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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

Coral Reef mapping using Sentinel-2 MSI Data in Poshitra and Pirotan Islands, Gulf of Kachchh, Gujarat

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KEY WORDS: Coral Reef, Spectral Signature, Landuse-Landcover, Sentinel-2, Landsat, QGIS

ABSTRACT:

Coral reefs are important part of biodiversity (Plaisance *et al*., 2011) that provide multiple natural resources and ecosystem services to human societies (Mumby *et al*., 2011). Remote sensing is more practical way to monitor the change in health and coverage of the reef ecosystem covering larger area. Spectral signatures are generally used to monitor a direct response to relatively small changes in coral cover, across a range from low to high cover levels (Joyce *et al*., 2013). In present study landuse maps of reef ecosystem of Poshitra and Pirotan Islands in Gulf of Kachchh were generated to identify the changes in total cover of coral reef area in last 20 years. The Sentinel-2 Digital data of the year 2019 and Landsat-5 Digital data of the year 1997-1998 were downloaded. The Land use maps of these Islands were prepared by on screen digitization of different landuse classes including coral reef and other coastal features. The digital numbers of each landuse class were extracted and plotted to study the spectral separability of corals and other landuse classes. Result of the study shows that the total area cover of corals area have been decreased during last 20 years in both the study sites. Which shows significant impact of different anthropogenic activities and natural phenomena Poshitra and Pirotan Island. The main aim of generating spectral signature of different classes is to differentiate corals from other classes. According to values generated from polygons of different classes shows that corals can be easily separated by spectral signatures.

1. INTRODUCION:

Coral reef are among the world's most important habitat and they provide home to many sea animals and supports the food web in aquatic ecosystem. Hard corals used to dominate the seascape of tropical reefs; but as coral reefs are extremely sensitive to the environmental conditions, they are often used as important indicators of climate change (Chaudhury *et al*., 2014). Coral reefs flourish in tropical and subtropical clear waters within a narrow range of bio-physical environmental parameters (Cumings, 1932) like temperature, salinity, turbidity in reef region. Coral reef protection is a global concern now. Decrease in reef area are noted at many places because of the climate change and anthropogenic stress. Habitat mapping and environmental stress assessment by remote sensing, especially by satellites, is highly cost-effective (Mumby, P.J. *et al*., 1999). Remote sensing covers the wider range which helps to detect the large-scale changes. Thus, it is significant benefaction towards the protection of reef ecosystem. Techniques for analyzing remote sensing data have progressed vary rapidly and several studies has been done to monitor any survey coral reef using remote sensing techniques. Remote sensing sensors have been improved over the last 3 three decades and multispectral satellite sensors such as Landsat MSS and TM, Sentinel-2 have been used successfully in recent years in mapping and identifying different reef features using their spectral signatures. Remote sensing instruments in these satellites has ability to distinguish the reflectance spectra of different coastal classes like corals, algae, mangroves, mud, sand etc. Remote sensing studies take empirical measurements of spectra and seek wavelengths which discriminate such benthic categories but benthic categories used in remote sensing sometimes consist of species groupings which are biologically or spectrally inappropriate (Hedley *et. al*.,2002) and difficult to distinguish separately.

2. STUDY AREA:

Among the World, reef covered area in India is estimated to be 2,375 sq. km and Andaman and Nicobar Islands has the highest reef covered area preceded by Lakshadweep, Gulf of Kachchh (GoK) and Gulf of Mannar (Saroj *et al*.,2016). Coral formation within the Gulf of Kachchh is mainly confined to the southern shore of the gulf along the Jamnagar district. Amongst the 45 islands in Gulf of Kachchh, in all 42 islands, presence of coral reef has been reported. Most of the islands on Gulf of Kachchh has Fringing types of reefs but some of the islands in the Gulf of Kachchh are also formed as platform and patchy reef type. Gulf of Kachchh has the total reef covered area approximately 352.5 sq. km (Jayaprakas and Radhakrishnan, 2014). Poshitra and Pirotan Island from Gulf of Kachchh were selected as a study site in present study. Pirotan Island is situated at 22.60061 N Latitude and 69.95652 E Longitude; and Poshitra is located at 22.40191 N Latitude and 69.19914 E Longitude in Gulf of Kachchh. For further analysis, the satellite image with 3 km buffer from the center of site location was extracted.

Spectral Response of Corals using Sentinel-2 Satellite Data in Narara, Gulf of Kachchh, Gujarat

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Abstract: Coral Reefs are the most ancient and one of the fascinating ecosystems on the earth (Dave C., 2011). As Coral reefs are extremely sensitive to the environmental conditions, they are often used as important indicators of climate change (Chaudhury et al., 2014). Remote sensing is more realistic way to detect the change in health and coverage of the reef ecosystem in wider area. Spectral indices are generally used to differentiate coastal classes by measuring absorption and scattering processes, which are highly adverse and positively correlated with the object's chemical and structural property. In present study, the Sentinel-2 Digital data of dated 24-April-2019.covering Jamnagar District was downloaded from https://earthexplorer.usgs.gov/.The study area covering Narara with a buffer of 6 km was extracted for further analysis. The Landuse-Landcover map of the Island was prepared by on screen digitization of different land-use classes including coral reef and other coastal features. The digital numbers of each land-use classes were extracted and plotted to study the spectral separability of corals and other land-use classes. Result of the study shows that the corals can be easily separated from the other coastal features by generating spectral signatures.

Key Words: Coral Reef, Spectral Signature, Landuse-Landcover, Sentinel-2, QGIS.

I. INTRODUCTION:

Coral Reefs are rich in diversity and important ecosystem which mainly founds in warm water near tropical region on earth. Coral reef absorbs wave energy and contribute to environmental protection through the reduction of coastal region; thus they protect both ecosystems located between the reef and coast. As it is rich in biodiversity; many living organisms depends on it including mankind but increasing anthropogenic activities and climate change affects the reef ecosystem as they are more sensitive towards temperature change and because of that coral reefs are degrading across the globe. If reef tourism and coastal development activity will manage in sustainable manner; it will limit the destruction and pollution caused by that. Field surveys provides accurate data but it is not cost effective for highly localized remote areas at frequent time intervals so for that remote sensing is the easiest alternative and complementary approach. Coral reef mapping usually relies on remote sensing for cost effectively identifying their structural complexity, benthic composition, and regime surrogates over large areas (Goodman *et al.*, 2013; Hedley *et al.* 2016). Remotely sensed spectral indices are used in a range of environments for estimating properties of corals and other different coastal features Spectral indices are common data transformations for mapping vegetation's structural or physiological attributes and they are simple and easy to implement from multispectral and hyper spectral data sets. The development of spectral reflectance library of common reef benthic features linear spectral mixing was used to create mixed reflectance signatures that represented image pixels in a reef environment. It helps to monitor a direct response to relatively small changes in coral cover, across a range from low to high cover levels (Joyce *et al.*, 2013). By generating spectral signatures corals can be easily separated from the other coastal features.

II. STUDY AREA

India has the total area of coral reefs is estimated to be 2,375 sq. km and the maximum area is in Andaman and Nicobar Islands followed by Lakshadweep, Gujarat and Tamil Nadu (Saroj *et al.*,2016). Among them area covered by Reef in Gulf of Kuchchh is around 352.5 sq. km (Jayaprakas and Radhakrishnan, 2014). The Gulf of Kutch located at 22°15'-23°40' N Latitude and 68°20'-70°40' East Longitude, is one of the indentations found on the northern side of the Saurashtra Peninsula. The Satellite image with 6 Km Buffer from the center of the Narara was extracted for further analysis.