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Secret of vibrant water- A Study on Coral Reef around Indian Coast

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Abstract:

Coral reefs are window to the past. They are ocean reefs created by coral (living animals) or especially by stony coral colony. These corals have outer skeleton made up of limestone which is made by carbon di-oxide and calcium which is present in the sea water. The network of these skeleton of dead coral are creates reefs under sea water. There are also the living coral reef as well. Beneath the water the dead coral reefs occupies the lower water are while living ones covers the top .But with the time these reefs are being affected greatly due to human activities. The waste that we are disposing in water eventually meets the ocean and pollute the water as well as its habitat. If we still don't take any step to prevent them, there might be the chance that the future generation won't even able be to witness these alluring window to the past. Affecting reefs will not only affect mankind but also affect the creatures underwater who are dependent on reefs for their survival and we all do know that even a single loop in the food chain will show impact to every individual from lower class to the upmost higher class on the Earth. In this paper we have covered the concerns for reef, impact of pollution on them and their fluctuating population around the Indian coast (Levy, 2008).

Keywords: *Coral Reefs, Ocean, Pollution, Limestone, Indian Coasts*

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Introduction

A reef is a ridge of material at or near the surface of the ocean. Reefs can occur naturally. Natural reefs are made of rocks or the skeletons of small animals called corals (National Geographic)

The chief coral reefs include atolls along the more than 2000 km Lakshadweep-Maldives-Chagos ridge; fringing and patch reefs in the Andaman and Nicobar Islands, India, around the Gulf of Mannar in India and Sri Lanka, and along the south western and eastern coastline of Sri Lanka. Less well developed coral communities occur in other parts of India, especially in the Gulf of Kachchh, as well as along the coast of Maharastra, Goa, Karnataka, Kerala and Tamil Nadu. Limited and rather poorly studied coral communities are found around St. Martins Island/Jinjiradwip and Jinjira reefs in Bangladesh, and along the Baluchistan coast in Pakistan, including around Astola Island and Gwadar. (Tamelander and Rajasuriya, 2013).

Reefs can be of following types:-

Artificially Manufactured Reefs-

Man-made reefs are built for three chief reasons. The first is to guard the coastline. Reefs work as barriers between the coast and powerful ocean tornadoes. They also protect coastlines from erosion. The Maldives, an island nation in the Indian Ocean, has built reefs to protect its low-lying coral islands from cyclones and other factors that may lead to beach erosion.

The second reason people construct reefs is to encourage sea life for recreation and aquaculture. A reef ecosystem is very diverse. Plants, plankton, algae, sponges, eels, fish, crabs, and sea turtles are just some of the organisms that thrive in healthy reefs. The wide variety of fish (including sharks) make recreational fishing popular in reef ecosystems. Brightly colored fish, sea anemones, and sea stars also make reefs popular with scuba divers and snorkelers. Artificial reefs off the Atlantic coast of the U.S. states of Florida, Georgia, and South Carolina have contributed to the area's wildlife and encouraged tourism. Artificial reefs can also prepare sedentary creatures, such as clams and oysters, for harvest. Japan is also a leader in creating artificial reefs for pearl-producing oysters.

A third reason for building reefs is to create a wave pattern that helps the sport of surfing. Surfers ride boards on top of waves. Engineers have tested reef shapes to improve surfing conditions. These reefs are usually located far offshore and have the advantage of creating a larger, safer swimming area near the coast.

Natural Occurring Reefs-

There are several types of natural reefs. "Live-bottom" reefs are ledges or projections of rock. Organisms such as sea anemones and seaweeds attach themselves directly to these kind of rocks, forming a live-bottom reef for fish and plants. The sharp rocks provide overhangs and protection for fish and other marine life, such as seals.

Oyster beds which is also called as shellfish reefs, are a unique type of live-bottom reef. Oyster larvae attach themselves to large adult oysters at the bottom of the reef, to form layers into huge oyster columns. Oyster shells, not rocks, provide the hard surface on which reef organisms like sponges can grow. They provide protection for fish like gobies and a food source for animals like turtles. The most acquainted type of natural reef, however, is the coral reef. These multicolored limestone ridges are constructed by tiny sea animals called corals. Their hard outer skeletons (exoskeletons) are what make up coral reefs. There are many different kinds of corals. The ones that form reefs are known as hard, or stony, corals. Corals that do not yield exoskeletons are known as soft corals.

Coral reefs grow slowly, usually at the rate of only a few centimeters per year while others may have formed over millions of years and can be measured up to hundreds of meters thick. Its best example is the Great Barrier Reef off the northeast coast of Australia and stretches for 3,000 kilometers (1,600 miles).

How are Coral Reefs formed?

A coral is known as a polyp and grows somewhat a bit larger than a human fingernail and is often only the size of a pinhead. It has a simple, tube like body with tentacles at one end.

Most hard corals replicate by budding, it is a process of forming small buds that develop into new individual of polyps. The polyps build hard, cup-shaped skeletons around their soft bodies. Sometimes, corals reproduce from eggs also where larva hatches from an egg laid by an adult polyp. The larva floats through the water until it reaches a spot it can attach itself to, usually part of an existing coral reef or other limestone structure. The young polyp produces a material called calcium carbonate, also known as limestone. This hardens around the polyp and joins it to the reef. The exoskeletons protect corals from enemies. As the animals die, more polyps build exoskeletons on top of the remains.

Different species of corals build different shapes of reef. Some look like branching trees or bushes. Others look like large domes, fans, or antlers or some may even look brain like structure. The bodies of living

polyps are often visualized in vivid colors of pink, yellow, blue, purple, and green.

In addition to warm water, coral needs water that is clear and transparent because water filled with silt or other sediment would smother or choke the polyps.

Some corals, however, do not need algae to survive. These corals can live in much deeper, colder water. Cold-water coral reefs, also known as deep ocean reefs, are found from Norway to the Aleutian Islands.

Apart from living or dead, on the basis of the type of formation, there are three kinds of coral reefs: fringing reefs, barrier reefs, and atolls.

A fringing reef forms along the edge of a coast and is attached to land. It extends outward from shore like a shelf, just below the surface of the water. A fringing reef is composed of a reef that is horizontal plane and a reef slope. The reef flat is nearest to shore. Due to heavy residue, few live corals live in the reef flat. It is mostly made of exoskeletons. The reef slope faces towards the ocean. Most marine life is found on the reef slope. Fringing reefs are the most common type of coral reef.

A barrier reef is divided from the shore by a lagoon. The reef produces a barrier between the coast and the Open Ocean or sea. Some barrier reefs consist of network of smaller reefs divided by narrow waterways. Its best example is The Great Barrier Reef.

An atoll is a reef in the open sea that is surrounded by a lagoon. This kind of reef is built when a ring of coral builds up on the sides of a volcano under the sea that has risen above the ocean surface. The volcanic peak gradually erodes and sinks below the water's surface, and the reef continues to build. As the time is passed, parts of the reef appear above the sea as a ring-shaped island or chain of islets.

Reefs are broken and wrinkled by fast-moving, influential waves that crash into them. When waves break down the hard coral of a reef, they strike it into a fine sand. Such sand covers many tropical beaches and helps form new land. As it grows, a coral reef provides homes for a vast number of living creatures. Coral reefs are among the richest, most varied communities of life found anywhere in the ocean.

(National Geographic).

Problems regarding reefs

Agricultural industries and construction also release harmful chemicals into rivers and drains that empty into oceans eventually. Many coastal cities dump sewage and other wastes into the ocean. This pollution causes certain types of algae to cultivate quite rapidly that form thick mats on the top of the ocean. These harmful algal blooms block sunlight and can be fatal to a living coral reef.

Reefs are also being harmed through underwater mining and oil drilling. Some of them have been damaged by explosives which are used to clear out channels in the seabed for ships for clearance of their way.

Overfishing has also caused great damage to some reefs. Cold-water coral reefs are especially vulnerable to overfishing because of the technology used. Huge trawling nets drag along the bottom of the ocean, terminating vulnerable coral habitats. Overfishing and habitat devastation have made shellfish reefs among the most endangered aquatic habitats on Earth in the current situation

Killing tropical fish for sport or collecting them live to sell to aquarium dealers puts tropical coral reefs at risk. Other reef individuals, such as the Hawksbill sea turtle, have been collected in such a major quantity that many are now endangered. The turtle was hunted for use in "tortoise shell" jewelry. Red and orange species of coral are also valued material for jewelry.

Artificial reefs have proven catastrophic for the environment. Osborne Reef, near Fort Lauderdale, Florida, was constructed of more than a million used car and truck tires. Among these, few animals has adapted to live life around the rubber reef. The tires were not fastened properly and many broke loose. Heavy tires crashed into natural coral reefs nearby, hurtful for the ecosystem. Hurricanes and storm surges carry tires to beaches and harm the natural habitat of reefs (National Geographic).

Review of Literature

Mc Clanhan, Maina and Muthiga (2011), majorly worked on connection between climatic stress and coral reef in western Indian Ocean. Their agenda was to determine if there was any associations between high diversity coral reefs and regions with low-to-moderate climate stress. Their findings suggested that disclosure to stress was monitored from satellite data based on nine geophysical– biological oceanographic characteristics that cause coral bleaching which are basically temperature, light, and current variables. The environmental stress model and the coral community's susceptibility index were temperately correlated (r 50.51) with southern and eastern parts of the WIO identified as areas with low environmental stress and coral communities with greater dominance of bleaching stress-sensitive taxa. Amounts of coral and fish taxa were encouraging and moderately correlated (r 5 0.47) but high diversity regions for fish were in the

north and west while multiplicity was highest for corals in central regions from Tanzania to northwestern Madagascar. Combining three and four of these variables into composite maps identified a region from southern Kenya to northern Mozambique across to northern–eastern Madagascar and the Mascarene Islands and the Mozambique–South Africa border as areas where low-moderate environmental exposure overlaps with moderate-high taxonomic diversity. It was further added in the paper management efforts in such areas should be majorly aims at maintaining high-diversity and intact ecosystems are considered least likely to be damaged by climate disturbances in the near term. Also, minimizing the additional human disturbances, such as fishing and pollution, in such areas is expected to recover the chances for their perseverance. These reefs are considered a high priority for increased local, national, and international management sweats in establishing coral reef refugium for climate change impacts.

Sheppard et al.(2012) in their paper they have analyzed the scientific work and historic information that demonstrated the outstanding ecological standards of the Chagos Archipelago, which was led in the year 2010. They reported that coral reef fishes are orders of magnitude which more ample in number than any other location in Indian Ocean, regardless of whether the latter are fished or protected. It was also reported that coral diseases are tremendously low, and no invasive marine species are known. Genetically, Chagos marine species are part of the Western Indian Ocean, and Chagos serves as a 'stepping-stone' in the ocean. It was suggested that Chagos is ideally situated for several monitoring programs, and its use is increasingly being made of the archipelago for prevention of reefs.

Tamelander and Rajasuriya (2013), in their paper basically worked on the current status of coral reef in south Asian Country. These country included Chagos, Bangladesh, Maldives, Sri Lanka & India. They maintained the status of reefs until 2004 and further until 2008. They witnessed in 2006, a strong recovery of coral cover after the mass mortality in 1998 in the Chagos archipelago. They mentioned that recruitment of Coral larval was very strong, such that the lowest Chagos recruit densities were at least 10 times higher than rates of recruitment at most other reefs in the central and western Indian Ocean. For the status of Maldives they reported that coral cover is now at the same level as in the pre-1998 community at many sites, the coral size class distribution still reflects the fact that the reefs are recovering, with the majority of colonies between 10 and 20 cm in diameter, followed by 20-40 cm sizes. Coral diseases, such as white band and black band, are less frequent than previously observed at some reef sites, while the sponge Terpios hoshinota is common at some sites where it overgrows and kills several coral species. For the status of India they reported that the main Indian reef areas, including the Lakshadweep Islands, Andaman and Nicobar Islands, and Gulf of Mannar, with limited and largely anecdotal information for reefs elsewhere in the country. There has been a reduction in algal turf and macro-algal cover compared to earlier studies, possibly explained by healthy populations of algal eating fish, particularly scarids and acanthurids, which are reported to facilitate coral recovery while there has been dominance of few other species in increasing population. For the status of Sri Lanka, they reported the highest rate of recovery from the mass bleaching in 1998 has been recorded at Bar Reef Marine Sanctuary where coral cover increased from 40% in 2004 to about 70% in early 2007, largely due to rapid growth of Acropora cytherea and Pocillopora damicornis. For the status of Bangladesh they have reported that there are 66 species of scleractinian corals in 22 genera and 15 families. Only limited coral bleaching has been observed since 1998. The area was declared an Ecologically Critical Area in 1999 under the Bangladesh Environmental Conservation Act. And for the status of Pakistan they reported that near Astola Island identified 25 coral species and 77 reef fish species. National capacity to survey and monitor coral reefs remains weak, while Mangrove and coastal wetland management initiatives are better develop.

Chevallier (2017), this paper addresses some dominating challenges in the West Indian Ocean area related to the comprehensive management which are required to ensure that resource management styles, specifically in and around MPAs, produce outcomes for nature and for people as well. The Western Indian Ocean (WIO) area has worthy and varied coastal as well as marine resources, but much of its natural assets is either threatened or deteriorating. Countries in the WIO region is making efforts to tackle for a sustainable oceans economy but there is a crucial need for effective tools to ensure the flexibility of coastal and marine biodiversity in order to regulate sustainable resource use and to defend the livelihoods of millions of individuals. Int the end of the paper it was suggested that Key to success is to enhance socio-economic development benefits and in order to communicate these aids through detailed economic valuations. Care should be taken for not only in expanding protected areas' coverage but also on improving the capacity of supervision agencies and communities to govern preservation of these areas effectively.

Conclusion

In recent few years, most of the tropical ocean has been badly affected by pollution, over-exploitation and numerous unwise types of development (Millennium Ecosystem Assessment, 2005). Almost all of the pointers of 'ocean health' remain to show adverse trails in improvement, and many attempted remedial measures have failed to capture the failure of habitats and ecosystems which is vital for both human welfare and maintenance of biodiversity and productivity as well. If we do not take action for their preservation, we will not be able to witness the window to the past in probably coming 30-35 years which is definitely a great loss to human and other eco-system which are directly or indirectly dependent on these coral reefs for their survival. May be the human won't witness the loss immediately but sooner or later mankind has to suffer. Yet it's not too late for us to save them and to prevent mankind from the consequences (Sheppard *et al.*)

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