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DIVERSITY AND DISTRIBUTION OF CORALS AT POSHITRA, GULF OF KACHCHH, GUJARAT

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ABSTRACT

Corals are the tiny invertebrates and are keystone species. The individual colony are called "polyps" which secrete calcium carbonate. Such colony forms a coral reef which play a major role in providing shelter to marine animals. Amongst four major reefs in India one is Gulf of Kachchh. Gujarat has a longest coastline of about 1650 km among all the marine states in India and the Gulf of Kachchh (22°15' - 23°40'N; 68°20' - 70°40'E) is the biggest gulf along the west coast of India. It is endowed with 42 islands with fringing reef of corals and mangroves which provided congenial habitat to many marine animals (Roy et al., 2015). In the present study, the diversity and distribution of corals were enumerated for three (03) different sites at Poshitra in the Gulf of Kachchh. The study was carried out during December 2019 to March 2020. The method used was random quadrant method. Total 18 hard corals and 01 soft coral were recorded. Further, diversity indices of corals were carried in which site 2 showed highest species richness which is also called alpha diversity, for beta diversity number of species variety were more in site 1 and site 2 and for evenness, the species were more evenly distributed in site 2.

Keywords: *Corals, Poshitra, Diversity indices, Diversity Distribution*

Coral reefs are the most ancient and tiny invertebrate ecosystem on the planet earth and surrounded by colourful fish with their huge diversity. Reefs are rather productive shallow water marine ecosystem based on rigid lime skeletons formed by deposition and consolidation of reef- building corals and coralline algae. Coral polyps and symbiotic algae that live in the coral tissue which helps the reef to grow (Cesar, 2003). The reef undergoes a coexisting, symbiosis and prey-predator relationship with many animals (Dave and Mankodi, 2009). Symbiosis is a natural eventin reefs and is very significant. The perfect example of this is the relationship between fish and anemones which helps to transfer nutrient from outside the reef and contributes to the overall reef development (Roopin et al., 2008).

The coral reefs are mainly divided into three types i.e. fringing reef, barrier reef and atoll reef. The most of the reef in gulf of Kachchh are of fringing reef type. Coral reefs play a major role in biological services through mobile link, Biogeochemical services such as nitrogen fixation, hiding spaces to the species that belong to various groups. A research concluded in Caribbean reefs reported 534 species belonging to 27 phyla from only 70% of the sample showing the richness of a coral reef area. (Spalding et al., 2001). corals reefs are predicted to account for 25%of world fisheries where they cover just 2% of the earth's surface.

The tiny invertebrate life form corals are marine and sedentary animal of aquatic ecosystem. They belong to phylum Cnidaria and animals of orders – Hydrocorallina, Antipatharia, Octacorallia and Scleractinia.The individual colonies are known as "polyps" which secrete calcium carbonate and other organic and inorganic elements to form exoskeleton (Sreekumaron and Gogate, 1972). Hard corals typically take asexual mode to expand grow and majority ofthem are hermaphrodite (Veron, 2000).

The Scleractinians are essentially hard corals and an example of symbiosis between plant and animals. Photosynthetic dinoflagellates commonly known as Zooxanthellae are present within the polyps in many hard corals, particularly in tentacles and oral disc (Trench, 1987). Such endosymbionts not only use the organic waste but also its host, but also encourage the host's calcification efficiency by meeting its energy requirements (Stanley, 2003).Further Scleractinians are classified into Hermatypic corals and Ahermatypic corals, they also help

in formation of reef.

The Indian reef region is mainly divided into four major reef regions i.e. Andaman and Nicobar Islands, Gulf of Mannar and Palk Bay, Lakshadweep and Gulf of Kachchh (Venkatraman et al., 2003). Amongst those four major reefs the diversity of corals is least seen in the gulf of Kachchhbecause of its extreme environment factors and industries that are also threating to support the area's biodiversity (Pillai et al., 1988). The coral diversity survey conducted at Poshitra has documented 45 species in the past (Dixit et al., 2010) well in present 56 species of 27 genera, and 10 families have been identified (Kumar et al., 2017). During past study in Narara total 26 scleractinian species belonging to 18 genera and 09 families were reported (Dave, 2011). Also 20species were recorded in past from Narara (Adhavan et al., 2014).

Gujarat has a longest coastline of about 1600 km among all the marine states in India. The Gulf of Kachchh (22º15' - 23º40'N; 68º20' - 70º40'E) is the biggest gulf along the west coast, endowed with 42 islands fringing with corals and mangroves which provided congenial habitatto many marine animals (Roy et al., 2015). Amongst the India coral reefs gulf of Kachchh stand at fourth position because of its least diversity in corals and the main reason behind it is extreme environment factors and industries that are also threating to support the area's biodiversity (Pillaiet al., 1988). One of the islands in GoK which has rich diversity of corals is Poshitra and is the area of interest for the present study. Poshitra is a sandy and rocky island located between latitude 22º22.0'N and longitude 69º11.1'E.

Gulf of Kachchh reefs had been studied for coral diversity, distribution, bleaching and disease.As gulf of Kachchh has the least diversity of corals and the main factor can possibly industrial development, climate changes and exploitation of coralline from the area by cement industries gave stress to coral reef of that area (Patel, 1978).

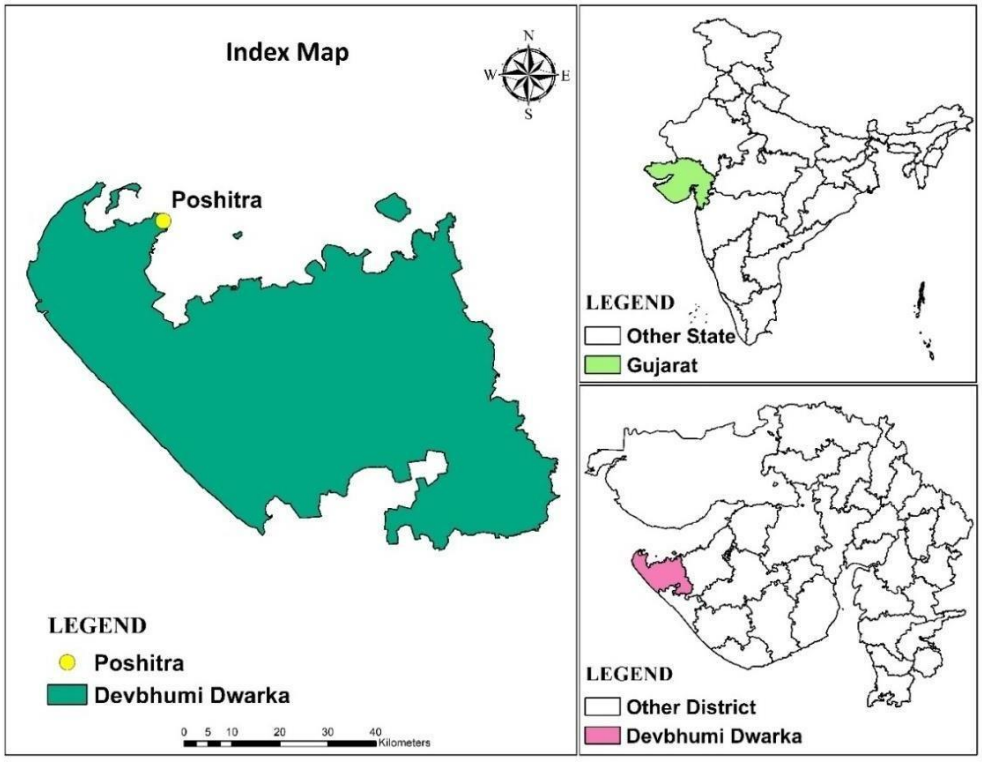


Figure 1:Location of Poshitra in Gulf of Kachchh

Methodology

The reef was surveyed for habitat characterization by random quadrant sampling method. The quadrant of size 1m² were placed randomly on the shallow water. The reef area was visited over the period of 03 months from December 2019 to March 2020 and for all the visit different site of patch was chosen. Each field visit was planned according to low tide. Each different coral species encounter was identified based on in-situ data and types of corals were recorded in the field sheet. The coordinates were also collected with the help of GPS camera

55 application which was installed in the mobile phone.

Figure 2: Quadrant sampling

The survey further quantified by finding the abundance values by using diversity indices method for the coral species. Three diversity indices were taken into consideration for calculating coral diversity namely Alpha diversity which stands for the highest species richness of a particular region, Beta diversity states the ratio between regional and local species and Evenness stand for how evenly the diversity is distributed in a particular region. The calculation of diversity indices for corals were carried out using Past4 software. The software itself calculates the indices by using Whittaker formula for three diversity indices.

RESULTS

The species classification and names were adopted from (Satyanarayana, 2009). During present study, total 19 coral species belonging to 09 families were recorded from Poshitra. Here in present study the list is given only for those species which were fully confirmed for correct identification. Family Merulinidae emerged to more diverse taxon with 05 species. *Siderastrea savignyana, Dendronephthya, Montipora explanata, Favites pentagona* was recorded only once in the present study and *Favia favus* is rich coral diversity of Poshitra region.Total 150 colonies of *Favia favus* was recorded during all the visits.

Porites lutea | *Porites lichen*




Goniopora minor

Faviafavus

Figure 3: Pictures of Coral species

The species distribution found to be highest in month of feb-2020 from site 2. The least distribution was seen in month of march-2020 from site 3. As, the main reason behind the least diversity was algal bloomas shown in figure 4, seaweed and settlements ofsedimentation as shown in figure 5 on coral colonies which also can called as seasonal shift in abundance and dominate the reef habitat.

Figure 4: Overgrowth of algal bloom Figure 5: Settlement of sediments on

Siderastrea savignyana species

Table 1: distribution of individual coral species during the recent study

sr. number	Species	site 1	site 2	site 3	Total sub-sites per species	Number of individuals
	Family: Poritidae					
1	*Porites compressa*	-	+	+	02	24
2	*Porites lichen*	+	+	+	03	59
3	*Porites lutea*	+	+	+	03	21
4	*Goniopora minor*	+	+	+	03	50
	Family: Merulinidae					
5	*Platygyra pini*	+	-	-	01	02
6	*Cyphastrea serailia*	+	-	-	01	04
7	*Platygyra sinensis*	+	+	-	02	20
8	*Favites bestae*	-	+	-	01	29
9	*Favites pentagona*	+	-	-	01	01
	Family: Faviidae					
10	*Favia favus*	+	+	+	03	150
11	*Plesiastrea versipora*	-	+	+	02	03
	Family: Acroporidae					
12	*Montipora*	+	-	-	01	01
	monasteriata					
13	*Montipora explanata*	+	+	-	02	10
	Family: Sargassaceae					
14	*Turbinaria mesenterina*	+	+	+	03	15
15	*Turbinaria peltata*	-	+	+	02	10
	Family: Mussidae					
16	*Symphillia radians*	+	+	-	02	13
	Family: Lobophylliidae					
17	*Acanthastrea hillae*	-	+	-	01	01
	Family: Nephtheidae					
18	*Dendronephthya*	-	+	+	02	01
	Family: Siderastreidae					
19	*Siderastrea savignyana*	-	-	+	01	01
	Total species per sub-site	12	15	10		

Amongst 19 coral species 18 species were hermatypic and 01 was ahermatypic coral as shown in table 1.

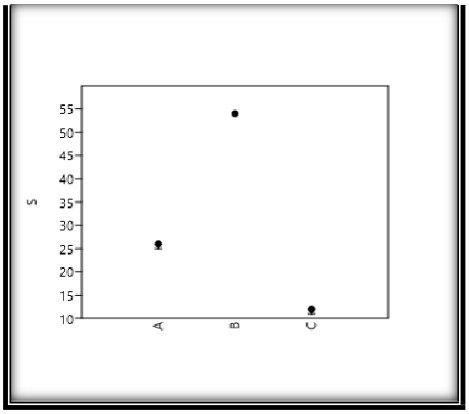
Different diversity indices named alpha, beta and evenness were calculated in the present study. As per the results shown in figure 6, highest alpha diversity was seen in site2. This result indicates that site 2 has the highest species richness in compare to other two sites in the month ofFebruary. In terms of distribution also, species were more evenly distributed in site 2 as compared to site 1 and site 3.Beta diversity was also calculated which shows the ratio between regional and local species. As per the calculation between all the 3 sites, highest variation was seen in site 1 and site 2 as shown in table 3.Hence, it can be said that the species variety was seenmore between site 1 and site 2.

Table 2: Species evenness Table 3: Beta diversity

Study sites	Evenness
site 1	0.7647
site 2	0.8811
site 3	0.732

Study site	site 1	site 2	site 3
site 1	0	0.35	0.42
site 2	0.35	0	0.63
site 3	0.42	0.63	0

Figure 6: Highest species richness



CONCLUSION

The interest of present study was to understand and evaluated corals at Poshitra, Gulf of Kachchh. This paper represents the information on diversity and distribution of coral species. The Poshitra reef was studied by random quadrate sampling method for corals diversity and distribution. 19 species of corals were reported amongst which 18 were hard coral and 1 was soft coral. The three diversity indices were calculated, and the result came for species richness was seen more in site 2, for beta diversity the number of species variety were more between site 1and site 2 and evenness showed species were more evenly distributed in site 2 as compared to site 1 and site 3. According to Dixit et al., 2010 and Kumar et al., 2017more coral diversity were found in Poshitra in past compare to present study. As Gulf of Kachchh is the least diverse coral reefs amongst another reef in India. The main reason behind the least diversity is climate change impacts and extensive industrialization came into existence in past few years which eventually gives stress on coral species. Also, in past, due to lack of awareness on conservation the Gulf of Kachchh area is already highly exploited for coralline and rocks(Dave, 2011). As corals are the keystone species, they should be preserved but due to local environmental conditionsand human interference, many corals suffer from bleaching or diseases. Hence, it is necessary to generate awareness and set a baseline for the present and future conservation of corals. Also,more this kind of research work should be conducted to understand the scenario of reef condition and according to that proper measure and steps should be taken for better conservative practices in the future.

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