

# **A Systematic Approach Toward Reviving And Protecting India's Coral Reefs**

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## ***Abstract***

*Coral reefs are crucial to sustaining the marine ecosystem. Corals are tiny living polyps that group together in colonies and interact in a symbiotic relationship with diverse microorganisms like algae, bacteria, and fungi to form giant calcium carbonate structures that are massive enough to be viewed from space. These structures, occupying less than 0.5% of the world's surface, serve as habitats to more than 30% of all marine species. This is why they are also known as the "rainforests of the sea". In addition, coral reefs also offer protection to coastlines from the damaging wave actions and contribute to the economic welfare of communities that reside in the vicinity of the reefs.*

*As these reefs are built by tiny organisms, the atolls existing today in the Indian Ocean have been formed over 30 million years. The fragile ecosystems are already under threat*

*Indian corals.*

*by many natural disasters such as climate change, diseases, bleaching, and irresponsible and unchecked anthropogenic action like overfishing, underwater mining, and tourism among many others. As reefs turn into graveyards, large scale ecological and economic consequences follow.*

*In India, there are four major reef ecosystems: the Andaman and Nicobar reefs, the Lakshadweep corals, the Gulf of Kachchh in Gujarat and the Gulf of Mannar in Tamil Nadu, and one minor reef in the Malvar region. All these have suffered severe degradation in the past few decades. This paper groups the major reasons for such degradation into two categories: natural and anthropogenic, and suggests replantation through passing electricity through the frames, along with promoting responsible tourism, as the most optimum method of restoring the health of*

## Introduction

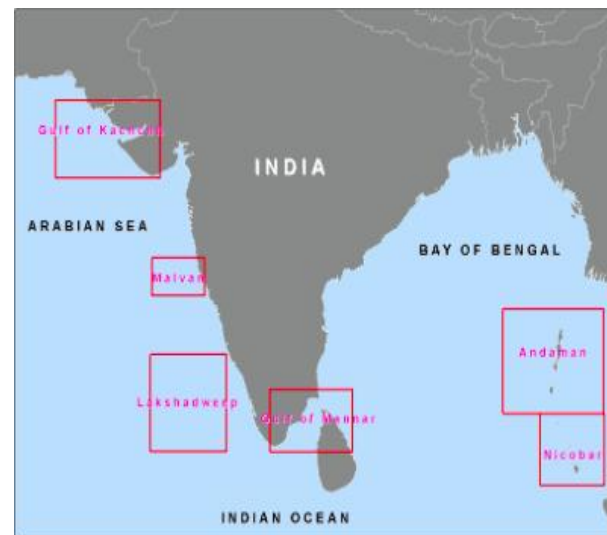
Corals are marine animals that typically reside in colonies of countless identical polyps (transparent sea animals related to sea anemones and jellyfish). More than eight hundred species of hard and soft corals are found around the world. A coral gets its color from the algae that resides within it. When a coral dies, its calcium carbonate (limestone) exoskeleton is left behind, which over countless generations, spanning millions of years, contributes to the formation of the reef structure.

A leading factor that causes the death of corals is stress. This includes changes in the pH level of the water, sediment deposition, temperature fluctuation, and tourism. While some of these factors are dependent on global atmospheric conditions (temperature), many are more closely related to local conditions (tourism). Through this paper, I seek to answer two questions<sup>1</sup>:

- (1) Which factors are instrumental in determining the health of the Indian coral reefs?
- (2) What is the most effective method of restoring the health of the Indian coral reefs?

In India, there are five reef regions (see Figure 1)—Andaman and Nicobar Islands,

Lakshadweep, Gulf of Kachchh, Malvar and the Gulf of Mannar. Degeneration of these reefs is a function of either individual stressors or multiple stressors acting together. However, coral bleaching appears to be the dominant factor that has resulted in the degradation of Indian reefs. In 2016, Andaman and Nicobar Islands lost about 23% of their total reef cover<sup>2</sup> owing to rising temperatures that resulted in bleaching. Moreover, the effects of mass coral bleaching on a regional scale have been observed and reported since 1998. The first mass bleaching event took place in 1998, then in 2010 followed by one in 2016, after which around a third of the world's reefs turned into graveyards. Indian reefs were affected by all three of these events.



<sup>1</sup> My interest in this topic was sparked through a few dives in the Havelock Islands at the Andaman Islands and when a coral that I had planted in the Maldives in 2012, died due to the massive bleaching outbreak in 2016 that caused 31% of the reefs across the world to die (Dunne, Daisy. "Severe Coral Reef Bleaching Now 'Five Times More Frequent' than 40 Years Ago." *Carbon Brief*, Carbon Brief Ltd., 4 Jan. 2018, [www.carbonbrief.org/severe-coral-reef-bleaching-now-five-times-more-frequent-than-40-years-ago](http://www.carbonbrief.org/severe-coral-reef-bleaching-now-five-times-more-frequent-than-40-years-ago). Date Accessed: 10th March, 2020.).

<sup>2</sup> Dutt, Anonna. "As Corals Die, Watery Grave Awaits Islands." *Hindustan Times*, Hindustan Times, 11 May 2018, [www.hindustantimes.com/india-news/as-corals-die-watery-grave-awaits-andaman-and-nicobar-islands/story-shgCNawKLiCCDjoxWKosEM.html](http://www.hindustantimes.com/india-news/as-corals-die-watery-grave-awaits-andaman-and-nicobar-islands/story-shgCNawKLiCCDjoxWKosEM.html). Date Accessed: 9th March, 2020

Figure 1: The five areas with India's coral reefs<sup>3</sup>

Over the last few decades, the Andaman and Nicobar and the Lakshadweep reefs have witnessed the maximum number of coral deaths in the world.

The Andaman and Nicobar Islands, and Lakshadweep are coral graveyards – they are some of the places that have seen maximum coral deaths in the world. The paper will explore the different factors affecting the mortality of the Indian reefs. In addition to examining the factors that have led to such devastation, this paper will scrutinize restoration methods in India and abroad, seeking to promote practices that can accelerate the process of coral reef restoration.

Globally, restoration projects have been administered through public private partnership, wherein reef sponsorship is advocated along with responsible tourism (this has been undertaken by travel hotspots such as the Four Seasons Landaa Giraavaru Resort in the Maldives). Moreover, researchers around the world propose breaking down polyps into tiny fragments and planting them using artificial structures of various shapes and sizes. A technique that has recently gained popularity is passing electricity through the artificial reef frames. However, such efforts are not common in India. Besides the well-known Mithapur coral recovery project, no other initiative has made a significant contribution to the health of Indian corals. Moreover, in India, the legal framework for safeguarding and protecting coral reefs is non-existent. In the

<sup>3</sup> Government of India. "ESSO - Indian National Centre for Ocean Information Services." *INCOIS*, Govt. of India, [incois.gov.in/portal/CoralReef.jsp](http://incois.gov.in/portal/CoralReef.jsp).

long-term, this can lead to mass destruction and even extinction of the corals in India.

## What causes reef degradation?

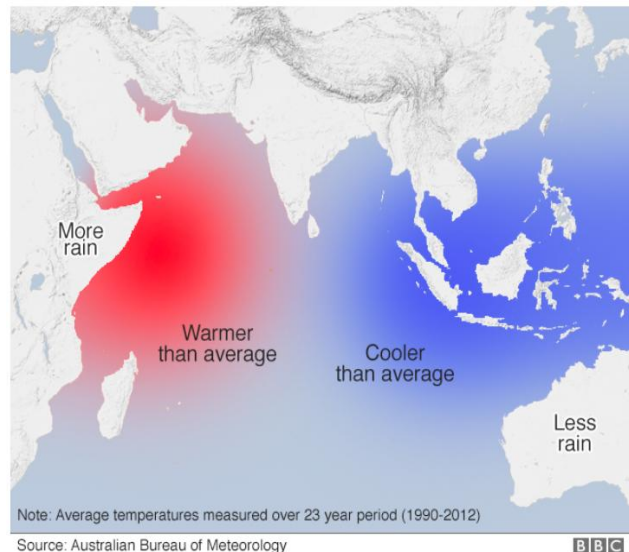
Coral death can result in mass poverty, hunger, and economic and political instability. To prevent this from happening, it is imperative to first understand the factors that lead to the degradation of coral reefs. The threats to corals can be broadly categorized into two categories:

### Natural Threats

#### Bleaching and temperature

Increase in ocean temperature is a major factor that leads to the death of reefs. Every few years, a complex climate cycle known as the "El Niño" leads to the heating of the waters in the Pacific Ocean, leading to massive coral bleaching<sup>4</sup>. A similar effect

#### A positive Indian Ocean Dipole means a wetter west and drier east



<sup>4</sup> stress from the increased water temperature causes corals to "bleach"; this is when they eject their symbiotic algae – their colour, food and energy source, leaving them white in appearance and on the verge of starvation and death.

occurs in the Indian ocean known as the “Indian Niño”, or the Indian Ocean Dipole. As suggested by the name, there are opposite temperatures on the two coasts of the Indian subcontinent (see Figure

2).Figure 2: the Indian Dipole effect<sup>5</sup>

Particulars	Graphical location	Area of the reef (in Sq.Km )	Destruction during bleaching - 1998	Potential for recovery
<b>Gulf of Mannar</b>	21 islands, South East coast of India 140 km, between Tuticorin and Rameswaram	94.3	60-80 percent loss of live cover, only 25 percent live corals remaining	Medium - low
<b>Gulf of kutch</b>	40 islands, Northern side of Saurashtra peninsula	325.5	50-70 percent	Medium - low

<sup>5</sup>Uchoa, Pablo. “Indian Ocean Dipole: What Is It and Why Is It Linked to Floods and Bushfires?” *BBC News*, BBC, 7 Dec. 2019, www.bbc.com/news/science-environment-50602971.

The temperatures usually fluctuate between warm and cold, going through “positive”, “neutral”, and “negative” phases. “Positive” refers to warmer temperatures and leads to higher coral deaths. The dipole has been increasing, and India faced its strongest dipole in six years, in 2019<sup>6</sup>. Stress in corals leads to whitening or “bleaching” due to the ejection of the zooxanthellae<sup>7</sup>. Global warming is the primary factor that causes bleaching as it raises the surface temperature of the world’s oceans by 4°C annually. In addition the rising sea levels also pose an existential threat for corals, which exposes the existing islands to erosion and negatively impact the formation of any new land mass.

The table below shows the reef destruction because of bleaching in 1998, in the four major reef centres of India, and their recovery potentials. During the 1997-1998 El Niño effect, approximately 70-80 % of the shallower corals in the Indo-Pacific reefs were killed (NMFS Office of Protected Resources, 2001).

<sup>6</sup>Ibid. This is of major concern for many reasons, not only because coral deaths will increase, but also because it is the dipole that is responsible for the Australian bushfires and the African floods.

<sup>7</sup> Zooxanthellae refer to tiny plant-like organisms that live in the tissues of many animals, including corals.

<b>Andaman and Nicobar Islands</b>	530 islands	1021.46	15-20 percent	Good
<b>Lakshadweep Islands</b>	Uninterrupted chain of coral atolls - stretch of 2000k	933.7	70-90 loss of live cover	Good

Table 1: reef destruction in the four Indian reef areas due to the 1998 bleaching<sup>8</sup>

### Predation by marine creatures

The starfish population has rapidly grown due to the commercial harvesting of their predators, the triton snails. Due to this, the coral population has declined as corals are a major food source for the starfish. The Gulf of Mannar and Lakshadweep Island corals are the largest victims of such predation. In some cases, reefs can be completely destroyed due to predation by fish, worms, snails, barnacles, crabs, and sea stars that prey on the softer tissues on the insides of the corals' polyps.<sup>9</sup>

### Natural breakdown

<sup>8</sup>Saroj (2016), Jayaprakas and Radhakrishnan (2014), SAC (2010), Rajasuriya, (2000), D.O. D. and S. A. C. (1997)

<sup>9</sup>Jones, O. and R. Endean. 1976. *Biology and Geology of Coral Reefs*, vols. 2 & 3. New York: Academic Press Inc. pp. 216-250.

While corals are home to fish, many swim past the coral, grazing them. This leads to a change in the shape and structure of corals, making them more prone to any physical or chemical threats. Natural breakdown itself is not a large concern, instead when it acts together with temperature changes or pH changes, it has a more devastating effect on the corals that have lost their “protective” layer due to grazing.

### Wave and tidal motion

Inter-tidal zones<sup>10</sup> are home to millions of corals that are frequently exposed to the atmosphere. Corals can withstand 1-2 hours of exposure, but the Gulf of Kachchh has a high tidal amplitude, leading to several hours of exposure. When combined with high temperatures, this can lead to the death of reefs. Periods of extremely low tides expose the shallow reefs, making them more prone to damage. The extent of damage depends on the weather and wave conditions. During the day, the exposed corals fall prey to the harmful ultraviolet radiation that dries out its tissues, thereby damaging or killing the coral, depending on duration of exposure.

While most corals grow within the depths of the ocean, those that are found in shallow waters are affected by violent storms and waves. Continued pounding by the waves can kill large portions of a reef. Damage is compounded as huge chunks of corals break away from the reef. This phenomenon, however, is somewhat uncommon in Indian reefs.

### Others

In addition to the aforementioned factors, the following contribute to the degradation of Indian corals:

<sup>10</sup>The intertidal zone is the area where the ocean meets the land between high and low tides.

- Salinity: Salinity refers to the amount of salt dissolved in the water. Low salinity diminishes the coral's ability to resist higher temperatures.
- pH changes: As the ocean's pH decreases, it becomes more acidic, making it harder for the corals to grow. Increasing carbon dioxide levels reduce the formation of calcium carbonate, thereby decreasing the number of skeletons that the corals can build for themselves. In addition, due to decreased calcification, wear skeletons are formed, making corals more susceptible to disease and destruction.
- Sediment deposition: sediments kill reefs. It is considered a primary stressor for the corals. This is because the sediments affect not only the feeding patterns of the corals, but also their ability to grow.

## **Anthropogenic Threats**

### **Coral mining**

Corals are made out of limestone and, therefore, are often used to build houses and other buildings. Unfortunately, a distinction is not made between dead corals and the ones that are alive, leading to the destruction of live corals. For example, in the 1980s, coral sands in the Gulf of Kachchh were leased to a cement company, spelling destruction for millions of tonnes of corals (as reported by the National Institute of Oceanography, India). Furthermore, it is estimated that 250 cubic metres of corals are extracted daily from the Gulf of Mannar, creating an ecological and economic catastrophe.

### **Irresponsible tourism**

Beach holidays have been rapidly increasing in popularity. With this increase comes a rise in tourist activities such as diving and snorkelling. While these activities are good for exploring the depths of the underwater world, it also has its drawbacks since people may step on corals, either breaking or killing them.

It is not only water sports, but also shopping that harms the corals. Due to coral jewellery being considered exquisite and fashionable, coral fishing has increased in the islands, making it the livelihood of thousands of islanders. The Gulf of Kachchh and the Andaman and Nicobar Islands are mainly damaged because of the collecting of corals. Although there are regulations to prevent coral harvesting, their vague nature makes them difficult to implement<sup>11</sup>. Furthermore, the UT Administration of Lakshadweep has recently announced an initiative to develop Eco Tourism Resorts in Lakshadweep and the Andaman and Nicobar Islands (See Figure 3). While this will certainly boost the economic status of island dwellers, it can also have a catastrophic impact on the health of corals. Thus, it is imperative to ensure that these resorts on Reef Atolls are conscious of the fragility of their ecosystems, and measures are taken during their construction and operational planning to ensure minimum impact to the reefs, thereby ensuring their longevity.

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<sup>11</sup> Saxena, A. (2015), "Coral Reefs and their Conservation - A Review", Biological and Chemical Research, 2015, 187-206.



Figure 3: Eco Tourism Resorts in Lakshadweep Islands<sup>12</sup>

### Boat anchors

In islands where fishing and tourism are major sources of income, corals are threatened by boat anchors that either uproot or damage the reefs. Cruise ships and cargo vessels often hit the reefs when grounding themselves and fisherman anchors destroy corals as ocean waves cause the boats to drift over shallow reefs. Larger ships with anchors that weigh around 25 tonnes inflict serious damage. In August 2010, two large cargo ship vessels caused immense destruction of the reefs found in the Kavaratti island of Lakshadweep.

### Mangrove destruction

Mangrove roots are extremely strong and help hold in the sediments such as mud. This

helps the mangroves filter the amount of sediment reaching the ocean and therefore affecting corals. Due to the large-scale destruction of these trees, unusually large amounts of sand is released into the ocean, preventing the corals from growing or feeding. The Gulf of Kachchh has experienced massive destruction of the mangrove forests, and therefore, dealt with extensive coral damage.

### Pollution

Water pollution makes it difficult for corals to grow and feed. These creatures are extremely sensitive to oil pollution, dominantly caused by oil spills. Reefs near the harbour are innately in danger. In the Andaman and Nicobar Islands, tourism is a major source of income, which leads to massive amounts of plastic, oil, solid waste, and sunscreen discharge into the ocean, contributing to the destruction of reefs.

## Reef Protection and Restoration

In India, fragile corals are monitored and managed by the Department of Forests and Wildlife. Unfortunately, the department has not taken any major steps to ensure preservation, and only reefs in prohibited areas remain safe from exploitation. While corals are classified as a special category of marine creatures, this does little to protect the reefs from damage. The Coastal Regulation Zone Notification of 1991—which oversees coastal activity—offers some legal protection, however, the lack of specific reef-related policies make corals prone to damage. In addition, the sheer absence of restoration efforts have transformed Indian reefs into a living

<sup>12</sup>Niti, Indian Government: niti.gov.in

graveyard. The only large-scale project ever undertaken in India is the Mithapur Coral Recovery Project in the Gulf of Kachchh.

## Regulatory Framework

The Indian government has seldom introduced legislations regarding the protection of corals. Most regulatory frameworks do not pertain directly to corals, instead, they are ‘umbrellas’ that cover the entire variety of marine wildlife, including corals. Some laws that can be indirectly invoked are the Environment Protection Act of 1986 and the Wildlife Protection Act of 1972. Nonetheless, coral reefs do not have a separate legal status under these laws. Other laws that can apply to coral reefs include the Coastal Regulation Zone Notification of 1991, the Indian Forest Act of 1927, and the Indian Fisheries Act, which is of ancient origin.

Marine protected areas are an important tool for the conservation of marine flora and fauna. A marine protected area is a broad term that includes sanctuaries, national parks, forests, lakes etc. It refers to an existing effort on a local, state, or national level to protect an area’s flora and fauna. Out of the 36 marine protected areas, 5 are for corals. These are the Gulf of Mannar Biosphere Reserve, Mahatma Gandhi Marine National Park, Gulf of Kachchh Marine National Park, Great Nicobar Biosphere Reserve and the Rani Jansi Marine National Park.<sup>13</sup> While a marine protected area was proposed for

Lakshadweep, no further action has been taken regarding the same since 1996.

While collecting corals is banned in the Gulf of Kachchh and the Andaman and Nicobar Islands, this does little to solve the problem of coral degradation. Most Indian laws lack comprehension. Indecisive language and the tendency to steer away from directly addressing coral reefs is a major cause of coral deaths in India. While the laws prescribe some preventive measures, such as banning coral collection, the scope of these laws must be widened to include how various stakeholders and civil society members can actively contribute to their protection, as well as restoration. This includes, but is not limited to promoting responsible tourism.

## Restoration Efforts

The Mithapur Coral Recovery project, focuses its attention on recovering coral reefs across the coasts of Gujarat, from the Gulf of Kachchh to the Gujarat’s Marine National Park. Launched in 2008, the Mithapur project is a joint effort of the Wildlife Trust of India, the Gujarat Forest Department, supported by Tata Chemicals Limited. Here, degraded reefs are restored through transplantations and natural recruitment.

Within the Mithapur reef, two species of Acropora are now extinct; and the recovery project is aimed at reintroducing these species by transporting and transplanting fragments from far away places.<sup>14</sup> This is the

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<sup>13</sup>Rajasuriya, A., et. al. (2000), “Status of Coral Reefs in South East Asia: Bangladesh, India, Maldives and Srilanka”. Status of Coral Reefs of the world, (95-114).

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<sup>14</sup>Allenshaji. “MITHAPUR CORAL REEF RECOVERY PROJECT.” *Wild Life*, Wildlife Trust of India, 2019, [www.wti.org.in/projects/mithapur-coral-reef-recovery-project/](http://www.wti.org.in/projects/mithapur-coral-reef-recovery-project/).



first time that corals are being transported over such a large distance (the donor site is the Agatti island in Lakshadweep). The process followed is simple. It consists of breaking off fragments of the Acropora from corals in Lakshadweep's donor colonies and implanting them on substrates. However, with this, there are also some concerns. The corals may not grow as well in different parts of the Indian Ocean, or the fragment may die during the transportation journey. Thus, it is imperative to keep the transplanted reefs under careful observation to notice any early signs of stress in them.<sup>15</sup>

In addition, several international organisations, such as the UNDP have taken measures to protect the Indian reefs. The UNDP's efforts to conserve the biodiversity in the Gulf of Mannar led to a 5% increase in the coral reef cover between 2005 and 2009. Other significant initiatives include the India-Australia Training and Capacity Building programme for raising awareness through seminars on responsible tourism and environmental protection through law. Moreover, the Coral Reef Degradation in the Indian Ocean (CORDIO) project involves 11 countries in the region around the Indian Ocean. Its primary purpose is to understand and assess the various causes for reef degradation. The Integrated Coastal Zone Management Training Project (ICZOMAT), funded by the UK, involves projects focused on studying the niche aspects of the Indian Ocean, and understanding how they affect different marine organisms.

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<sup>15</sup>The easiest way to detect whether a coral is stressed is that the color of the coral will dim slightly. The coral will grow bright before it then dies.

## **Accelerating Coral Restoration**

To prevent Indian corals from complete decay, it is necessary to rapidly accelerate the process of restoration. To this end, India can learn from countries across the globe that have taken measures to protect their native varieties of corals.

The Australian and Queensland governments have invested approximately AUS \$ 6 billion into improving the health of the Great Barrier Reef. Over the years, several measures, such as the Reef 2015 Long Term Sustainability Plan, the Reef Trust and the Great Barrier Reef Gully and Stream Bank Program have been undertaken. The Australian model of restoration thrives on Public-Private Partnership, wherein private enterprises have supported the government's efforts to conserve and restore corals. In addition, Australia's effective water management system which ensures minimum pollution provides corals with a conducive environment for growth and multiplication. Another country that has fostered the growth of corals through public-private partnerships is the Maldives. The Maldives Four Seasons Resort features an information section about the reefs and encourages its guests to sponsor the plantation of various variety of corals in the ocean. This has led to more than 7500 frames being planted in the surrounding waters.

Indonesia, on the other hand, relies heavily on the involvement of the local public. By creating awareness about the ecological importance of corals, Indonesia has successfully motivated its population to adopt reefs and ensure that human activities do not lead to their degradation. Through its ecosystem-based approach and effective

governance, Indonesia has been able to protect the health of its marine ecosystem.

On the scientific side, many marine biologists have confirmed that passing electricity through the frames increases the ability of the reefs to grow. Thus, it is recommended that the frames used to plant coral reefs must be made out of conducive elements. The frame must also be light enough to be carried into the water easily, but strong enough to withstand the currents and a number of fishes. Reef frames are constricted from a variety of materials: steel, mineral accretion devices, cement, glass, concrete, and even wrecks. Recently, frames have also been 3D printed. However, steel seems to be the most viable option—out of all the other substances, steel has the highest conductivity, which means that it is perfect for growing reefs by passing an electric current through them. In addition, steel is cheaper than other materials such as glass or cement. While 3D printing may be more viable for the environment, steel frames are sturdier and therefore have a higher probability of lasting in the ocean without getting carried off with currents.

The size of the frames depends on the amount of area available and the type of coral that are going to be grown through them. For example, if a coral is being planted in an area with a dense coral population, a small frame (containing about 35 fragments) should be used; however, if the area is empty then a large frame (containing about 90 fragments) should be used. The frame size also depends on the type of coral being grown. While some corals need a large amount of space to grow, others do not. For example, while the Elkhorn coral can grow up to 3.7 metres, the pillar coral can grow up to 2.5 metres only,

therefore, some corals need more space than the others, thereby necessitating larger frames.

Furthermore, the most optimum frame shape is the hexagon, as it is a result of the optimization between the cost of making it and the surface area that the coral would cover. With its six sides, it would allow the coral to cover a large surface area, and at the same time, minimise the cost of making it by having to bend the pipe fewer times as compared to other shapes such as octagons. The increase in the area covered by the shape also increases but the marginal area begins to decrease after a hexagon.<sup>16</sup>

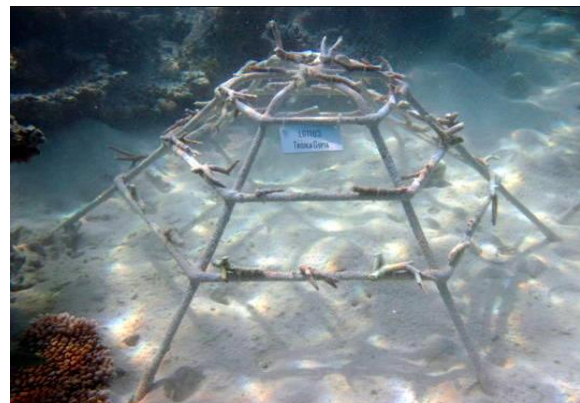


Figure 3: sample of a steel frame used for planting corals<sup>17</sup>

The best method to regrow corals is through replanting coral fragments through the hexagonal, electrified, steel frames and raising awareness about the danger that reefs are in. It is also important to have strict laws regarding the preservation of reefs and promoting responsible tourism. These are both preventive and growth methods. If this

<sup>16</sup>The area that increases as the number of sides increase (change in area divided by the change in the number of sides of the shape)

<sup>17</sup>A coral reef that was planted in the Maldives.  
Source of picture: reefscapers archive

matches the rate at which reefs are dying, coral preservations can be more successful than any other possible courses of action, and there will be no net loss of corals.

## Conclusion

Corals are of immense importance to mankind and need to be preserved. They play a pivotal role in the sustenance of the marine ecosystem, and awareness must be created regarding the danger that the corals are in. Over the years, many natural (temperature changes, predation, and changing pH levels) and anthropogenic (irresponsible tourism, pollution, and coral harvesting) factors have led to the degradation of corals, and it is important for us to compensate for the damage before it is too late to undo what the human civilization has done. Corals can be found up to 91 metres below the surface, but reef building corals grow poorly below 18 to 27 metres. Considering all these factors, the following methods can be adopted by the Indian government to bring Indian coral reefs back to life:

- Establishing a comprehensive legal framework that provides corals with a special status and prescribes methods to protect and preserve the rainforests of the oceans. This framework must provide strict guidelines regarding issues such as pollution of the sea and coral harvesting, thereby regulating industrial activity that threatens the health of corals. This also includes introducing a framework for promoting responsible tourism—keeping a check on hotels and resorts built near the coastline, banning the mining of live corals and regulations for ensuring sustainable fishing practices.

- The center must delegate the responsibility to protect corals from activities like mining to the respective state and union territory governments.
- Efforts must be taken to protect mangroves, which will lead to less soil deposition into the ocean. This will allow fewer sediments to interact with the corals, thereby positively affecting their growth.
- The central and state governments must undertake a public service campaign to raise awareness about the dangers that the corals face. Through such campaigns, the government must seek civil society participation in the preservation and restoration of corals.
- Both central and state governments must also invest in Public-Private partnerships to monitor and maintain the health of corals. The government has already taken such measures to preserve historic sites such as the Red Fort, and similar methods must be adopted for coral conservation. This will reduce the government's financial burden and involve the private sector in the process of development.
- Replace anchors with the buoys that float on the water.
- Commission more projects such as the Mithapur recovery project and use techniques such as passing electricity through hexagonal frames to increase the speed of coral growth and development.

If exercised with caution, the aforementioned measures can turn the tables on the restoration of coral reefs. By restoring coral reefs to their previous health and status, these efforts will go a long way in ensuring the sustainability of the marine ecosystem, as well as our planet.

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