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Coral reef associated gastropods in Tuticorin coast of Gulf of Mannar biosphere reserve, India

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Abstract

Coral reef associated gastropods diversity study was undertaken in Tuticorin group of islands (Hare, Vaan and Koswari). Underwater survey was made in three quadrants (10 sq.m) in each site. A sum of 40 species of gastropods were recorded from the study area. Most of the species are commonly found in three islands. Twelve were rare viz., *Ficus ficus, Colubraria muricata, Casmaria erinaceus, Natica didyma, Nerita polita, Rapana bulbosa, Purpura rudolphi, Strombus* sp., *Architectonica perspectiva*, *Cypraea tigris, Cymatium lotorium and Haustellum haustellum* were reported form the study area. Species diversity and richness were found to be higher in the Vaan island.

Keywords: Mannar biosphere reserve, India, biodiversity, fauna, conservation, Tamil nadu, coral reef, gastropods

Introduction

India has coral reef ecosystem which confined mainly in four places namely Gulf of Mannar, Gulf of Kutch, Palk Bay and Andaman and Nicobar and Lakshadweep area. The total area of coral reef ecosystem is 2,375 sq.km in which Gulf of Mannar is the most protective system covers about 10,500 sq.km, having great diversity in the form of flora and fauna. It comprises a chain of 21 tiny islands that lie between Tuticorin to Rameswaram of Tamil Nadu South East coast of India. It is situated between latitude 8˚47' to 9˚15'N and longitude 78˚12' to 79˚14'E and is a part of Mannar barrier reef which is 140 km and 25 km wide between Pamban and Tuticorin. The shallow sea with less waves make the area more protective Corel reef found in this region that provides shelter, shade and food to the many organisms and it also attracts the migration of organism towards the coast. As a result many organisms are associated with coral reefs and sea grass bed of this area. The islands area harbor 104 species of hard corals, 13 species of sea grasses which are supporting population of Green and Olive-ridley turtle, Dugongs, 450 species of fishes, 79 species of crustaceans, 99 species of echinoderms, 108 species of sponges and 484 species of molluscs (Melkani *et al.,* 2007; Kannaiyan & Venketraman, 2008). Due to its rich and diverse marine organism it is declared as India's first Marine National and Marine Biosphere Reserve in 1980s (Melkani *et al.,* 2007). Among the reef associated, gastropods are also abundantly found in this area and form major members in the marine food web. Apart from that they are one of the commercially important organisms exploited from the coast for food, extraction of lime, preparation of ornamental goods and it also serves as medicine to some extent. In addition to that various destructive fishing operations in the shallow coastal region on these species make facing severe threats. As a result many of the species listed in the scheduled species of Indian Wildlife Protection Act (Patterson *et al.,* 2004; Melkani *et al.,* 2007). First account on marine gastropods of Gulf of Mannar was reported by Melvill and Stander (1878). Recently, Subba Rao (2003) has compiled detailed information on gastropod resources and identification keys in Gulf of Mannar region. So far about 484 species of molluscs were reported from this region, out of which 260 species are gastropods (Melkani *et al.,* 2007; Kannaiyan & Venketraman, 2008). Conservation and management of gastropod species in the Gulf of Mannar region need a detailed inventory on current diversity, distribution patterns along the coastal regions. Present study is part of the ongoing research programme on conservation and sea ranging of important gastropod species in the Tuticorin group of islands.

Materials and methods

The present study area was confined in Hare, Vaan and Koswari islands of Tuticorin group of islands. Each study area was divided in to four quadrants (10 sq.m) about 0.5 Km away from the coast at coral reef area. Under water observation was made in all quadrants by four persons. The samples were mainly collected by hand picking based on one time sampling during low tide period (Plate 1). Apart from that samples have also been collected from crab net, trawl net, thallumadi etc. from regular fish landings. The data obtained from quadrat methods and fish landing were pooled in respective area, the data were used for gastropod richness in the coast of Tuticorin. The samples were brought to the laboratory and they were rinsed, adhering debris removed and sorted out species and then transferred to 4% formalin. Identification of gastropods was done according to descriptions of Ramesh *et al.* (2002). The data were subjected to Shannon diversity and Jaccard similarity

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measures to find out diversity and similarity in faunal assemblage in four stations (Ajmal-Khan, 2005).

1. Shannon diversity index

$H' = -\Sigma i\ pi \log(pi)$

Where pi = the proportion of individual (n/N).

2. Jaccard`s similarity index

$J = 2c/a+b$

Where a = No. of species in site 'a'

b = number of species in site 'b'

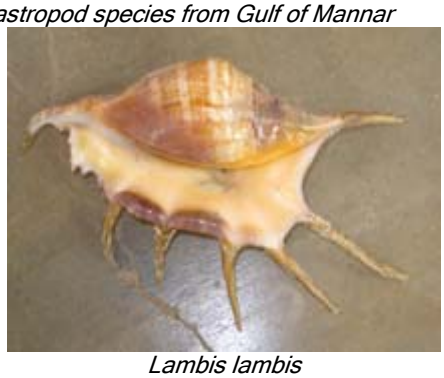
c = common species in both 'a' & 'b'

Results and discussion

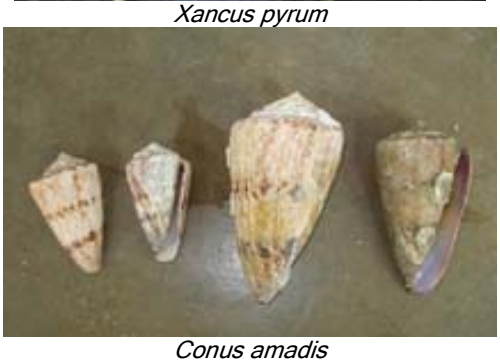
In the present study 40 species of gastropods were recorded (Table 1). Most of the species are commonly found in all the study areas except *Distorsio anus* which is found only in Vaan island. The species *Ficus ficus, Colubraria muricata, Casmaria erinaceus, Natica didyma, Nerita polita, Rapana bulbosa, Purpura rudolphi, Strombus* canarium., *Architectonica perspectiva*, *Cypraea tigris, Cymatium lotorium and Haustellum haustellum* ware rare to Gulf of Mannar region. Among the species, *Lambis lambis* and *Trochus niloticus* are listed in scheduled list of Wildlife Protection Act (Melkani *et al.,* 2007). Even though, these species are heavily exploited from this region mainly for ornamental values of the shells and this area is the major source, which supplies these shells for the entire country. Considerably good number of individuals was recorded form the present study (Table 1) indicating this area to harbor the scheduled species. Rare and economically important species are given in Plate 1 and they are mostly used for ornamental fish industries. High species diversity was recorded in Vaan island, the Shannon index was 1.4 (Fig. 1). The major reason is that, ecologically this island has a combination of sea grass bed, sandy bottom and very good coral reef cover, which might be the attraction for more species. Based on the Jaccard similarity analysis, all having common faunal assemblages and Vaan and Koswari have more similar faunal assemblage (Table 2). Since these islands are spatially very closer to each other and similar environmental conditions might be explained for such similarity of faunal assemblages. Based on 1950s report, there were 450 species of gastropods from Gulf of Mannar region and the recent report indicated that only 354 species in the same region (Samuel *et al.,* 2005).

Plate 1. Rare and economically important gastropod species from Gulf of Mannar

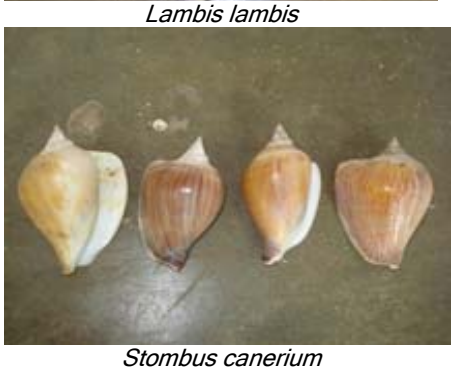
Xancus pyrum



Lambis lambis

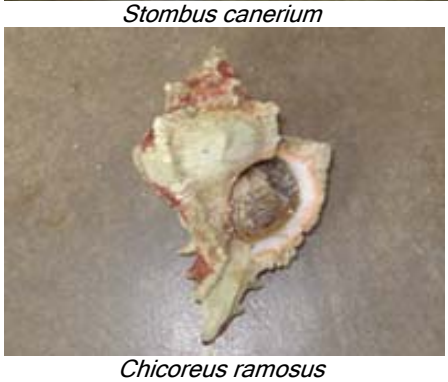


Conus amadis



Stombus canerium

Murex trapa



Chicoreus ramosus

This reduction in gastropod diversity clearly indicates that they are being commercially exploited for various purposes such as ornamental, medicine, food as well as industrial uses.

For the conservation and sustainable fishery of marine gastropods in Gulf of Mannar Biosphere Reserve, complete knowledge on biology and distribution is essential. Since most of the marine gastropods are very closely associated with coral reef ecosystem either for food, shelter or reproduction, it is utmost important to save the coral reef ecosystem which in turn conserves the gastropods. The exact biology of most of the gastropods except few, their role and relation to the food chain or food web, how the depletion affects the other species is not yet clearly known. Therefore, the species which are already in the list of endangered and threatened species or fall under the Wildlife Protection Act need special attention. Strict rules and regulation should be applied so such species will be protected from extinct. Scientific technologies have been innovated for the conservation and enhancement of natural stocks such as transplantation and sea ranching. Transplantation is

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cost effective but it is hard to find out the brood stock of a particular species and its further impacts on the other systems on that particular area. *In situ* conservation coupled with artificial breeding can be helpful.

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Table 1. List of gastropod species recorded from the study area

Name of the species	Hare Island	Vaan Island	Koswari Island
Architectonica perspective	1	2	1
Pleuroploca trapezium	4	6	9
Duplicata duplicata	3	6	5
Cantharus undosus	5	4	6
Casmaria erinaceus	2	1	1
Chicoreus ramosus	13	12	13
Colubraria muricata	1	1	2
Conus amadis	4	4	3
Cymatium lotorium	0	2	1
Cypraea annulus	13	23	20
Cypraea caurica	12	22	19
Cypraea labrolineata	10	15	13
Cypraea miliaris	9	13	11
Cypraea moneta	12	25	23
Cypraea teres	16	13	14
Cypraea tigris	0	4	1
Distorsio anus	0	3	0
Ficus ficus	2	1	2
Harpa sp.	1	2	2
Haustellum haustellum	1	1	2
Hemifusus pugilinus	20	26	23
Lambis lambis	12	28	21
Murex trapa	30	47	43
Murex tribulus	28	37	32
Nassarius papillosus	0	8	6
Natica didyma	2	1	1
Nerita polita	12	1	0
Oliva aurula	1	2	2
Phos senticosus	4	11	8
Polinices aurantius	3	14	9
Polinices pyriformis	7	13	9
Purpura rudolphi	1	2	1
Rapana bulbosa	1	1	1
Strombus canarium	1	2	1
Tectarium radiates	0	2	1
Trochus radiatus	28	56	43
Turbo niloticus	22	48	46
Umbonium sp.	12	17	15
Vasum ceramicum	15	3	2
Xancus pyrum	2	5	4

Fig. 1. Shannon diversity of Hare, Vaan and Koswari islands

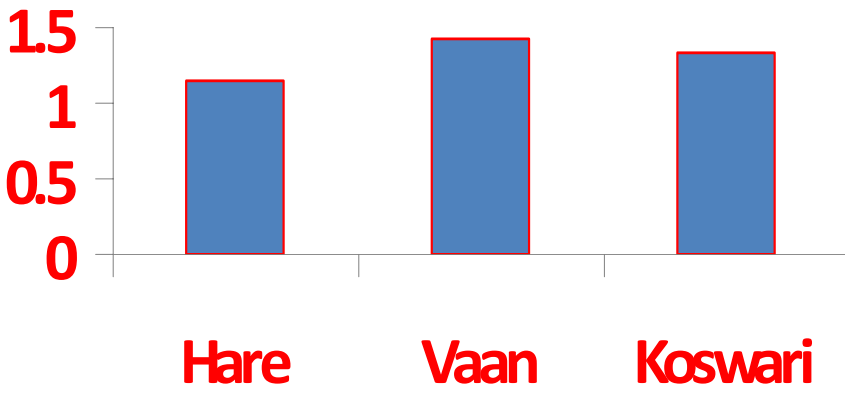

Table 2. Similarity index between the study area

	Hare	Vaan	Koswari
Hare	0	0.93	0.93
Vaan		0	0.97
Koswari			0