

The coral reefs crisis: an axiomatic threat of possible extinction

Jasmine Madaan

3rd Year Student, B.B.A. LL.B. (H), Vivekananda Institute of Professional Studies (VIPS), GGSIPU

Email: jasminemadaan100@gmail.com

Abstract

Extensive bleaching and the threat of probable extinction of coral reefs are major concerns of the current scenario. It is estimated that if the same situation persists, by 2030, 90 percent of coral reefs will be endangered (Baswapoor, Irfan, 2018). The axiomatic statistics have time and again insinuated the non-effective social and legal protection catered to coral reefs. The paper highlights the dreading situation bifurcating it into five parts. The first part introduces the topic and sheds light on coral reefs' existence and their importance in the environment. The second part highlights the international legal initiatives including the UN initiatives to protect and revive coral reefs and their environment. After employing international initiatives as the foundation, the third part of the paper analyzes the Indian legal regime which implicitly or explicitly offers protection to coral reefs. While tracing the development of the legal regime in India, the paper has highlighted the lacuna in strict and separate laws pertaining to coral reefs' protection and simultaneously makes a case to implement one. The fourth part highlights the current deteriorating situations, the existing natural and anthropogenic threats, recent bleaching and exploitation events and the paper also provides suggestions to safeguard and help in the revival of coral reefs. Lastly, in the fifth part, the paper is concluded. With the help of doctrinal method, the proposed paper has attempted to highlight the current situation and legal regimes both internationally and in India, taking the hypothesis that the lacuna in strict laws for the protection of coral reefs in India and insufficient implementation of the existing ones for coral reefs' protection is the major cause of its depletion; and man-made threats are more grave and destructive human actions aggravate natural threats.

Keywords: coral reefs, legal regime, international, Indian, bleaching

Introduction

The entire world is witnessing the increasing voice for aggressive climate change actions. Across the globe, inter alia, coral reefs have been falling prey to the side effect of aggravated climate change, a by-product of destructive human actions.

Coral reefs often referred to as the “tropical rainforest of the sea”, are one of the most biologically delicate and diverse underwater ecosystems around the globe formed by calcareous organisms i.e. those who secrete calcium carbonate (CaCO₃). Coral polyp, soft-bodied marine organisms, form a limestone skeleton by absorbing calcium in the water and attaches to a rock budding into thousands of clones forming the reefs and collectively a coral reef. They live in a symbiotic relationship with zooxanthellae, a marine alga, wherein zooxanthellae is provided with a safe environment to live and photosynthesize and in return, it provides energy to the corals in the form of its photosynthesis products.

Due to their over-sensitive nature, coral reefs cover only an area of 260,000 - 600,000 km², 0.2% of the ocean’s surface, or less than 0.1% of the Earth’s surface. The crisis of coral reefs’ extinction and excessive bleaching has been rapidly increasing globally, and despite the resolutions being taken by the international community the condition continues to deteriorate. The present legal regime towards curbing this crisis has fallen short of reaping effective results. As per the estimates made by the United Nations Environment Programme (UNEP), around 25% to 50% of the coral reefs around the globe have been destroyed and 60% are under grave threat.

Research Objective

The crisis of coral reefs’ extinction and excessive bleaching has been rapidly increasing globally. The aims and objectives of this research work are as follows:

- To highlight the importance of coral reefs to marine organisms, nature and humans;
- To bring out the incomplete legal framework for coral reefs protection in India and the loopholes in it;
- To bring out the international legal initiatives that are contributing to the safeguarding of coral reefs;
- To identify the existing threats to coral reefs and the best possible solutions.
- To highlight the current deteriorating situation and importance for prevention from extinction.

Research Questions

The following questions are attempted to be answered through this research:

- What are the international legal initiatives to protect and help in rejuvenation of coral reefs?
- Whether India needs a separate law for coral reefs' protection?
- Whether destructive human activities aggravate the natural threats to coral reefs?

Hypothesis

- The lacuna in strict laws for the protection of coral reefs and insufficient implementation of the existing ones for coral reefs' protection is the major cause of its depletion.
- There is no separate legal framework in India pursuant to coral reefs protection and revival and no present law is sufficient for the same.
- Man-made threats are graver and destructive human actions aggravate natural threats.

Research Methodology

The Methodology used in this research work is doctrinal i.e. primarily analytical and evaluative in nature. This type of research has hypotheses which are to be verified by analyzing various sources of the data. The doctrinal design has been used to study the importance of coral reefs, existing threats to coral reefs, various international initiatives for protection of coral reefs and existing Indian laws for protection of coral reefs. This has been done primarily with the help of different High Court judgments have been relied on to highlight the Indian legal stance on coral reefs' protection from illegal trade and primary sources including the Indian laws like the Environment Protection Act, 1986, The Wildlife Protection Act, 1972 and others. Additionally, inter alia, research of Spalding Mapping The Global Value And Distribution of Coral Reef Tourism (Spalding et al., 2017), The United Nations Convention on the Law of the Sea (UNCLOS), 1982, The Convention on International Trade and Endangered Species of Wild Flora and Fauna (CITES), Convention of Biological Diversity, 1992 are relied to understand the international legal initiatives to protect and revive coral reefs. Conclusion and suggestions have been drawn by keeping in mind the need for protection of coral reefs. Till now no field work has been done by the researcher.

Importance

The contribution of Coral reefs to the ocean is way more than merely adding to its scenic view. Coral reefs are often misbelieved to be mere enhancers of underwater beauty at a time when they constitute one of the most important marine creatures. As per estimates, coral reefs account for around \$2.7 trillion per year in the ecosystem service value (Spalding et al. 2017).

Reefs buffer the coastlines from natural calamities such as hurricanes and also prevent erosion. Coral reefs serve as an anchor for the small vessels and also offer protection to lagoons. It thus offers protection to communities, beaches, harbours, agricultural lands, property and life. The protection offered by the coral reefs helps in saving up the cost of coastal defence. Coastal wave energy can be reduced by 97% by a healthy reef.

Coral reefs, the medicine chest of the sea, are extensively used for medicinal purposes. They provide cures for diseases such as leukaemia, skin cancer, cardio-vascular and more. The skeletal structure is used for bone grafting.

They work as natural water filters due to their capacity of consuming matter suspended in the water leading to enhancement of quality and clarity of water near shores.

They help in the maintenance of underwater air quality by converting the dissolved carbon dioxide in the water into limestone thereby controlling the level of carbon in the ocean. They help in nitrogen fixation

Coral reefs play a crucial role in the world's fisheries. They are a vital source of protein, food and provide for nurseries to the marine organisms. The birth animals of reefs are found to play a vital role in the maintenance of food supply and protection of low-lying islands and act as a large habitat for marine plants and animals.

The importance of coral reefs to humans is evident from the statistics which show that around 850 million people situate within 100 km of a coral reef and offer economic benefits (Spalding et al. 2017). Ironically, they exist in places with high populations. They are a boon for the coastal economies by bringing in tourists thereby increasing job opportunities and enhancing the source of income of the people. The economies of small Caribbean islands are majorly dependent on coral reefs.

International Legal initiatives

The principal flaw with the international legal regime is its enforceability only on the countries that have signed or ratified them. However, the following are the international initiatives taken to protect and embrace coral reefs:

I. The United Nations Convention on the Law of the Sea (UNCLOS), 1982

It is the parent and principal convention pertaining to the ocean and its resources. It is a crucial treaty due to its conservation-oriented provisions. The preamble itself provides for “study, protection and preservation of the marine environment”. It provides that States shall protect and maintain their marine creatures including the ones in internal waters (Arts. 192–94). The States have been provided with the right to exploit their natural resources subject to the protection of their marine environment. It provides that necessary measures shall be taken to prevent, control and reduce pollution; and the State shall consider all forms of pollution. The States that are party to the convention or have ratified it are bound by the above-mentioned duties provided under Articles 192 to 194. In the arbitration matter between the Republic of Philippines and the People’s Republic of China, commonly called the South China Sea Arbitration, the Permanent Court of Arbitration inter alia held that China violated the provisions of UNCLOS by indirectly permitting fishing vessels to conduct harmful harvesting practices for coral reefs and other marine organisms.

II. Agenda 21

The final draft of Agenda 21 was adopted by 178 governments at the United Nations Conference on Environment and Development held in the year 1992 at Rio de Janeiro. The main objective was to implement an integrated international initiative to achieve sustainable development’s goal. Chapter seventeen of the Agenda inter alia provides protection to coral reefs and states that high priority shall be accorded to coral reefs ecosystems. Chapter fifteen is also significant and relevant with respect to coral reefs as it provides for the conservation of biological diversity wherein inter alia governments at the appropriate level should take action to reinforce aquatic, terrestrial and marine protected areas and embrace vulnerable coral reefs. In furtherance to implement chapter seventeen and other conventions at the Small Island Developing States Conference in 1994, the International Coral Reef Initiative (ICRI) was brought into force.

III. The International Coral Reef Initiative (ICRI)

It is an informal international partnership between countries and organizations to preserve coral reefs and similar ecosystems around the globe. It has developed action plans in adherence to the regional circumstances with national governments. Its work is recognized by the UN. It declared 2018 as the third International Year of the Reef at the 31st General Meeting in Paris, France to spread awareness regarding

their importance. In May 2020 the International Coral Reef Initiative (ICRI) which is a partner of UNEP has adopted certain recommendations to safeguard the coral reefs. These recommendations aim to bring the coral reefs in the priority list of the Convention on Biological Diversity Post-2020 Global Biodiversity Framework which is to be decided in May 2021. The biggest drawback of this initiative is the non-binding effect of resolutions passed by it even on the member countries. Thus in the author's view, such initiatives lose their value due to their non-binding nature as the states don't strictly adhere to the objectives.

IV. Convention of Biological Diversity, 1992

As the name suggests it is an international legally binding convention that aims at the protection and maintenance of biological diversity including coral reefs. India is one of the 188 parties to the convention and has thereby enacted the Biological Diversity Act, 2002. This was a landmark step as it made many countries implement national laws pertaining to the protection of wildlife.

V. The Convention on International Trade and Endangered Species of Wild Flora and Fauna (CITES)

It deals with the issue of international trade in endangered species including various forms of coral reefs. Coral reefs are often traded as they are used for various purposes like jewellery, souvenirs, etc. Trade of species mentioned under Appendix I is prohibited. It provides for a licensing system that is to be adopted by the member states to conduct import, export and re-export of species mentioned under Appendix II and III (Arts. IV-V). The members have banned international commercial trade in the list of endangered species and also monitor trade in others. All stony and reef-building corals are listed in Appendix II due to the deteriorating effect of the coral trade on its ecosystem. Thus, for the purpose of international trade of blue corals, black corals and antler corals permit is required by the country of origin. Almost 230 species of corals are listed under CITES Species Database. Earlier traders often avoided the problem of illegal trade or trade without due permits by stating that the said coral is a living rock and not hard rock making it permissible to be traded without permissions. After 2000 both hard and living rock are subject to convention.

VI. The United Nations Framework Convention on Climate Change (UNFCCC), 1992

It aims at stabilizing greenhouse gases and thus controlling the increasing temperature due to climate change and ultimately protecting the coral reefs from bleaching or extinction. Climate change is the main reason for coral reefs bleaching, even though this convention was a step in the right direction, climate change continues to take a dangerous shape.

VII. The United Nations Educational, Scientific and Cultural Organization (UNESCO)

UNESCO is another useful convention as it states that biological and physical formulations that hold outstanding value from a scientific or aesthetic point of view are natural heritage. It offers financial and technical assistance in the protection of natural heritage which is listed under the 'World Heritage List'. Eleven out of the 160 world heritage list's natural properties are coral reefs. Three are present in Australia including the Great Barrier Reef, two in Indonesia, India's Gulf of Mannar, and others are located in the USA, the UK, the Philippines, Mexico, Belize, and Seychelles.

VIII. The United Nations Environment Programme (UNEP), 1972.

It is the most crucial, often called the voice of the environment within the UN. It plays a crucial role in ICRI, the establishment of Coral Reef Unit (CRU), 2000 to oversee the finding to the International Coral Reef Action Network (ICRAN). Its authority body is the United Nations Environment Assembly, also known to be the world's highest-level decision-making body in matters related to the environment.

Various other initiatives like Global Coral Reef Alliance and Global Coral Reef Monitoring Network (GCRMN) play a crucial role in raising public awareness, conducting scientific research and monitoring coral reefs areas.

Indian Legal Regime

Despite the highly populated coastal areas, coral reefs in India are present in two areas off the mainland coast. These two areas are the Gulf of Kutch, in the northwest; and the Gulf of Mannar, in the Southern region. The remaining reefs are present in India's union territory islands: Lakshadweep Islands and the Andaman and Nicobar Islands (GOI, 2007). The Ministry of Environment and Forests is the authoritative department of coral reefs areas.

The absence of separate legislation pertaining to the coral reefs in India is significantly evident as none of the existing laws distinguishes coral reefs areas from the rest of the marine and coastal areas. However, there are certain environmental laws that are invoked for its protection, namely, the Environment (Protection) Act, 1996, the Coastal Regulation Zone (CRZ) Notification of 1991 and the Wildlife (Protection) Act (WPA), 1972. Other laws, namely, the Forest Conservation Act, 1980, the Indian Fisheries Act and the Indian Forest Act, 1927 also have relevance in coral reefs areas' protection.

I. The Environmental Protection Act, 1986

The umbrella legislation of environmental laws in India provides for general provisions catering protection to all the elements of nature, namely land, air, water and their interrelation. The Act grants power to the Central Government to protect and preserve the marine environment (ss. 6(3)(d), 7(4)(d)) but lacks any special provisions related to coastal reefs. In this author's view, the major gap can be filled by including coral reefs as ecologically sensitive under the Act, 1986. The main objective behind this would be to enable the concerned authorities to protect coral reefs areas without any limitation on the seaward side and prevent any harmful industrial activity near the area.

II. The Wildlife Protection Act, 1972

Four species of coral are covered under the Schedule-I list of the Wildlife Protection Act thereby covering them under the definition of wild animals under Section 2(36) (any animal mentioned under Schedule I to IV and found wild in nature is called wild animal) of the WPA. The coral species covered therein are Black corals, Sea Fan, Reef-building corals, Organ Pipes and Fire Corals. Inclusion in the Schedule offers them protection from exploitation and overuse by trade activities and industries. Section 39(3) provides that inter alia wild animals are government property which shall not be acquired or kept in possession or, transferred or, destroyed or damaged unless the Chief Wildlife Warden permits. Section 29 and 35(6) prohibits any person from destroying, removing or exploiting any wildlife from a sanctuary or a National Park, respectively unless the Chief Wildlife Warden gives permission and the State government is satisfied. Thus, as per these sections removal of listed coral reefs from the protected areas i.e. sanctuary or national park would be illegal. However, it doesn't cover all forms of corals thereby leaving the scope of misuse.

Madras High Court held in the case of the *State of Tamil Nadu & Another v. M/s.Kaypee Industrial Chemicals (P) Ltd. & Others* (2005 SCC OnLine Mad 252: AIR 2005 Mad 304) that if the coral reefs are washed ashore after the death of the reef-building coral, they can be sold, bought and used for commercial purposes and the government authorities don't have any right to interfere as such activities don't violate the provisions of WPA. However, the Supreme Court had granted a stay on the above-mentioned judgment. The opinion of Madras High Court was contrary to the Delhi High Court's view in the case of *Cottage Industries Exposition Limited v. UOI* (2007 (122) ECC 7, 2007 (148) ECR 7 Delhi) wherein dead corals were declared as a trophy or uncured trophy and thus were considered to be protected under the Act. The major concern here is that the coral invertebrates and reef fishes, in whose absence the coral reefs fail to maintain a healthy ecosystem, are traded under the Act leaving them open for exploitation. It would be interesting to note the Apex Court's view on this point as this can help in furtherance on the literature on coral reefs' protection in India.

In another case of *C. Rathinavel v. The State of Tamil Nadu* (Writ Petition No. 3631 of 2005), the petitioner contended that the coral reefs are minerals and lifeless substances, and the WPA isn't applicable. The court held that the above-mentioned contention is fallacious and coral reefs are not just animal articles but also habitat which provides a surviving environment to innumerable marine organisms and thus Section 29 prohibits the destruction of such habitats. The Madras High Court thus relied on the inclusion of coral reefs under the WPA and Supreme Court's stay in the *M/s Kaypee Industrial Chemicals Pvt. Ltd.* case for the trading of skeletons of dead washed ashore coral reefs.

The Gujarat High Court in the case *Gujarat Positra Port Company Limited & Ors. v. Union of India, Ministry of Environment, Forest and Climate Change and Ors.* (2011 SCC OnLine Guj 4703) rejected the petition of the petitioner seeking an order to grant permission for Environmental Impact Assessment for the development of a port at Positra. The Court highlighted the sensitive nature of coral reefs and stated that construction of shipping lanes and berths would inter alia destroy coral reefs and the following turbidity would kill the corals. Thereby, the Court provided protection to the corals and denied permission.

Despite the slight recognition by the Courts, the situation regarding various protection related issues remains unanswered. Different High Courts have passed various judgments including the above-mentioned ones, however, the view of the Supreme Court is awaited which can create uniformity by setting a precedent.

III. CRZ Notification

Coastal Regulation Zone (CRZ) Notification of 1991 and 2011 which were issued under the EPA prohibits certain types of activities in the CRZ, inter alia, coral mining, setting up or expansion of industries, fish processing units, effluents and waste disposal units, and discharge of untreated effluents and waste from cities, towns, other human settlements and industries, dumping of ash or any thermal power stations' waste and city waste for landfilling. It classifies the Coastal stretches within 500 m of High Tide Line (HTL) into four categories: CRZ- I, II, III and IV. Corals and coral reefs come under the CRZ-I declaring them ecologically sensitive areas and offering protection. As per Notification of 1991, CRZ-IV covers the Lakshadweep Islands, Andaman and Nicobar Islands and any other island which is not covered under CRZ- I, II and III. CRZ-IV is a protected zone where construction activities, dredging and blasting in and around coral reefs are prohibited; there's also a ban on the use of coral reefs from the shore for construction or any other person. Corals and sand from the beaches and coastal waters are prohibited to be used for construction or any other purpose. This part of the notification is often criticized for its restricted application to the abovementioned islands and not to other coral reefs areas such as the Gulf of Kutch and Mannar. The 1991 Notification was amended 37 times due to which 2011 Notification was released. The current draft of CRZ Notification 2018 is being highly criticized for permitting enhanced activities in the coastal regions.

IV. Others

Another hurdle is the old formed laws which need to be amended but have been stalled for so long. One of such laws is the Fisheries Act which penalizes only poisoning of water and use of explosives; it fails to take into account that with the advancement of civilization and depletion of resources, the methods of exploitation have also been diversified causing harm to underwater organisms including coral reefs.

The Marine Fishing Policy, 2004 bans all destructive methods of fishing but the term ‘destructive’ has not been defined and secondly, the policy fails to inculcate the interrelation of fishing methods with marine biodiversity. The legislature has failed to understand till date that imposing bans isn’t enough and measures for coral reefs’ regeneration and development of coastal bio shields are required.

V. Marine Protected Areas(MPA)

MPAs are existing patchworks of local, state and national efforts to protect biodiversity, in this case, corals. Most importantly they play an integral role in the protection of marine biodiversity. They cover the national parks & sanctuaries, national marine sanctuaries, etc. Currently, India has 36 MPAs in India of which only five are coral reef MPAs: Rani Jhansi Marine National Park, Mahatma Gandhi Marine National Park in Andaman Island, Gulf of Mannar National Park, Gulf of Kutch Marine National Park, and Great Nicobar Biosphere Reserve. They are monitored by the Ministry of Environmental and Forests.

VI. Indian Coral Reef Monitoring Networking (ICMRN)

Based on the recommendation of the National Committee on Wetlands, Mangroves and Coral Reefs, the Indian Coral Reef Monitoring Networking (ICMRN) was set up by the Ministry of Environment and Forests, GOI. ICMRN has the responsibility to manage databases of coral reefs, monitor the health of coral reefs, strengthening, training and capacity building of institutions for the management of reefs and implementation of Management Action Plans.

The USA has a special Coral Reef Task Force to protect and preserve the coral reef ecosystem. It also has a specific law called the Coral Reef Conservation Act, 2000 to restore and preserve the coral reef ecosystem. Moreover, a special list of corals is added to the Endangered Species Act which penalizes any offence committed against such endangered species. Whereas, a lacuna in Indian legislation is there with regard to coral reefs. India can implement similar law dealing specifically with coral reefs and a task force to monitor the deteriorating situation of coral reefs in India.

The current deteriorating situation

I. Threats

Coral reefs depletion has led to disruption in the marine food chain. To better understand the deteriorating situation it is crucial to understand the main threats. The threats can be categorized into three parts:

A. Natural/Climatic threats

Presence of certain species of marine organisms which graze coral make corals reefs more vulnerable to any chemical or physical threats. For instance, lionfishes are now found throughout the Caribbean which isn't its native place and where coral reefs exist in abundance.

Coral reefs are sensitive to the continuous high tidal amplitude, for instance in the Gulf of Kutch, exposing corals to the atmosphere for several hours which if coincided with hot temperature or weather can lead to the death of corals.

As a part of the natural food chain, the triton snails which feed on thorn starfish are depleting and in turn the increasing starfish population feed on the coral reefs, as seen in Lakshadweep Islands and the Gulf of Mannar.

B. Anthropogenic / Human-made threats

Marine pollution damages coral reefs' health. Oil spills, ships discharge, leaks in pipelines have short to long term endangering effects. Exposure of coral reefs to oil leads to severe reactions inter alia expulsion of the algae zooxanthellae, death of tissues, alteration in calcification rate and death of larvae (Hoff, 2001). As per a study, a single one-week cruise ship with almost 3000 people exclusive of crew generates around 3,700 m³ of graywater; 8 tons of solid waste; and 100m³ oily bilge water i.e. 70 times more waste than a cargo ship.

The Mauritius oil spill of 2020 which leaked more than 1000 tonnes of fuel oil into the ocean, was one of the many and recent alarming tragedies which call for the protection of coral reefs. Mauritius being an island nation located on the South-east coast of Africa in the Indian Ocean it is known to be home to some of the finest coral reefs in the world. The removal of oil is expected to be completed in January 2021 and thereafter the exact damage can be estimated. However, this has caused an impact on coral reefs and the Nation's people who depend on the sea for food, tourism and livelihoods that generates US \$4.3 billion and accounts for 36% of its GDP (UNDP, 2007).

While removing coral reefs for the construction of houses and production of lime, often dead corals aren't distinguished from alive corals due to which large patches of reefs are lost.

With the increase in population, the farmers are forced to increase the extent of fishing. They often indulge in deleterious ways of fishing, for instance, one such form is factory type fishing which scrapes the sea bed clean. Some countries use dynamite to blow the coral reefs leading to the death of marine life in that water body. Chemical substances like cyanide and organochlorines are often used in fishing posing a threat to reefs. Coral species in Lakshadweep Islands have been highly impacted due to the practice of live bait fishing due to which coral reefs are encircled and hit with nets. The Status paper prepared by the Zoological

Survey of India on coral reefs of the Gulf of Mannar found that the industrial pollution near the corals and mining of corals by locals had driven corals to extinction (Venkataraman et al. 2004).

Coral collection is another threat that promotes the usage of branching corals for jewellery making and souvenir purposes. In India, despite the laws in existence, the practice is still damaging the coral reefs of the Gulf of Kutch and the Andaman and Nicobar Islands.

The destruction of mangrove forests affects the coral reefs as the forests bind the mud and reduce the amount of sedimentation on the corals. Mangrove forests in the Gulf of Kutch are prone to destruction.

The increasing irresponsible tourist activities like snorkelling and excess untreated waste aggravates the problem.

C. Climate Change

Aggravating climate change is a product of the catastrophic actions of humans. Increased ozone layer depletion has in turn increased the number of ultraviolet rays entering the earth's surface, and these increased UV rays can damage the corals in the shallow water bodies. As a result of the warmer water temperatures, corals expel zooxanthellae living in their tissues and thereby turning white, this phenomenon is called coral bleaching. As a consequence the density of zooxanthellae decreases; they experience a decrease of 50%-80% in their photosynthesis pigment. The world witnessed its worst coral bleaching in 1998.

Ocean acidification is a phenomenon in which due to the absorption of CO² the chemical composition of the water body changes and the pH value ranges between 0.0-6.9 making it acidic. Coral reefs and other marine creatures aren't able to grow their skeletons in an acidic medium; even the ones that make are weak and more susceptible to destruction by storms.

Another climate change is the increase in the intensity of storms. Powerful and longer storms destroy the coral branches and sometimes overturn the colonies. Due to increased temperatures the glaciers have been melting at a faster rate thereby increasing the sea levels. Increased sea levels make the corals end up deeper in the water due to which they receive less sunlight thereby slowing the pace of their growth. The rate of sea-level rise is 0.13 inches per year in 2018 as compared to 0.1 inches per year in the 1990s (Lynch, 2018). The rate of probable extinction of corals has increased drastically and one-third of reef-building corals face extinction risk due to the local impact and climate change (Carpenter et al., 2008). 23 reef-building corals are listed in the IUCN Red List of Threatened Species as endangered and 6 as critically endangered.

Three events in history have been recorded to be the most fatal to coral reefs: 1998, 2010 and 2014-2017. The 2014-2017 coral bleaching has proved to be the most widespread and the longest bleaching event in history killing two-thirds of Australia's Great Barrier Reef. The El Nino effect of 2015-16 was the most drastic in the history for coral reefs due to aggravation circumstances offered by climate changes.

Temperatures in the Great Barrier Reef in Australia and Islands at Hawaii to Fiji recorded high temperatures (Borunda, 2019) indicating alarming signs.

II. Suggestions

Based on the above-mentioned discussion, this author has some suggestions for the continuing deteriorating situation of coral reefs:

Training and awareness shall be provided to people on the concept of conservation use of coral reef resources, especially in developing countries like India. NGOs, Government Institutions, International intergovernmental organizations shall be strengthened by merging their synergies to conserve coral reefs. ICRMN should be strengthened to act as a coordinating body to integrate local groups to better implement management action plans.

The establishment of MPAs can be increased to provide a safer, protected, fishing, mining and recreating free environment. MPAs offer more resilient power to coral reefs and make them healthier. It can't protect corals from heatwaves but a system of checks and balances is operated wherein fishes keep the algae in check enabling corals to survive. Infrastructure and building capacity shall be strengthened.

Establishment of no-take zones, a specific kind of MPAs that completely prohibit harvesting, extraction, and destruction of marine resources. Their objective is to provide a favourable environment to fishes for their proper growth which in return benefit coral reefs.

Adopting improved fishing methods help in the protection of coral reefs. Reducing or banning harmful fishing methods allow other sustainable practices to be promoted benefiting the communities dependent on corals for livelihood and the corals themselves. Moreover, controlled harvesting of fishes shall be ensured. UNESCO should add more coral reefs to its World Heritage List. It should offer protection to coral reefs by including them in the World Heritage in Danger list under Article 11. Article 19 and 22 provide that a State containing a reef can request and seek either monetary or technical international assistance.

Scientists have found MPAs to be helpful in saving reefs if rightly placed. The increasing development of genetic engineering and biotechnology has raised hope for the development of heat-tolerant coral reefs and therefore shall be strongly supported to find ways for the revival of coral reefs and prevent them from extinction. Countries shall invest in their Research and Development wings to promote biotech engineering and ultimately such new creations.

A strong requirement for separate legislation for coral reefs is there in India. India being a part of various International conventions like UNCLOS, CBD and CITES is bound to prevent coral reefs from exploitation as it has the sovereign right over resources within 200 nautical miles of their shore. The National Committee on Wetlands, Mangroves and Coral reefs shall form a national policy to safeguard and replenish coral reefs

areas. Along with new legislation, a strong need for its rightful implementation is there i.e. measures shall be taken to prevent corruption, bureaucracy and unnecessary exploitation by those in power etc.

Conclusion

No one would be incredulous that coral reefs provide immense benefits to both nature and organisms. Their role in the environment cannot be looked down upon. It is evident from the current deteriorating situation and minacious statistical data that if not taken care of then soon we will be witnessing the extinction of the coral reefs. Various departments across the globe are working towards the restoration of bleached coral reefs before they die completely. Similarly, the Zoological Survey of India is attempting to restore coral reefs in the Gulf of Kachchh using mineral or bio rock accretion technology.

Thus, the hypothesis that lacuna in strict laws for the protection of coral reefs and insufficient implementation of the existing ones for coral reef protection is the major cause of its depletion stands positive. The second hypothesis that there is no separate legal framework in India pertaining to coral reefs protection and revival; and no present law is sufficient for the same also stands positive. The last hypothesis that man-made threats are graver and destructive human actions aggravate the natural threats some of which are even an aggravated result of also stands positive as even climate change is a by-product of human actions.

References

1. UNDP, *Restoring Marine Ecosystem Services By Restoring Coral Reefs To Meet A Changing Climate Future* [online] UNDP Climate Change Adaptation, Available at: <https://www.adaptation-undp.org/projects/Mauritius-Seychelles-Marine-AF> [Accessed on 7 Dec. 2020].
2. IYOR, About IYOR - IYOR 2018, Available at: <https://www.iyor2018.org/about-iyor/> [Accessed 9 Jan. 2021].
3. Agenda 21, in Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992, UN Doc. A/CONF.151/26/Rev.1 (Vol. 1), Annex II.
4. Borunda, A., 2019. *El Niño, Explained.*, [online] National Geographic, <https://www.nationalgeographic.com/environment/weather/reference/el-nino-la-nina/> [Accessed 30 Jan 2021]
5. Convention for the Protection of the World Cultural and Natural Heritage, Paris, 23 Nov. 1972, reprinted in 11 ILM 1358 (1972).
6. Carpenter, K. E. et al., *One-third of reef-building corals face elevated extinction risk from climate change and local impacts*. Science (2008).
7. Coral reefs, UNEP.org, <https://www.unenvironment.org/explore-topics/oceans-seas/what-we-do/working-regional-seas/coral-reefs> [Accessed 19 Dec. 2020].
8. Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, 3 March 1973, 12 ILM 1085 (1973), Arts. IV-V
9. Cottage Industries Exposition Limited v. UOI, 2007 (122) ECC 7, 2007 (148) ECR 7 Delhi
10. Rathinavel v. The State of Tamil Nadu, Writ Petition No. 3631 of 2005
11. Government of India, Report of the Task Force on ISLANDS, CORAL REEFS, MANGROVES & WETLANDS IN ENVIRONMENT & FORESTS (Planning Commission, 2007)
12. *Global Threats To Coral Reefs Coral Reef Alliance*, Coral.org., <https://coral.org/coral-reefs-101/reef-threats/global/> (Accessed 29 Jan 2021).
13. Gujarat Positra Port Company Limited & Ors. v. Union of India, Ministry of Environment, Forest and Climate Change and Ors., 2011 SCC OnLine Guj 4703
14. Hoff, R. Z., and G. Shigenaka. 2001. *Oil Spills in Coral Reefs: Planning and Response Considerations*. Silver Spring, MD: NOAA, National Ocean Service, Office of Response and Restoration.
15. ICRIforum About Us, Icriforum.org., <https://www.icriforum.org/about/> [Accessed Jan. 5, 2021].

15. K. Venkataraman, R. Jeyabaskaran, CH. Satyanarayana and K. P. Raghuram, *STATUS OF CORAL REEFS IN GULF OF MANNAR BIOSPHERE RESERVE*, Marine Biological Station, Zoological Survey of India, 2004, <http://faunaofindia.nic.in/PDFVolumes/records/103/01-02/0001-0015.pdf> [Accessed 28 Jan 2021].
16. Lynch, K., 2018. *New Study Finds Sea Level Rise Accelerating – Climate Change: Vital Signs of The Planet*, <https://climate.nasa.gov/news/2680/new-study-finds-sea-level-rise-accelerating/> [Accessed 29 Jan 2021].
17. *Status of Coral Reefs in South Asia* (2002), <http://www.aims.gov.au/pages/research/coral-bleaching/scr2002/pdf/scr2002-06.pdf> [Accessed 6 Dec. 2020].
18. Spalding, M., Burke, L., Wood, S., Ashpole, J., Hutchison, J. and zu Ermgassen, P., 2017. *Mapping The Global Value And Distribution Of Coral Reef Tourism*. Science Direct, <http://sciencedirect.com/science/article/pii/S0308597X17300635> [Accessed 23 Dec. 2020].
19. Srihitha Baswapoor & Zareena Begum Irfan, *Current Status Of Coral Reefs In India: Importance, Rising Threats And Policies For Its Conservation And Management* - India Environment Portal, INDIANENVIRONMENTPORTAL.org, Available at: <http://www.indiaenvironmentportal.org.in/content/458561/current-status-of-coral-reefs-in-india-importance-rising-threats-and-policies-for-its-conservation-and-management/> [Accessed 27 Nov. 2020]
20. State of Tamil Nadu & Another v. M/s.Kaypee Industrial Chemicals (P) Ltd. & Others, 2005 SCC OnLine Mad 252: AIR 2005 Mad 304
21. The Environmental Protection Act, 1986 (Act no. 29 of 1986), ss. 6(3)(d), 7(4)(d)
22. United Nations Convention on the Law of the Sea, Montego Bay, 10 December 1982, 21 ILM 1261 (1982). [hereafter UNCLOS]
23. Warm-water coral reef, Biodiversitya-z.org, Available at: <https://biodiversitya-z.org/content/warm-water-coral-reef> [Accessed 19 Dec 19 2020].
24. What is CITES, CITES Secretariat, available at <https://cites.org/eng/disc/what.php>, (Accessed 10 Jan. 2021).
25. Wildlife Protection Act, 1972, s. 2(36) (India) [hereafter WLPA, 1972].