1 INTRODUCTION

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The term biodiversity is used to describe the variation of life on Earth, which is considered at dissimilar levels of biological group including genes, species and ecosystems (Gaston and Spicer 2004).

The study of life in the sea is called Marine biology, which is one of the largest parts of the natural sciences. The Study of marine life offers a wide-ranging understanding of life on earth and the conditions that make such life possible. (Fell, 1975)

From bacteria to baleen whales, earth is home to tens of millions of different life forms. Only biologists can singly guess at the factual number of species on earth. There are existing lives everywhere we look in the ocean. How many and what kind of organisms there are depend on where we go, that is on the specific nature of the habitat. Each and every environment has unique and different characteristics that define which organisms breathing there and which do not breathe. For example, Algae and plants will grow; it depends on amount of light in their surroundings. The type of bottom and other parameters such as temperature and salinity of the water, waves, tides, currents and many other characteristics of the surroundings will enormously affect the sea life in the.

As per Olsen *et al.* (1999), the coastline strip is the area, where the population of human lives. A major part of human population in the worlds is to be located in the coastal strip and it will not be more than 150 km from the shoreline. It is assessed that approximately 60% population of the world stay alive in the coastline strip and nearly 70% cities of the world with more than 2.2 million populations are stay alive nearby

the tidal estuaries. Research expected that the inhabitant of the coastal strips will be doubled by the end of year 2020.

Still, the surroundings, which we enjoy, are degrading more rapidly and the resources of nature on which we depend are more decreasing at a remarkable rate that we cannot imagine.

Biodiversity of marine is direct advantage to the population of the world as a source of food, possible pharmacopeia (Hunt and Vincent, 2006), preservative of inshore surroundings (Jie *et al.*, 2001) and controller of atmospheric procedures (Murphy and Duffus, 1996). It also delivered unintended benefits to society by ecological stability (Menge et al., 1999) which contributes to self-sustaining marine environments.

Benthos is the community of creatures, who live on or in the bottom of an aquatic body. The "*benthos*" word was familiarized by well-known German ecologist Ernst Haeckel (1834–1919) first time, "*ecology*" word was also familiarised by Ernst.

The benthic community contains an extensive range of organisms from microorganisms to floras (phytobenthos) and faunas (zoobenthos) and from the different levels of the food web. Benthic animals are generally classified by their size: for example microbenthos is less than 0.063 mm, meiobenthos is between 0.063–1.0 (or 0.5) mm, macrobenthos is more than 1.0 (or 0.5) mm and, sometimes, megabenthos which is more than 10.0 mm. This implementation considers benthic animals, mostly invertebrates, lager than one millimetre, i.e. macrozoobenthos.

Well known assemblages of benthic animals are worms such as polychaetes and oligochaetes, molluscs such as bivalves and gastropods, and crustaceans such as amphipods and decapods. Benthic invertebrates can be categorized by the location,

which is occupied on or in bottom sediments: Infauna - animals that live in sediments, almost all worms and bivalves belongs to this category; Epifauna - animals which live on the surface of bottom sediments for example crabs and gastropods.

Benthic invertebrates play a significant role in ecosystems, by filtering phytoplankton and then acting as a food source for larger organisms such as fish, by this means associating primary production with higher trophic levels. They also construct and oxygenate the bottom by reworking sediments and play an essential role to break an organic material before bacterial remineralisation. In addition, some benthic invertebrates like clams are used by humans for food and worms are used for fishing bait (Davide and Marco, 2010). Macro benthos plays a significant role in developments of ecosystem like nutrient cycling, pollutant metabolism, dispersion and in secondary production (Snelgrove, 1998). Fluctuation in quality and quantity of macro benthos will disturb the abundance of demersal fishes that are essential fishery resources in the sea. Therefore, study of macro benthos may be used as baseline information to estimate the current demersal stocks and it may also serve as a reference study for upcoming research on ecological studies and variations in this area (Giere, 1993)

Are of Indian coastline is approximately 8000 km, which includes an exclusive economic zone (EEZ) and a continental shelf of 2.02 million sq. km and 468,000 sq. km respectively. These areas include 10 coastal States, 7 Union Territories and the islands of Andaman-Nicobar and Lakshadweep. Due to the geomorphological structure and climatic differences of the coastal area of India, Coastal water is extremely diverse. The environment of coastal and marine area contains immediate shore gulf waters creeks, mud flats, tidal flats, coastal dunes, seaweed, mangroves and

seagrass beds deltaic plains, estuaries, lagoons and coral reefs. In India the four most important coral reef regions are Andaman and Nicobar group of islands, the Lakshadweep group of islands, the Gulf of Mannar and the Gulf of Kutch. (Venkataraman et al., 2012)

Gujarat located on the western coast of India with the longest coastline of 1,650 km in India, which is 21% of the total coastline of India. This kind of varieties make it a strategically a best natural resource. The Saurashtra coastline of Gujarat, India is categorised by countless habitable intertidal zones harbouring rich mixture of flora and fauna (Nayar and Appukuttan, 1983). Rock layer of this area is generally formed of miliolite and laterite stones, which providing altogether a variety of habitat for the sustenance of the flora and fauna of intertidal zone (Pandya, 2015).

Quick industrial development resulting toxic waste on the coastline has bring about into decline of the faunal community of the Coastal area of Saurashtra, their ecological attributes with respect to fluctuating environmental conditions. The habitations of coastline and estuarine have been under remarkable stresses due to huge economic, entertaining and transport action values of human. Tourism can create countless pressure on local resources like energy, food, land and water that may already be in short supply. According to the Third Assessment of Europe's environment (http://reports.eea.europa.eu/environmental_assessment_report_2003_10/en) the direct local impacts of tourism on human and the environment at destinations are strongly affected by concentration in space and time.

Most of the waste produce by human on land such as plastic bags, pesticides Oil, Fertilizers, balloons, glass bottles, shoes, packaging material, sewage disposal, Toxic chemicals etc will reached to the oceans at the end, either through throwing away by

human or by run-off through drains and rivers. Other than this if we do not dispose of anything correctly, almost everything we throw away can reach the sea (http://wwf.panda.org/about_our_earth/blue_planet/problems/pollution/).

Due to glaciers and polar ice melting, and thermal expansion of warmer water, worldwide sea levels may increase by as much as 69 cm by the next 100 years. It will have serious effects on ecology of marine. The amount of light reaching offshore plants and algae dependent on photosynthesis could be reduced and it may also affects the ecology of marine life. Rise in sea level will be the extreme climate change challenge to environments of the mangrove, which needs balanced sea levels for long-term existence. Most researchers accept it as true fact that global warming will be the messenger for upcoming era of extreme and unpredictable weather.

Hot storms and heavier rainfall may increase which physical damage to coral reefs, coastal ecosystems and coastal communities. Hurricanes Hugo and Marilyn hit the US Virgin Islands National Park in 1989 and 1995 respectively, and resulting massive destruction to coral ecosystems. (http://wwf.panda.org/about_our_earth/blue_planet /problems/climate_change/)

Changes in environment will supplement to other pressures like rapid urbanization, economic and industrial development, which donate to unmanageable utilization of natural resources, increase in pollution, land degradation and other ecological problems. Rise in sea level and increase in temperature of sea surface are the most probable major environmental change related pressures on coastal ecosystems (Joshi, 2016). Worldwide researches have projected the movement of several millions of people from the region's coastal zone, assuming a 1m rise in the level of sea. The

costs of response measures to reduce the impact of sea level rise in the region could be vast. (IPCC, 1997)

Most important causes of coastal pollution are progression in population, urbanization and industrialization. In India pollution in coastal area arises mostly starting from terrestrial based sources such as domestic waste, industrial waste, and agricultural runoff such as pesticides. Shipping activity, offshore exploration, development in infrastructure and the crop of recently started coastal industries are the other sources, which use seawater as a resource and the coastal area used as a disposal of all the waste produced. Oil and sewage, garbage, pesticides, toxic chemicals, heavy metals, radioactive waste, thermal pollution and nutrients are the main pollutants in coastal and marine environments. (NIO, 2008)

Due to human activities, the environments of coastal area are being changed at increasing rates, over and over again without seeing into the forthcoming future values. Resources of seawater are considered as a most important component of environmental incomes, which are now under pressure after completed misuse or pollution produced by us. Coastal area is the very useful and most dynamic ecosystems and these are moreover attentions of industry, human settlements and tourism. Thus, the value of water shows a vital role in well-being of human, animals and plants populating the area. The surface water quality of certain region is influenced by both anthropogenic actions and natural processes. The quality of marine water is a difficulty of serious concern due to its impact on human health as well as aquatic ecosystems together with marine life. Dissimilarities in physicochemical parameters disturb the water quality which resulting life of animal in water.

As per the EMECS (2007), for water bodies BOD, COD, pH and DO are the most important water quality parameters. Temperature is a one of the very important parameters which is useful for determination of some other parameters such as pH. In Increasing level of water temperature is some time associated with hot water release from industries as well as power stations, which uses water as a coolant. Metabolic rate and the some other activities such as reproduction of marine life are controlled by temperature of water. It is a significant factor to monitor the distribution of marine animals and plants (IOSEA, 2006). Most of the fauna in marine environment cannot tolerate much fluctuation of pH as compare to freshwater animals, so the ideal pH for marine fauna is generally between 7.5 and 8.5(Boyd, et al., 2000). The organism's salt balance maintaining capacity is affected reproduction at lower pH, (Lloyd, 1992). Suspended solids can come from sediment, by decomposing flora and fauna, sewage, industrial wastes etc. They have certain importance for aquatic life that are dependent on solar radiation and those whose life forms are sensitive to deposition. Concentrations from higher side have a number of adverse effects, such as declining the source of light to enter the water, in that way photosynthetic processes will be slow due to this the production of dissolved oxygen will be lower; high absorption of heat from sunlight, increasing the temperature which can also result to lower oxygen level; low visibility will affect the ability of fish's to hunt for food; clog fish's gills; prevent development of egg and larva. It also indicated that concentration of bacteria and pollutants in the water are high.

On the other side, dissolved solids contains materials which are dissolved in the water, like nitrate, bicarbonate, magnesium, sulphate, phosphate, calcium, sodium, organic ions and other ions, which are essential for marine animal to sustain life in

marine. However, damages in organism's cell can be due to high concentrations of such ions (Mitchell and Stapp, 1992). In water body, factors disturbing the level of dissolved solid are fertilizer run-off, wastewater and septic effluent, soil erosion, decaying flora and fauna and also geological features of that particular area.

A gradient of ecological situations spreads all over the intertidal zone, mainly due to the diverse periods of submergence at each tidal level hence sea shore experiences irregular differences in salinity and temperature, which calls for a broad spectrum, physiological, behavioural adaptations (Newell, 1970). The habitations are different but on the other hand compacted in a lesser region of intertidal zone where higher limits of distribution and upper limits are generally determined by physical situations and by biological collaboration respectively. (Branch, 1976) The collaboration amongst the biotic and abiotic factors is responsible for the temporal and spatial variability in the species abundance in biological populations (Danielson, 1991). This kind of identification of temporal and spatial scales of variation allows the understanding of the role of these processes (Underwood and Chapman, 1996). The spatial patterns in the structure of assemblages on hard substrates have been widely documented from intertidal substrates (Benedetti-Cecchi, 2001). In the sub tidal, data are still less or unavailable and mainly limited to sessile (Boero and Fresi, 1986).

1.2 Aim

The aim of this study was to generate a baseline database of the diversity of macro benthos, the ecology of some key intertidal macro benthos and variations of the seawater quality on the selected area of South Saurashtra coastline.

1.3 Objectives

Keeping in mind the above-mentioned aims of this study, the following objectives had been set forth:

- To study the coast for its habitat characteristics.
- To generate a database of the coastal macro-benthos assemblage
- To estimate the attributes of population ecology such as abundance, density and frequency of some prominent species (Key species) of the assemblages in terms of space and time.
- To evaluate ecological status of selected sites.
- To observe some quality parameters of water for the selected site.