INTRODUCTION

Coral reefs all over the world cover an estimated area of 2,84,399 km^2 (Venkataraman et al., 2003) which is less than 0.2 % of the global ocean area and about 15 % of the shallow sea areas within 0-30 mts depth (Lalli and Parsons, 1997). Around 54 % of the coral reefs lie in the Asiatic Mediterranean and the Indian Ocean. The remaining Pacific reefs account for 25 %, Caribbean reefs for 9 %, Atlantic for 6%, Red sea for 4 % and Persian Gulf for 2% (Smith, 1978). Majority of corals are concentrated on western side (Fig. 1) of the three oceans (Scheer, 1985).

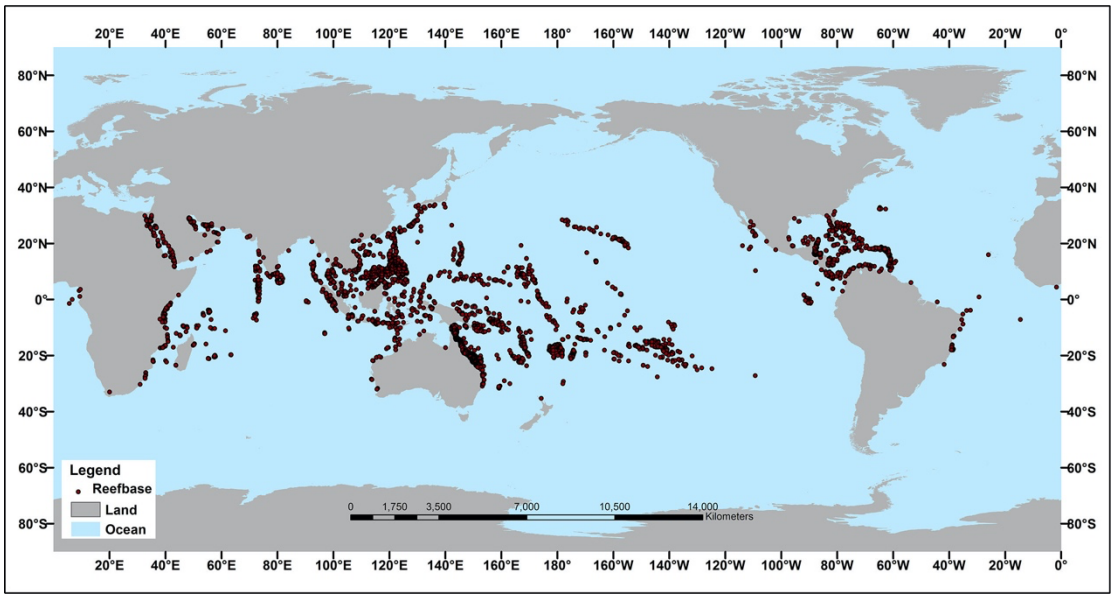

FIGURE 1 MAP SHOWING CORAL REEFS IN THE WORLD (SOURCE: EARTHLABS)

They are the largest structures ever created by millions of tiny animals over thousands of years. Reefs being the prime productive zones of the oceans and morphologically cryptic. They are refuge to many thousands of flora and fauna in comparatively nutrient rich marine realm. Reefs are also referred as Oasis of the oceans harbouring most diverse forms of life on the earth. As per an estimate reefs support 0.5 million of species globally (Spalding et al., 2001). The coral reefs are the best examples to experience all kind of inter-organism relationships at a place. In a coral reef environment, many a species coexist and symbiosis and prey-predator relations are common phenomenon everywhere (Dave, 2011).

Geologically reef like structures are dated to exist on earth for about 2,000 million years. The Devonian reefs were abundant with rugose corals but mostly dominated by non-coral organisms. But due to an unknown reason these diverse and abundant Devonian coral community suffered mass extinction at the end of the Paleozoic Era. The modern corals differ in skeletal properties from their counter parts of Devonian period by replacing Calcite form of Calcium carbonate with Aragonite form of Calcium carbonate. The Mesozoic reefs thrived well until many of the coral families disappeared by the end of the era. The survived families were further diversified into various reef building corals in the beginning of the tertiary period of the Cenozoic era. Thus, modern known corals came in to existence in the world's reefs (Veron, 2000).

Corals are tiny invertebrate life forms, exclusively marine and sedentary animals. They belong to Phylum Cnidaria. In ancient time the word "Coral" was used for precious red corals - *Corallium rubrum*. The term coral collectively applies to animals of Orders - Hydrocorallina, Antipatharia, Octacorallia and Scleractinia of this phylum which are commonly known as fire corals, black/deep-sea corals, soft corals and hard/stony corals respectively. The term more specifically refers to colonies of genetically identical individuals known as "Polyps" which secrete composite of calcium carbonate and other organic and inorganic elements to form the exoskeleton (Sreekumaron and Gogate, 1972). Corals are diploblastic and radially symmetrical animals like other cnidarians.

The scleractinians or Hard corals, evolved 245 million years ago in Mesozoic era. They were diverse and chief contributors in reformations of structures. Their body cavity opens through an opening - the mouth that is surrounded by tentacles. The gastric cavity of polyps is vertically divided by septa. The polyps bear nematocysts in the tentacles and other body parts as predatory defence tools that also help in capturing tiny prey. The hard corals can reproduce sexually and asexually. Generally, they adopt asexual mode to grow in colony size. Majority of hard coral colonies are hermaphrodite; however, a few percent of total population may be unisexual possessing only male or female sex organs (Veron, 2000). The hard corals have been reported to reproduce sexually anytime of the year by releasing gametes

in the water which get fertilized outside and form planula larvae. Pandey et al. (2010) have stated the strong effect of photoperiodicity, water temperature, tides and lunar phase on the mass spawning that occur during specific times of the year. The planula settles to hard substratum after initial free-swimming life and develops in to juvenile polyps which lead to colony formation asexually.

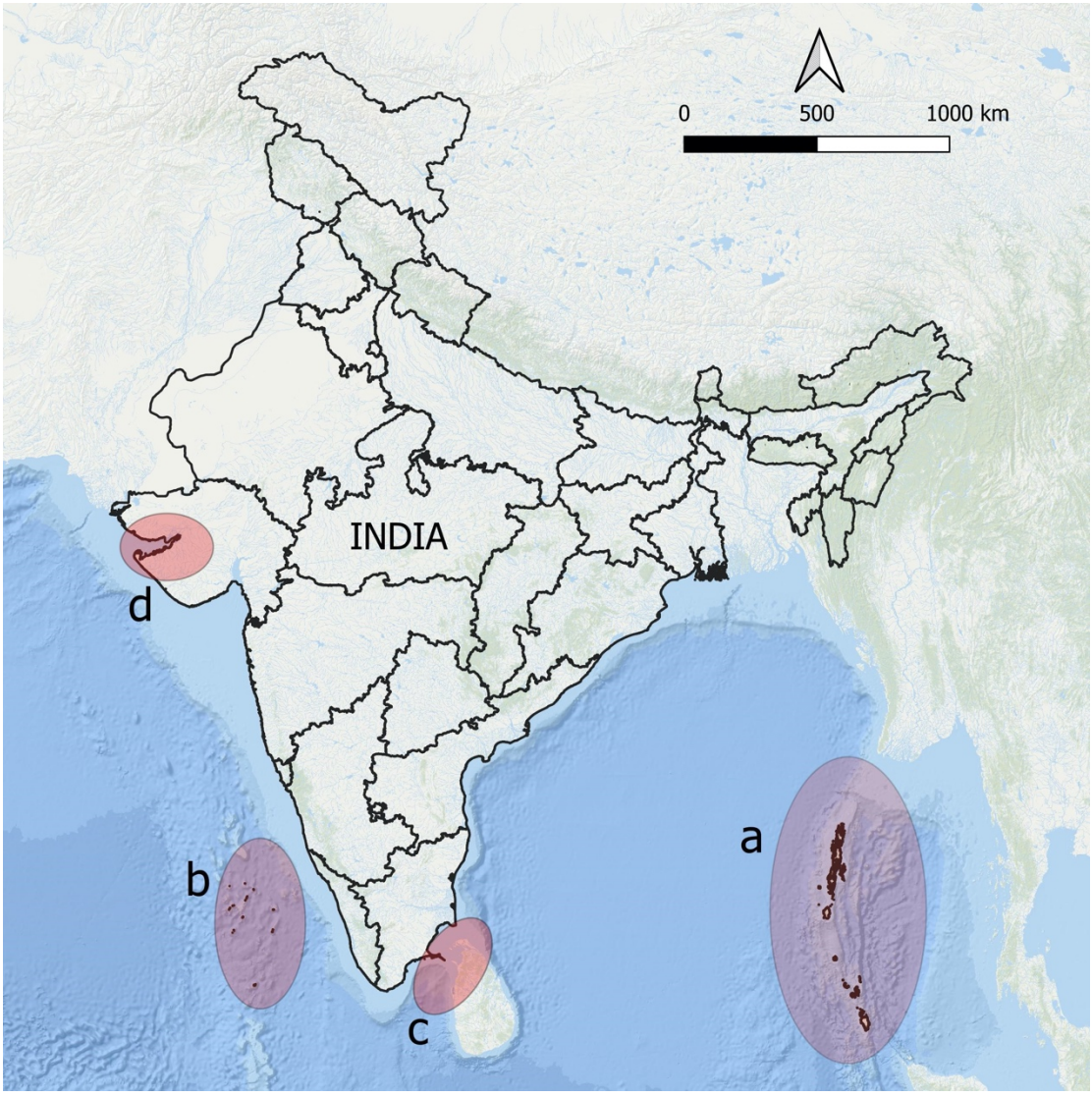

FIGURE 2 MAJOR CORAL REEFS OF INDIA (A) ANDAMAN AND NICOBAR ISLANDS, (B) LAKSHADWEEP ISLANDS, (C) GULF OF MANNAR, AND (D) GULF OF KACHCHH

Looking at the coral reefs, the Indian reef regions fall into Indo-Pacific reef zone. The Indian reefs can be divided roughly into four major reef regions viz. Andaman and Nicobar Islands, Gulf of Mannar and Palk Bay, Lakshadweep Archipelago and Gulf of Kachchh (Venkataraman et al.,

2003) (Fig.2). The Andaman and Nicobar Islands lies in southeastern direction in the Indian Ocean. This reef region represents the highest generic diversity of scleractinians from the Indian waters. The Andaman and Nicobar reefs are nearer to the Indonesian coasts therefore the coral diversity of this region is more similar to that of the Indonesian and the Southeast Asian reefs (Bahuguna et al., 2010). These islands have two Marine National Parks Viz. Mahatma Gandhi Marine National Park and Rani Jhansi Marine National Park. All together 177 species of hard corals have been reported from Andaman and Nicobar Islands (Venkataraman et al., 2003).

Lakshadweep Archipelago is situated in the Arabian Sea in the southwest direction about 200-470km off the Kerala coast forms the second most diverse Indian reef region (Venkataraman et al., 2003). Lakshadweep reefs harbour 91 species of hard corals and is also rich in other biodiversity associated with it.

Gulf of Mannar and Palk Bay, the third most important coral reef region of India, is located along the southern coast of Tamil Nadu state. Subsequently in 1989 the Gulf of Mannar was declared as "Marine Biosphere Reserve" (MOEFCC). Gulf of Mannar and Palk Bay reefs have been reported to have 82 species of corals, however recent surveys have reported all together 117 species of hard corals (Patterson et al., 2007; Venkataraman et al., 2003).

Gulf of Kachchh (GoK), an indent of Arabian Sea into mainland of Gujarat, is the fourth major coral reef region of India. Though smaller to other reefs of India, it has the credit of being first Marine National Park of India. Fringing, platform and patchy types of reefs are found along the southern coast of GoK. No barrier and atoll reefs are found in the GoK. Further, geographic isolation from other coral reef areas of India and extreme environmental conditions are the main factors for the least coral diversity of this reef region among the major Indian coral reef regions (Pillai and Patel, 1988). Early studies have reported 36 species of hard corals occurring in GoK, the list was then updated to 45 species recently (Dixit et al, 2010; Pillai and Patel, 1988).

Further, apart from the above mentioned major reef regions, distribution of corals in the form of patchy reefs and otherwise on rocky intertidal areas have been reported along the coast of Vizhinjam, Mangalore, Gaveshani Bank, between Vengurla and Vijaydurg, Redi Port, Malwan, Bombay High (near Mumbai) on the western part of India (Jasmine et al., 2009; Nair and Qasim, 1978; Qasim and Wafar, 1979; Sengupta and Deshmukhe, 2000).

The El Nino oscillations in the year 1998 drew attention of many researchers towards the global phenomenon of coral bleaching, the major threat to reefs in the world. Coral bleaching is the expulsion of dinoflagellate algae zooxanthellae from the coral tissue resulting in white or pale appearance of the coral colony. The living tissue of coral animals without algae is translucent, so the white calcium carbonate skeleton appears through, producing a bleached appearance. The phenomenon of Bleaching is a general stress response that can be induced by high or low temperatures, intense light, changes in salinity, or by other physico-chemical stresses. Hence, ecologists have expressed the coral bleaching as a biological reflection of environmental changes prevailing above corals' acclimatization capacity (Glynn, 1976). A number of environmental factors have been identified to induce the dissociation of host and symbiont i.e., extremes of temperature (heat shock and cold shock), high irradiance, prolonged darkness, heavy metals (especially copper and cadmium) and pathogenic microorganisms (Hoegh-Guldberg, 1999). However, globally the elevated sea surface temperature is recognized as a major contributor to the considerable coral bleaching events (Stone et al., 1999). The coral bleaching can be evident as a localized or widespread event over large geographic scales based on the type and magnitude of the causative factors. It has been observed that localized bleaching events are often due to direct anthropogenic stressors (e.g., pollution or freshwater runoff), which can be mitigated by refined management practices and controlling the source of stress (Salm et al., 2001). Three types of bleaching mechanisms are associated with high temperature and/or light: "animal stress bleaching," "algal-stress bleaching," and "physiological bleaching" (Fitt et al., 2001). Though all the three are important to understand the climate-coral interactions, the last two are particularly relevant to present concerns. They are: the algal-stress bleaching, an acute response to impairment of photosynthesis by high temperature coupled with high light levels; and the physiological bleaching, which reflects depleted reserves, reduced tissue biomass, and less capacity to house algae as a result of the added energy demands of sustained above normal temperatures.

Globally, the distribution of reef-building corals is limited by annual minimum temperatures of ~18°C (64°F) (Veron, 1995; Kleypas 1999). Although global warming might extend the range of corals into areas that are at present too cold (Precht and Aronson, 2003), the new area made available by warming will be small, and the countervailing effects of other changes suggest that any geographic expansion of coral reefs will be very minor.

At present, coral reefs are limited to the tropics and occur only in waters where temperature remains warmer than 18°C. 2°C warming of the oceans will expand the range by few degrees of latitudes. Locations within this region that have suitable depth, substrate and other environmental conditions could potentially support new coral reefs at the higher temperatures. Only Southern China, Japan, Australia and Southern Africa present geographically realistic opportunities for reef expansion. Additionally, sea-surface temperature (SST) gradients are very steep in the vicinity of 18°C, and the ocean model projections suggest that SST warming associated with doubled CO_2 will only move the 18°C contour by a few hundred kilometers, especially in the critical western boundary areas (Kleypas et al., 2001). Whereas the west coasts of North and South America, Europe, Africa and southeastern United States and near the Amazon River, reef expansion along the coast is blocked due to the flow of cool water towards the equator and are thus "upstream" from potential sources, causing restricted distributions of coral reefs in the former while muddy coastal shelves, river deltas, and turbid water for the latter.

The reef ecosystem is considered to be the richest ecosystem, next to the rain forest. It harbours good species diversity, both in terms of flora and fauna thriving in close association and maintains diverse pattern of biotic assemblages including rare and endangered species (Sakkaravarthi et al., 2012). The Faviidae is one of the most important scleractinian families of reef corals. It is the largest in terms of number of genera and the second in terms of number of species. Faviids are also very abundant in many coral communities and they play an important role in reef ecosystems (Veron et al., 2000, Tamal et al., 2012). In India, Family Faviidae is represented by 26 genera (Venkataraman et al., 2003)

All extant faviids are hermatypic and colonial. They may have Septa, paliform lobes, columellae and wall structures. Septal structures are simple, columellae are a simple tangle of elongate septal teeth, and walls are composed of thickened septa and cross-linkages. When all these structures are present, all species appear to be similar.

Though found to be common in the ecosystem of reef habitats, it is having complex and cryptic structural morphology with the nearest species and genus. The corallite structure of different species is different and helps in identification of corals upto species level. Such scientific studies have been so far concentrated at Andaman and Nicobar Islands, Gulf of Munnar, and Lakshadweep islands (Satyanarayana and Ramakrishna, 2009). The Gulf of Kachchh has varied diversity of coral species and it needs to be studied in systematic way for identifying corals at species level through their corallite structure. Some of the species in genus Favia are not yet identified. Hence Family level studies are required to find out the occurrence of complex faviids. Hence the present study aimed to find out the status of family Faviidae and the fauna associated with it at two coastal reefs of Gulf of Kachchh, Narara in Jamnagar District and Poshitra in District Devbhumi Dwarka of Gujarat, India.

Though reef in the GoK is being explored for more than a century, majority of these studies are on specific groups of fauna. There are comparatively few publications on the fauna associated with corals reef ecosystem, mainly with faviids one of the important family of Scleractinian corals. Hence, a study was initiated with one of the objectives to understand status of faviids and the fauna associated with faviid community of GoK in detail. Gulf of Kachchh reefs have been studied for diversity, coral cover, bleaching, coral recruits etc. Earlier studies reported coral diversity of this region with difference in total number of species (Chhaya and Patel, 1977; Patel, 1985). The first systematic reporting of 37 species of scleractinians from 15 localities across Gulf of Kachchh was made by Pillai and Patel (1988). Later on, there was a huge gap of information on the coral reefs of this region. In 2011, Dave conducted ecological assessment of Narara reef while Parasharya (2013) studied corals and some associates in Marine National Park. During same period GEER Foundation, Gandhinagar also

conducted surveys as well as worked on coral implantation in the area (Pandey et al., 2010).

New sights of coral formations have been reported along the Kachchh district in the northern part of GoK and along the Saurashtra coast also (Deshmukhe et al., 2000; Raghunathan et al., 2004. Parasharya and Padate, 2014). Joshi (2016) documented impact assessment of coral reef ecosystem with special reference to climate change. As adapted to wider range of seasonal temperature fluctuations, the GoK reefs were not found much affected by 1997-98 El-Nino southern oscillation events (Arthur, 2000). However, the region is facing heavy industrial developments in the form of major petroleum-based refineries and related industries and crude transport through the gulf water. Hence, it becomes important to monitor the status of Flora and Fauna in the Gulf of Kachchh. So, the present study was aimed to find out coral diversity with main emphasis on Faviids, fauna associated with the faviids, physicochemical properties of sea water and the substrate characteristic of the reef. This can help in finding out if there is any change in the ecology of coral reef ecosystem in GoK and help in planning management and conservation of the area as it also includes India's first Marine National Park.

GLOBAL

Coral reefs are distributed in a circum-tropical band mostly between the latitudes of 20^0 North and 20^0 South. The western Atlantic and the Indo-Pacific are the two main coral reef regions in the world (Wells, 1988). The largest reef settlements on the globe is the Great Barrier Reef situated in the Coral Sea off the state of Queensland in the Australian continent. The reef is composed of more than 2900 smaller reefs spread in an area of 3,44,400 km^2, with more than 400 coral species (Veron, 2000). From the biodiversity point of view, the Indo-Pacific reef is roughly ten times more diverse than the western Atlantic reef. For example, there are approximately 60 species of hermatypic corals reported from the coral reefs of the western Atlantic whereas 500-600 species are reported from the Indo-Pacific reefs. Approximately 800-1000 spp. of corals are found all over the world. More than 100 countries are endowed with coral reefs worldwide; most of these are developing countries (Venkataraman et al. 2003).

The species diversity of corals varies at different regions. The maximum coral species are found in South East Asia at a region known as the Coral Triangle where 605 spp of the world's coral species have been reported. The Coral Triangle is a geographical term referring to the tropical marine waters of Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands and Timor-Leste. The highest coral diversity resides in the Bird's Head Peninsula of Indonesian Papua, which hosts 574 species, with individual reefs supporting up to 280 species per hectare. Within the Bird's Head Peninsula, reef of Raja Ampat is the World's best coral diversity spot with 553 species (Venkataraman et al., 2003).

The southernmost distribution of coral reef can be observed in the southern side of Australia and also in the Southern side of Africa whereas the northern most distribution of the coral reefs can be found in the northern Caribbean reefs. The coral reefs of GOK are also considered to be the northern most reef of the Asian continent.

Coral reefs have been studied for their ecology, bleaching, diseases, degradation, reef associated fauna, intra-specific competitions, reef fishes and their economical values etc. worldwide. However, most coral reef surveys have been limited to discrete reefs or species or time limited (Bythell et al, 1992; Dustin and Halas, 1987). Study of coral diversity of Arabian Gulf and the Gulf of Oman showed clear effect of geographical isolation and extreme environmental conditions with the decreased number of species and highly altered community structure. The Dendrophylliidae, Faviidae and Siderastreidae families have been over represented than the most diverse family Acroporidae (Coles, 2003). Further, the diversity of coral and other sessile organisms has been recorded to follow a consistent pattern of increase with depth up to 20m and then gradual decrease; this is attributed to the gradient of light energy (Huston, 1985). The same preference for illuminated places (substratum) has been shown by coral larvae, the preference is found to be independent to depth contour for exposed microhabitats; the vertical microhabitats are second most preferred up to 17m depths whereas cryptic habitats are preferred below 20m depths (Edmunds et al, 2004). However, on local scale the distribution of corals and other sessile organisms is mainly restricted by inter-specific competitions, predators and water movements (Glynn, 1976).

Veron (2000) states that due the inability of Acropora to survive and dominate in slightly turbid waters, such habitats if protected from strong wave actions can turn out to be more diverse than their counterparts in the clearer waters in the depth.

Association or symbiosis is a common and very important phenomenon in reefs. Association between fish and anemones, shrimp and anemones, and, corals and bivalves are known examples. In contrast to the association between organisms, reefs are places to witness aggressive competitions for resources like food and space. However, genus like *Palythoa* can dominate the marine sessile invertebrate community in various reef zones with about 2.5 mm/day growth rate, irrespective of physico-chemical environmental condition (Suchanek and Green, 1981). While, studies on corallimorpharians has revealed their aggressive behaviour exhibiting the role of defensive mechanism of their tentacles and mesenteries in space

competition with scleractinians and actiniarians (Miles, 1991). Further, *Rhodactis rhodostoma*, has been observed to over grow the branching corals with smaller corallites but could not challenge the massive corals with larger polyps. Soft corals were found resistive to the corallimorph's stings (Langmead and Chadwick-Furman, 1999) and occupy any left-out space in reef with rapid growth though longitudinal fission, inverse budding, and marginal budding. Their growth was found to be controlled by photoperiod and sea water temperature. Chadwick-Furman and Spiegel (2000) by means of cloning could double them within a year.

The reefs are also threatened by various factors; anthropogenic and natural as well. Sediment, sea temperature rise, outbreak of disease, anchoring, diving is a few to name. Physiology of corals under sedimentation loads showed lowered photosynthesis during the day and respiratory increase during night (Abdel-Salam et al, 1988), Excess fishing in reef areas have been reported to lead to degradation of the reef food chains. Interestingly, reduced fishing does not only allow the reef fish stock to remain at minimal essential level, but also help in increase in number of grazers in reef ecosystem which promote the coral recruits by controlling macro algae (Mumby et al, 2007). Presence of ammonium ion also significantly decreases the motility (Bassim and Sammarco, 2003). Neverthless, reduction in coral cover due to anchoring on reef areas has been found to be the prime factor than recreational diving and chemical pollution due to antifouling paints (Saphier and Hoffmann, 2005). Many coral diseases have been recognized and their spread, causative agents and effect of climate have been studied. In recent, years number of coral diseases and their frequency of occurrence has increased, but our knowledge of the diseases, their progression and underlying cause is very limited (Kim et al, 2009). A detailed structural and microbiological investigation revealed the difference between looking alike disease - the white syndrome and white disease (Ainsworth et al, 2007). A new kind of disease from Southern Arabian Gulf "Yellow Band Disease", has been found to affect *Acropora, Porites*, and *Turbinaria* with rapid spread in summer than in winter (Korrubel and Riegl, 1998). Further, field experiments have indicated that 2 to 5 time increase in nutrients in reef environment is

sufficient to double the tissue loss by the yellow band disease (Bruno et al, 2003). This suggests that alteration in water chemistry due to excess nutrients promote outbreak of Yellow band disease and not the increase in macro algae due to nutrient influx.

The human sewage entering into reef environment is also likely to trigger disease outbreak in corals. In Caribbean reefs, microbes from human faeces were found to be common link between White pox disease, vectors and surrounding environment (Sutherland et al, 2010).

INDIA

Indian coral reefs have been studied for extent, management issues and socioeconomic aspects (Muley et al, 2000). However, majority of ecological studies on Indian reefs remained limited to the diversity, distribution and assemblage patterns of hard corals and other associated fauna and flora. Early studies by C.G.S Pillai documented Scleractinians' diversity from Indian waters with many descriptions of new species and new records (Pillai and Patel, 1988). Recent studies of Gulf of Mannar and Andaman Nicobar reefs have added many new species into account of India's coral diversity (Venkataraman et al., 2003; Patterson et al., 2007). The community structures and spatial variations have been studied at Gulf of Mannar, Palk Bay and also along the Southwest coast of India (Jasmine et al, 2009). The associated soft corals from the Indian water are reported from north Andaman waters (Vinod et al, 2007). Bleaching and tsunami like natural catastrophic events in Indian coral reefs have been given proper attentions (Vivekanandan et al, 2009). South Indian reefs were studied for bio-invasion of macro algae that was reported to gain dominance in the local reef environment and, overgrow live coral colonies (Chandrasekaran et al, 2008). Indian reefs are comparatively less studied and monitored for disease outbreaks. In 2001, association of fungi was studied with healthy and diseased colonies of *Porites lutea* from Lakshadweep (Ravindran et al, 2006). Subsequent structural and microbial studies revealed the cyanobacterial infection as the cause for the Pink Line Syndrome (PLS) in the Porites. However, role of physical environment was also not denied in promoting the PLS in the genus (Ravindran et.al 2006).

In Gulf of Mannar, total 09 diseases were found common with varied degree of prevalence, with PLS dominating the numbers (Thinesh et al, 2009).

The studies on the taxonomy of Indian corals have a history of nearly 160 years by Link (Pillai 2010) from Nicobar Islands, parallel to the works of Darwin. Subsequent studies by British scientists on materials housed in British Museum of Natural History, London and works of Late Prof. George Matthai and C. S. G. Pillai have elucidated the coral fauna to some extent. These were considered to be the first stage of surveys, which were basically unplanned as they were a part of the Surveys of other coastal ecosystems (Wafar Coral reef surveys in India 1988). The coral fauna of Gulf of Mannar and Palk Bay were estimated (Pillai and Patel, 1988), Lakshadweep and Gulf of Kachchh (Pillai and Patel, 1988) and Andamans (Pillai, 1983) and also west-coast of India i.e. the erstwhile Travancore coast including Kanyakumari coast (Pillai and Jasmine, 1991). For details of references the recent work of George (2008) may be referred along with Pillai (1986). Pillai (1996) published a detailed status report on the corals and coral reefs of India which still remains as the basic document. However, subsequently status reports were prepared and published by several authors including Wilkinson (2002), Muley et al. (2000) and Patterson (2007). Pillai (1996) listed 199 species of corals from Indian waters belonging to 71 genera of which 55 were colonial hermatypes and the rest ahermatypes. The hermatypes comprised 155 species and the rest deep sea or shallow water ahermatypes. Venkataraman et al. (2003) listed 208 hermatypes from India. Additional information based on recent works from Marine biosphere in Gulf of Mannar accounts for nearly 8 more species, thus totalling to about 220 species of colonial corals plus nearly 45 species of deep water and shallow water ahermatypes. This accounts for about 265 species of stony corals from Indian waters. However, Venkataraman et al. (2003) states another 111 species of hermatypes from Andamans by underwater diving which should be added to the list. The species listed by SCUBA diving on more sights, are unreliable since identification of corals in-situ underwater with any certainty is difficult (Pillai, 2010). Wells (1988) stated that approximately 700 species of corals occur in the whole of Indo-Pacific region including 35% occurring in the Indian waters.

The history of reef-based research in Gujarat is almost one century old now. The first comprehensive document on the marine flora and fauna was published under the authorship of Hornell (1909). Two volumes of his work published for the state of Baroda ruled by the HH Maharaja Sir SayajiRao Gaekwad III is one of the finest descriptions of the coral reefs of Okhamandal (now known as Poshitra cluster). Hornell also described the reef based chank fishery and other fishery based small scale businesses. He also described some of the important groups of the reef diversity such as hydroids, polyzoans, nudibranchs and poriferans. In the modern era of coral reef research, Gideon (1957) described the first occurrence of scleractinian corals from the area. Pillai and Rajagopalan (1979) gave a report on their preliminary survey at various locations such as Paga and Boria in the western gulf and Pirotan in the eastern gulf. They mainly described the coral formations and its diversity. The duo of C.S.G. Pillai and M I Patel contributed maximum in the reef research of the Gulf of Kachchh. Their most comprehensive publication (Pillai and Patel, 1988) described 37 species of hard corals from 16 different reefs of the southern Gulf of Kachchh. Patel (1985) also described the impact of mining on the patchy coral reefs of the Gulf of Kachchh. Earlier Patel (1976; 1978) had given an account of the coral diversity at Poshitra point in which he studied 16 reefs present in the Poshitra bay. DOD Space Application Centre (SAC), (1997) using remote sensing as a tool, gave detailed mapping of the Indian Coral reefs, dividing them into various reef classes. SAC (2003) has also published "Ecomorphological Zonation of the Coral reefs of India", in which few of the coral reefs of the GoK have been included for supervised classification of the habitat. Further, SAC (2010) has also published an "Atlas of Coral reefs of India", in which they have classified some of the coral reefs of GoK in various geomorphologically distinct habitat classes.

Arthur (2000) described the bleaching event in all the major reefs of India including the Gulf of Kachchh, which concluded that the reefs of the GoK to be more resistant to the environmental fluctuations. Pradhan et al. (2004) described the utility of remote sensing for classifying the reefs with reference to their eco-morphological zones, while Bhattji (2011), gave

effects of sedimentation that affects corals through tissue damaging. The GoK receives heavy load of sediments from the Indus River (Kunte et al., 2003). Multi-temporal, high spatial resolution, and multi-spectral satellite images can be integrated on a GIS platform to identify the micro reef-zones vulnerable to future sedimentation. Vethamony et al. (2005) described the physical processes such as current circulation and sediment dispersal -with special reference to the coral reefs of the Gulf. Chauhan et al. (2000; 2006) mainly described the sedimentation and suspended solids in the Gulf of Kachchh. Deshmukhe et al. (2000) gave an overview of the coral reefs of the Gulf of Kachchh, in which they described the diversity of corals at Pirotan, Kalubhar, Boria and Beyt Shankhodar in the southern Gulf of Kachchh. Pandey et al. (2010) have given the recruitment and growth rates of some corals at six locations in the Gulf of Kachchh.

Several studies have been conducted on the fauna present in the Gulf of Kachchh. Few major among these are considered here. In 2001 Kundu has described the intertidal macro fauna of the Narara and Sikka intertidal area. Dave (2011) encountered three species of Zoanthus sp. categorizing them by the mouth color (green, orange, green mouth). Nagale (2014) reported twelve species of intertidal hydroids of which six were reported for the first time from the Indian coasts. Many wintering migratory birds at Narara coastal reef have been reported by Bhuva in 1988. Adhvan (2014) reported 32 species reef fauna from the intertidal reef at Narara and also (2015) reported the impacts of algal bloom on reef ecosystem at Narara as well as Poshitra coastal reefs. *Thordidsa villosa*, a newly reported Ophisthobranch was reported by Prasade et al., (2013). The interactions between scleratinians and Zoantharians in the rocky intertidal areas of Saurashtra coast has been reported by Khushali et al., (2012). A nudibranch *Stiliger smaragdinus* was reported from Narara and Poshitra coastal reefs by Apte et al., (2015). Where Parasharya also worked on coral reef biodiversity in the Gulf of Kachchh.