

Diversity of Marine Mollusca in Gulf of Kachchh, Gujarat

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ABSTRACT

The Gulf of Kachchh is bestowed with diverse array of habitats like coral reef, rocky coast, mangrove, sandy coast. The present study focused on three sites i.e., Poshitra, Pirotan and Narara, in the Gulf of Kachchh. Molluscs are commonly well distributed in mangrove patches, rocky coast and coral reefs. During the present study, fifty-four species of Mollusca belonging to four classes were recorded. It includes forty-five gastropod species, seven bivalve species, one cephalopod species and one Polyplacophora species.

Keywords Gulf of Kachchh, Mollusca, Gastropod, Bivalve, Cephalopod.

INTRODUCTION

The mollusc is an extraordinarily varied phylum with estimates of 80,000-1,00,000 described species (Strong et al. 2008). All major groups of molluscs have marine representatives and many are exclusively marine (Petercastro and Michael 2003). It evolved about 600 million years ago during the Cambrian

period. Molluscs exhibit wide range of diversity such as slugs, muscles, octopus and snails. Generally, the mollusc are known by their shell, though the shell may be absent in some mollusc species. The Indian coasts show occurrence of 3370 marine mollusc species (Venkataraman and Wafar 2005). While in Gujarat, a total of 395 species of gastropods belonging to 87 families and 199 genera are recorded (Viswanathan et al. 2017). Molluscs show significant commercial as well as medicinal value. It provides livelihood to millions of peoples. Still, a number of studies are going on regarding various aspects of marine molluscs. The organisms of this phylum can live in varied environments of the sea including the rocky shores, sandy beaches, mudflats, mangroves, coral reefs and sea grasses (Ramakrishna 2010). Several species are used in traditional medicines in different part of the world. Various body parts of mollusc such as shells, soft tissues, even entire organism has been traditionally used as medicine for cancer, dotage, inflammation and other diseases (Chakraborty et al. 2009, Kehinde et al. 2015). Gastropods and bivalves are among the most fascinating classes of molluscs. Both classes have high economic importance and hence are widely cultivated. Pearl oyster culture, as well as pearl farming, is a multi-million dollar industry (Chalermwat et al. 2003, Caturano et al. 1988, Gervis and Sims 1992).

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Study area

Gulf of Kachchh (GoK) is famous for its uniqueness,

Table 1. Diversity indices.

Sites	Domi- nance	Simp- son	Shan- non	Even- ness
Poshitra	0.06	0.93	3.2	0.59
Narara	0.71	0.28	0.80	0.11
Pirotan	0.24	0.75	1.8	0.61

coral reefs, sandy shores, mudflats, mangroves. All such geographic and environmental conditions give rise to mosaics of habitats. For the present study, three sites viz. Poshitra, Pirotan, Narara were selected. These sites fall under Marine National Park and Sanctuary. The total area of MPA is 620.81 km², which includes a 148.92 km² area of islands and 309.02 km² of the intertidal zone along the coast.

MATERIALS AND METHODS

The study was carried out during low tide, when most of the reef area gets exposed. The part of micro-habitat survey such as mangroves, coral reef, sandy coast, rocky coast, crevices, muddy, were surveyed. All molluscs were observed properly for systematic classification. Identification was done through identification manuals, reports and with the assistance of

Table 2. Checklist of Mollusca.

Class	Order	Family	Species
Gastropoda	Neogastropoda	Muricidae	<i>Purpura bufo</i> (Lamarck, 1822)
			<i>Purpura panama</i> (Röding, 1798)
			<i>Menathais intermedia</i> (Kiener, 1836)
			<i>Chicoreus maurus</i> (Broderip, 1833)
			<i>Murex ternispina</i> (Lamarck, 1822)
			<i>Murex</i> sp.
			<i>Conus</i> sp.
			<i>Pollia undosa</i> (Linnaeus, 1758)
			<i>Engina zea</i> (Melvil, 1893)
			<i>Strigatella scutulata</i> (Gmelin, 1791)
Gastropoda	NIL	Mitridae	<i>Scabricola guttata</i> (Swainson, 1824)
			<i>Nassarious</i> sp.
			<i>Nassarious olivaceus</i> (Bruguere, 1789)
			<i>Tibia curta</i> (G. B. Sowerby II, 1842)
			<i>Tibia insulaechorab</i> (Röding, 1798)
			<i>Echinolittorina pascua</i> (Rosewater, 1970)
			<i>Cerithium caeruleum</i> (G. B. Sowerby II, 1855)
			<i>Clypeomorous bifasciata</i> (G. B. Sowerby II, 1855)
			<i>Cerithium</i> sp.
			<i>Cerithium coralium</i> (Kiener, 1841)
Gastropoda	Littorinimorpha	Rostellariidae	<i>Tibia curta</i> (G. B. Sowerby II, 1842)
			<i>Tibia insulaechorab</i> (Röding, 1798)
			<i>Echinolittorina pascua</i> (Rosewater, 1970)
			<i>Cerithium caeruleum</i> (G. B. Sowerby II, 1855)
			<i>Clypeomorous bifasciata</i> (G. B. Sowerby II, 1855)
			<i>Cerithium</i> sp.
			<i>Cerithium coralium</i> (Kiener, 1841)
			<i>Cerithium</i> sp.
			<i>Cerithium</i> sp.
			<i>Cerithium</i> sp.
Gastropoda	Caenogastropoda	Cerithidae	<i>Cerithium</i> sp.
			<i>Cerithium</i> sp.
			<i>Cerithium</i> sp.
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			<i>Cerithium</i> sp.

reference books (Apte 2014). For detailed classification, World Register of Marine Species website was consulted. Transect method and quadrature methods were utilized for population ecological surveyed. The present study involves survey of benthic molluscs that includes some benthic sessile animals as well as some of the creeping creatures. Therefore, the method adopted was line transect along with quadrates at regular interval in order to cover benthic sessile animals. The quadrates of 1 × 1 m size were laid along the transect line at the interval of 20 m on the coastal area, in order to assess the benthic or bottom dwelling life forms. The data of the quadrature survey were recorded in pre-designed quadrature datasheet. The results of the quadrature survey has brought forth the observations of occurrence of biodiversity along the transect line. Nadir photography and geo-coordinates of the quadrates were recorded.

RESULTS AND DISCUSSION

The mollusc diversity at three sites viz. Poshitra, Narara and Pirotan, was recorded with 42, 20 and 9 species, respectively. During the present study 54 species of Mollusca belonging to Gastropoda (45), Bivalva (7), Cephalopoda (1) and Polyplacophora (1) were observed (Tables 1 and 2). *Octopus vulgaris*,

Table 2. Continued.

Class	Order	Family	Species
	Neogastropoda	Columbellidae	<i>Anachis terpsichore</i> (G. B. Sowerby II, 1822)
		Columbellidae	<i>Zafra atrata</i> (Gould, 1860)
	Littorinimorpha	Littorinidae	<i>Littoraria scabra</i> (Linnaeus, 1758)
	Caenogastropoda	Potamididae	<i>Telescopium telescopium</i> (Linnaeus, 1758)
	Caenogastropoda	Potamididae	<i>Pirenella cingulata</i> (Gmelin, 1791)
	Caenogastropoda	Planaxinae	<i>Planaxis sulcatus</i> (Born, 1778)
	Cycloneritimorpha	Neritidae	<i>Nerita albicilla</i> (Linnaeus, 1758)
		Neritidae	<i>Nerita chamaeleon</i> (Linnaeus, 1758)
		Neritidae	<i>Nerita balteata</i> (Reeve, 1855)
		Neritidae	<i>Nerita litterata</i> (Gmelin, 1791)
		Patellidae	<i>Scutellastra flexuosa</i> (Quoy & Gaimard, 1834)
	Systellommato- morpha	Onchididae	<i>Peronia verruculata</i> (Cuvier, 1830)
	Anaspidea	Aplysiidae	<i>Aplysia oculifera</i> (A. Adams & Reeve, 1850)
	Sorbeoconcha	Turritellidae	<i>Turritella</i> sp.
	Placobranchidae	Sacoglossa	<i>Elysia tomentosa</i> (K. Jensen, 1997)
	NIL	Turbinidae	<i>Lunella coronata</i> (Gmelin, 1791)
		Turbinidae	<i>Astralium stellare</i> (Gmelin, 1791)
		Turbinidae	<i>Turbo bruneus</i> (Roding 1798)
		Turbinidae	<i>Turbo intercostalis</i> (Menke, 1846)
		Turbinidae	<i>Lunella</i> sp.
		Trochidae	<i>Umbonium vestiarium</i> (Linnaeus, 1758)
		Trochidae	<i>Rochia nilotica</i> (Linnaeus, 1767)
		Trochidae	<i>Trochus radiatus</i> (Gmelin, 1791)
		Nacellidae	<i>Cellana radiata</i> (Born, 1778)
		Chilodontidae	<i>Euchelus asper</i> (Gmelin, 1791)
Bivalva	Cardiida	Cardiidae	<i>Vasticardium flavum</i> (Linnaeus, 1758)
	Venerida	Veneridae	<i>Sunetta effossa</i> (Hanley, 1843)
		Veneridae	<i>Sunetta scripta</i> (Linnaeus, 1758)
	Pectinida	Placunidae	<i>Plecenta plecenta</i>
	Pectinida	Placunidae	<i>Placuna placenta</i> (Linnaeus, 1758)
	Ostreidae	Pinnidae	<i>Pinna bicolor</i> (Gmelin, 1791)
Cephalopoda	Octopoda	Octopodidae	<i>Zea mussels</i>
Polyplacophora			<i>Octopus vulgaris</i> (Cuvier, 1797)
			<i>Chiton</i> sp.

the only species representing class cephalopod was found at Narara as well as Pirotan. While *Chiton* sp., the only species representing class Polyplacophora was found at Poshitra.

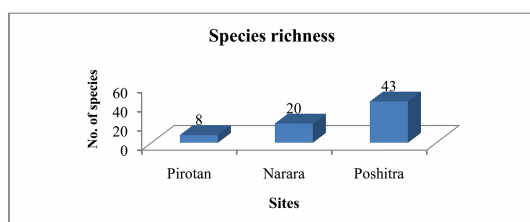


Fig. 1. Species richness of Mollusca.

Species richness

The highest species richness was recorded at Poshitra (43) followed by Narara (20) and Pirotan (8) as shown in Fig. 1.

Similarity index

Similarity index was carried out by PAST (Paleontological statistics) software using the Bray- Curtis similarity index. The highest species similarity was observed between Narara and Pirotan showing about 48% of species similarity (Fig. 2).

The commonness of mollusc species is attributed

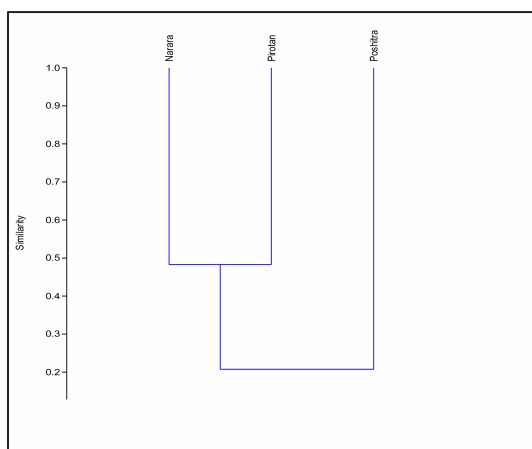


Fig. 2. Similarity index (Bray - Curtis).

to the habitat resemblance of Narara and Pirotan at the Central Gulf of Kachchh i.e., abundance of mangroves, mudflats / mud over reef, tidal pools, reef flats, algal beds. The habitats of Poshitra are chiefly dominated by tidal pools and live corals in addition to other microhabitats but varying significantly from the other two study sites.

Diversity indices

The highest species dominance among Mollusca was observed at Narara (0.71), followed by Poshitra and Pirotan. The Simpson and Shanon diversity indices for Molluscan species diversity status came out to

be the highest for Poshitra followed by Pirotan and Narara respectively (Table 1).

Frequency

The frequency of occurrence of the recorded species ranged between 2 to 28% (Fig. 3). Among the common species mollusc found from the GoK, *Pirenella cingulata* was found to be the most frequent species followed by *Lunella coronata*. *Pirenella cingulata* is a marine and brackish water species found in mudflats of mangrove ecosystems of various countries i.e., Philippines, Indo-West Pacific, North to Japan and South to Queensland.

Lunella coronata can be found in tidal pools, rocksor crevices near low tide mark. Rocky tidal pools are also one of the typical and common microhabitats of the marine environments in the Gulf of Kachchh. It consequently renders growth supporting factors to the species. Shell size of *Lunella coronata* may vary from 20 to 25 mm however smaller than *T. bruneus*. Color of the shell is light brown with white mottling spires, low with a large body whorl, Umbilicus absent. Surface bars as blunt spines. It feeds on green and brown algae from rock surface. However, its breeding season is early summer (Apte 1998) which may be the limiting factor to its abundance ; as water pools may attain higher temperature during summer at GoK. Hence, the species is found frequently but not abundantly in the GoK. It is distributed at Red

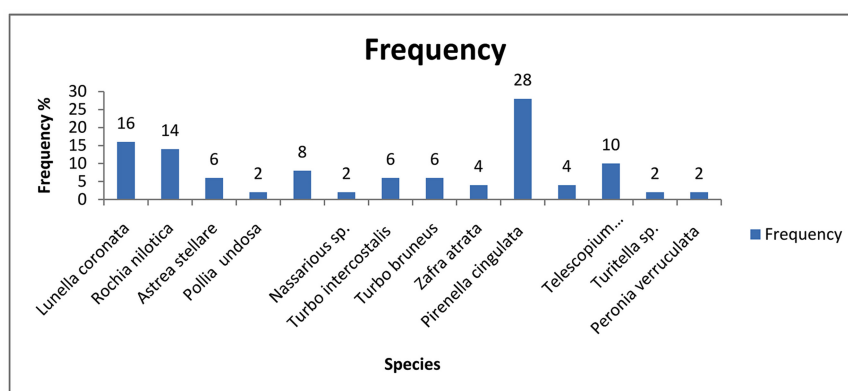


Fig. 3. Frequency of various mollusc species.

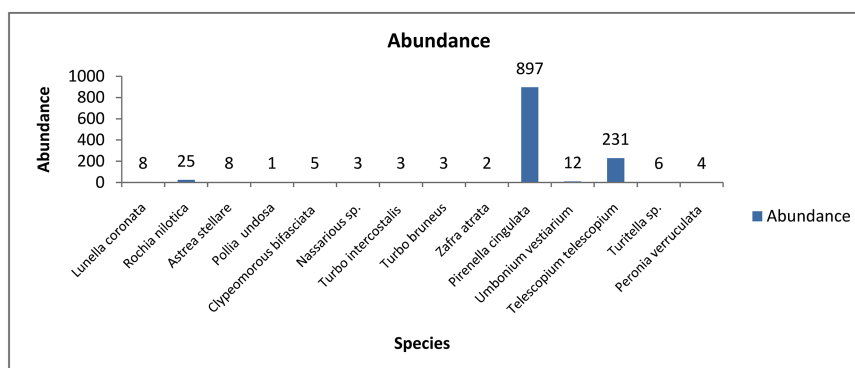


Fig. 4. Abundance of mollusc.

sea, off Southeast Africa, the Mascarene basin and in the Indo-Pacific regions. They are also traded for aesthetic and religious purpose. The less frequent species includes *Polia undosa*, *Nassarious sp.*, *Turritella sp.* and *Peronia verruculata*.

Abundance and relative abundance

Pirenella cingulata was the most abundant species followed by *T. telescopium*; showing the same results for relative abundance (Figs. 4 and 5). Both the species are inhabitant of mangrove area and are found very densely distributed hence, resulting in high abundance. *Pirenella cingulata* previously known as *Cerithidea cingulata* is a 3.5 – 4.5 cm long, conical shell, with spirals of large beads, having shell opening

large and flared with a spout like tip (Fig. 6). In India it is found on the East and West coast of the country. *P. cingulata* is very frequently found in mangrove habitats, mudflats. Prevalence of such habitats abundantly avails shelter to this species; thereby supporting its population growth and hence abundance. Moreover, other study shows that *P. cingulata* can starve up to 28 days, adding to its ecological tolerance and population survivorship (Rao et al. 1987). It is extensively collected for food and shells are used to make lime in Philippines. They play an important role in food chain. They are also traded for aesthetic and religious purpose. The second abundant species *T. telescopium* prefers mangrove forests as their habitat since they depend on detritus contributed mainly by mangroves. The organic matter and nutrients are rich in the man-

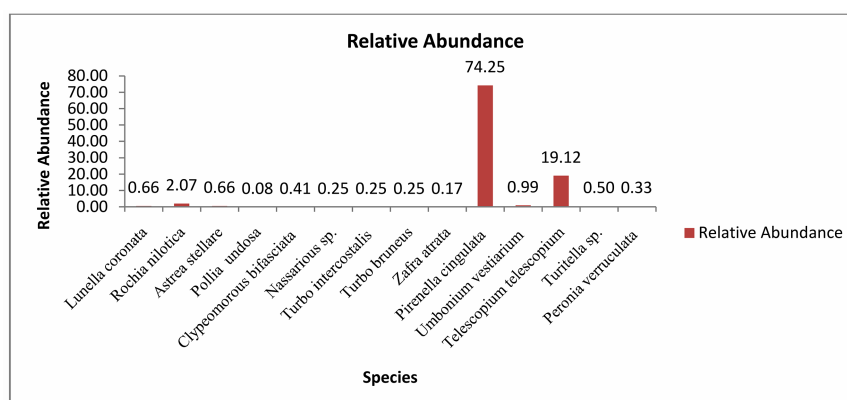
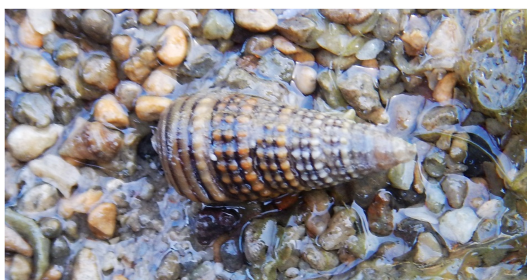


Fig. 5. Relative abundance of mollusc.



Pirenellacingulata



Telescopiumtelescopiu



Lunellacoronata

Fig. 6. Glimpse of Molluscan diversity in the GoK.

grove area (Haque and Choudhury 2013, Pramudji 2001). As mentioned earlier, these species are found to be the most common and abundant species of mangrove areas, mudflats.

Density

The highest density was shown by *Pirenella cingulata* followed by *Telescopium telescopium*. *Pirenella cingulata* is a fast growing snail. It exhibits great tolerance to hypoxia and adverse conditions (Vonareva and Kantor 2016, Vohra 1970) *Telescopium telescopium*

is found on mangroves area, mudflat. It inhabits where the rich nutrients and muddy substratum are found. The lowest density was found in *Polia undosus* (Fig. 7).

CONCLUSION

During the present study, a total of fifty-four species of Mollusca were observed, belonging to class Gastropoda (forty-five), Bivalva (seven) species, one cephalopod species and one Polyplacophora species. The Gulf of Kachchrenders all essential habitat re-

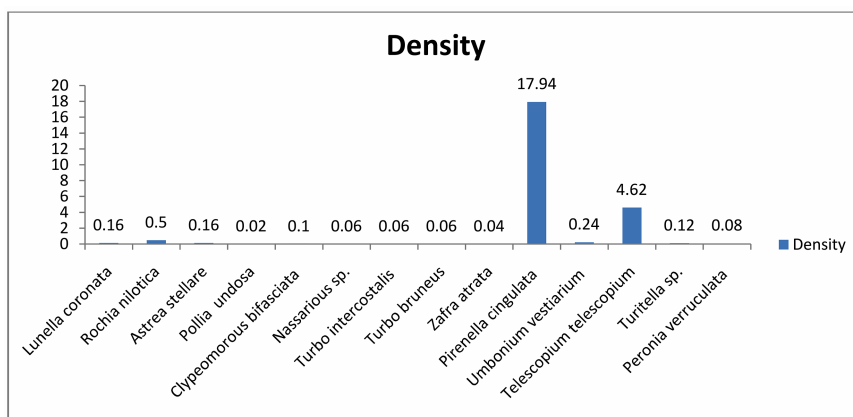


Fig. 7. Density of mollusc.

quirements to the mollusc species, hence, abundant marine molluscs prevails over there. Moreover, the mangrove dependent and detritus requiring species

are found well distributed as well as flourished in the Gulf of Kachchh.

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