It has a large amount of dead coral debris and boulders. There are, however, a few live corals.

Zonal distribution (Table I)

1. *Sandy beach*: The molluscan fauna on the beach was scanty and was represented by one bivalve only, viz. *Mesodesma glabratum*. Such a poor representation of molluscs in the beaches is well documented in the literature. On many beaches molluscs are not represented at all (Taylor, 1971). On Aldabra (Taylor, 1971) and on Diego Garcia (Stoddart and Taylor, 1972) the bivalve *Atactodea glabrata* is the only inhabitant of beaches. Similarly from Inhaca, Macnae and Kalk (1962) have recorded only *Donax faba*.

2. *Lagoon floor*: The inhabitants of this area were mostly gastropods. Since this zone includes both algal and non-algal areas, animals of various feeding habits were found. *Cypraea moneta* and *C. tigris* were frequently seen grazing on sea grasses. Cones such as *Conus marmoreus*, *C. frigidus* and *C. coronatus* were comparatively abundant in the non-algal zone. *Cerethium morus*, *Euchelus asper*, *Duplicaria*

duplicata, *Terebra* sp. and *Turbo intercostalis* were frequently seen. *Natica* sp. was quite common in the lagoon floor. A few benthic gastropods which were collected using a grab were *Cylinchna protracta*, *Pupa solidula* and *Acteocina townsendi*. The giant clam *Tridacna cumingii* was seen byssated in the crevices of coral boulders. *Lima lima* and *Beguina variegata*, though less common, were generally attached to the corals. *Bullia tranquebarica*, a poorly known form was seen buried in the sandy areas of the lagoon. This species has not been previously reported from any of the islands of the Indian Ocean excepting south of Madagascar although it is widely distributed in continental margins from Cape of Good Hope to Burma (Taylor, 1971).

3. *Intertidal rocky shore* : This zone can be subdivided into two areas. One area faces severe wave action and lies partly on the eastern side and partly on the northern side. The other is on the southern tip, which due to the extension of the reef, faces comparatively lesser wave action.

Low coralline island usually has low beach rock exposures available for colonisation and this frequently gets covered with sand (Taylor, 1971). Only during the neap tides considerable area of the eulittoral zone is exposed. The littoral fringe is crowded with coral boulders of various sizes. These are covered by algal film on which many gastropods feed. This zone gets submerged during high tide and has mostly gastropods such as *Nerita plicata*, *N. albicilla*, *Littorina scabra*, and the pulmonate *Siphonaria stellata*. Slightly lower down the zone where *Nerita* sp. occurs, the oyster *Crassostrea cucullata* is seen attached to coral boulders.

The eulittoral zone has an extensive live coral bed except in the southern tip where coral growth is scattered. This zone gets exposed only for a short time during the lowest low tide and here species diversity was found to be remarkably high. Vasseur (1964) has described a similar high species diversity at the upper part of the sublittoral zone at Tulear.

Molluscs observed on coral boulders and on living corals both on the upper or open side and on the lower or in the shaded sides were remarkably specific in their distribution. Some species like *Drupa tuberculata* and *D. horrida* were seen attached to the shaded (inner) side of the boulders. *Thais tissoti* and *T. rudolphi* were seen on the exposed (upper) side of the boulders. *Murex adustus* was seen on the sea floor. *Cypraea talpa*, *C. caputserpentis*, *C. maculifera* and *C. tigris* were often seen on the sea floor underneath the coral stones. *Conus coronatus*, *C. betulinus*, *C. pennaceus*, *C. marmoreus*, *C. frigidus* and *C. piperatus* were the common cones seen in this zone. *Vassum* sp., *Strombus gibberulus*, *S. canarium*, *Planaxis sulcatus*, *Engina zonata*, *E. trifasciata*, *Cerethium morus*, *Euchelus asper*, *Duplicaria duplicata*, *Terebra* sp. and *Turbo intercostalis* were the other gastropods frequently seen in the area. Among the bivalves, *Arca complanata*, *Beguina variegata* and *Gafrarium* sp. were found to be widely distributed. *Tridacna cumingii* was seen among the crevices of coral boulders.

4. *Inner reef platform* : Topographically this zone is almost similar to the intertidal rocky shore. Living corals were considerably less in number probably because the reef is somewhat raised and gets exposed for a considerably long time during the low tide. The reef is extensive and slopes down into the lagoon gradually.

Table I. Distribution of molluscan species according to their habitat.

Sandy Beach 1	Lagoon floor 2	Intertidal rocky shore 3	Inner reef platform 4
<i>Mesodesma glabratum</i> Lamk.	<i>Cypraea moneta</i> Linné <i>C. trigris</i> Linné <i>Conus marmoreus</i> Linné <i>C. betulinus</i> Linné <i>C. coronatus</i> Dillwyn <i>C. frigidus</i> <i>Cerethium morus</i> Lamarck <i>Euchelus asper</i> (Gmelin) <i>Acteocina townsendi</i> (Melvill) <i>Duplicaria duplicata</i> (Linné) <i>Terebra</i> sp. <i>Turbo intercostalis</i> Menke <i>Natica</i> sp. <i>Tridacna cumingii</i> Reeve <i>Begonia variegata</i> Bruguiere <i>Bullia tranquebarica</i> (Roding) <i>Lima lima</i> (Linné) <i>Pupa solidula</i> (Linné) <i>Cylinca protracta</i>	<i>Littorina scabra</i> Linné <i>Nerita plicata</i> Linné <i>N. albicilla</i> Linné <i>N. maura</i> Recluz <i>N. polita</i> Linné <i>N. rumphii</i> Recluz <i>Siphonaria stellata</i> (Helbling) <i>Crassostrea cuculata</i> (Born) <i>Yassum</i> sp. <i>Thais rudolphi</i> (Lamarck) <i>T. tissoti</i> (Petit) <i>Conus marmoreus</i> Linné <i>C. betulinus</i> Linné <i>C. piperatus</i> Dillwyn <i>C. ebraeus</i> Linné <i>C. pennaceus</i> (Born) <i>C. coronatus</i> Dillwyn <i>C. obscurus</i> Sowerby <i>C. frigidus</i> <i>Strombus canarium</i> Linné <i>Cerethium morus</i> (Lamarck) <i>Euchelus asper</i> (Gmelin) <i>Duplicaria duplicata</i> (Linné) <i>Terebra</i> sp. <i>Strombus gibberulus</i> Linné <i>Planaxis sulcatus</i> (Born) <i>Engina zonata</i> (Reeve) <i>E. trifasciata</i> (Reeve) <i>Arca complanata</i> Chemnitz <i>Gafrarium</i> sp. <i>Begonia variegata</i> Bruguiere <i>Drupa horrida</i> (Lamarck) <i>D. tuberculata</i> (Blainville) <i>Peristernia pulchella</i> (Reeve) <i>Murex adustus</i> Lamarck <i>Cypraea talpa</i> Linné <i>C. caputserpentis</i> Linné <i>C. tigris</i> Linné	<i>Trochus stellatus</i> Gmelin <i>Tridacna cumingii</i> Reeve <i>Cerithium obeliscus</i> Bruguiere <i>Strombus canarium</i> Linné <i>S. gibberulus</i> Linné <i>Drupa horrida</i> (Lamarck) <i>D. tuberculata</i> (Blainville) <i>Thais tissoti</i> (Petit) <i>T. rudolphi</i> (Lamarck) <i>Cypraea tigris</i> Linné <i>C. caputserpentis</i> Linné <i>C. maculifera</i> Schilder <i>C. talpa</i> Linné <i>Murex adustus</i> (Lamarck) <i>Conus betulinus</i> Linné <i>C. ebraeus</i> Linné <i>C. coronatus</i> Dillwyn <i>C. obscurus</i> Sowerby <i>C. frigidus</i> <i>Peristernia pulchella</i> (Reeve) <i>Pterocera chiragra</i> (Linné) <i>Arca complanata</i> Chemnitz <i>Gafrarium</i> sp. <i>Begonia variegata</i> Bruguiere <i>Asteronotus caespitosus</i> (Van Hasselt) <i>Phyllidia varicosa</i> (Lamarck) <i>P. zeylanica</i> Kelaart <i>Oncidium</i> sp.

4

3

2

C. maculifera Schilder
Trochus stellatus Gmelin
Turbo intercostalis Menke
Mitra sp.
Oncidium sp.
Tridacna cumingii Reeve
Pyrene versicolor (Sowerby)

28

45

19

Table II. Distribution of molluscan species according to their feeding habits

Grazers	Suspension Feeders	Filter feeders	Polychaeta Feeders	Bivalve Feeders	Limpet Feeders	Scavenger	Gastropod Feeders
<i>Cypraea talpa</i>	<i>Tridacna cumingii</i>	<i>Crassostrea</i>	<i>Conus frigidus</i>	<i>Natica</i> sp.	<i>Thais</i>	<i>Bullia iran-</i>	<i>Mitra</i> sp.
<i>C. caputserpentis</i>	<i>Arca complanata</i>	<i>cuculata</i>	<i>C. coronatus</i>	<i>Murex</i>	<i>tissoii</i>	<i>quebarica</i>	
<i>C. tigris</i>				<i>adustus</i>			
<i>C. moneta</i>							
<i>C. maculifera</i>							
<i>Cerethium morum</i>							
<i>Nerita albicilla</i>							
<i>N. plicata</i>							
<i>N. maura</i>							
<i>N. rumphi</i>							
<i>Siphonaria stellata</i>				<i>Vassum</i> sp.	<i>T. rudolphi</i>		
<i>Littorina scabra</i>				<i>C. betulinus</i>			
<i>Strombus canarium</i>				<i>C. ebraeus</i>			
<i>S. gibberulus</i>				<i>C. piperatus</i>			
<i>Planaxis sulcatus</i>				<i>C. pennaceus</i>			
<i>Drupa horida</i>				<i>C. obscurus</i>			
<i>D. tuberculata</i>							
<i>Peristernia pulchella</i>							
<i>Pterocera chiragra</i>							
<i>Trochus stellatus</i>							
<i>Duplicaria duplicata</i>							
<i>Turbo intercostalis</i>							
<i>Engina zonata</i>							
<i>E. trifasciata</i>							
<i>Pyrene versicolor</i>							
<i>Euchelus asper</i>							

The large number of coral stones provide protection for the animals which are less resistant to intense wave action, bright light and high temperature.

The fauna was comparatively rich and had a close similarity with the fauna of the intertidal rocky shore. *Trochus stellatus*, *Cerethium obelicus*, *Strombus canarium*, *S. gibberulus*, *Cyprea tigris*, *C. maculifera*, *C. caputserpentis*, *C. talpa*, *Drupa tuberculata*, *D. horrida*, *Thais tissoti*, *T. rudolphi*, *Conus betulinus*, *C. ebraeus*, *C. coronatus*, *C. obscurus*, *C. frigidus*, *Peristernia pulchella* and *Pteracera chiragra* were the gastropods generally seen. In the crevices of the coral stones, as in the intertidal rocky shore, *Tridacna cumingii* was seen byssated. In addition, a few bivalves such as *Beguina variegata*, *Gafrarium* sp., *Arca complanata* were also observed. *Opisthobranch*, *Oncidium* sp. were also frequently present.

Apart from these, three nudibranchs, *Asteronotus caespitosus*, *Phyllidia varicosa* and *P. zeylanica* recently reported by Rao, Sivadas and Krishna Kumari (1974) from Kavaratti island were collected from the inner reef platform.

DISCUSSION

At Kavaratti, species diversity of molluscs was found to be maximum in the intertidal rocky shore. When 45 species were found in the intertidal rocky shore, inner reef platform had 28 species, the lagoon floor 19 and the intertidal sandy beach had only one. This observation corroborates well with the findings of Vasseur (1964) and Taylor (1971). Taylor (1971) noted that the high species diversity in the seaward edge of the reef platforms is due to high rate of water change, high rate of oxygenation and low insolation. This is also applicable to the intertidal rocky shore since this zone is also exposed to open sea. Availability of food and space is another reason for the high species diversity in this region. The inner reef platform which biomorphologically is almost similar to the intertidal rocky shore had the next high species diversity. Excepting the species of the littoral fringe such as *Nerita* and *Siphonaria*, most of the grazers found in the intertidal rocky shore were seen in the inner reef platform.

Although species of almost all types of feeding habits were observed, grazers were dominant numerically (Table II). There were altogether 26 grazers. It was also observed that functionally similar but unrelated species lived together in the same habitat. Although neritids and siphonarids belonged to two different groups, they were found to co-exist in the same zone possibly because they both grazed on algae. A similar situation has been reported from the rocky intertidal shore of Aldabra (Taylor, 1971).

Besides grazers, the next major group observed was polychaete-feeders belonging to the genus *Conus*. These were *Conus coronatus*, *C. frigidus*, *C. betulinus*, *C. ebraeus*, *C. piperatus*, *C. pennaceus* and *C. obscurus*. The common polychaetes observed here were *Eurythoe* sp., *Glycera* sp., *Perinereis* sp., *Nereis* sp. and *Sabella* sp. Only four *Conus* species were found on the lagoon floor. The polychaete fauna in the lagoon was rich and *Nereis* sp., *Phyllodoce* sp., *Eunice* sp., *Syllis* sp., etc., were very abundant.

A few bivalve - feeders such as *Natica* sp., *Murex adustus*, and *Vassum* sp. were seen in the rocky areas. The last species was seen on the inter tidal rocky shore and *M. adustus* on the inner reef platform. *Natica* occurred in the lagoon and fed on the soft part of its prey by boring. Though the bivalve fauna was comparatively rich, the predators on them were rather poorly represented.

Only one gastropod feeder *Mitra* sp. and two limpet feeders, *Thais tissoti* and *T. rudolphi* were recorded. The scavenger *Bullia tranquebarica* thrived well on the abundantly present dead and decayed organic matter in the lagoon.

Poor representation of molluscan fauna in the sandy beach, with the exception of only one suspension feeder *Mesodesma glabratum* may be due to increased exposure of beach as suggested by Gauld and Buchanan (1965) and Ansell, Sivadas, Narayanan, Sankaranarayanan and Trevallion (1972) in tropical areas and McIntyre (1970) for the temperate regions.

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