

Coral bleaching

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Source: *The Hindu*

Manifest pedagogy: In the era of climate change, coral reefs are severely threatened and they face the existential crisis. Through technology and innovation, the ill-effects of climate change can be overcome. Environmental technology would be an important area of preparation for both prelims and mains.

In news: Biorock technology

Placing it in syllabus: Corals

Static dimensions: Coral reefs & Threats to coral reefs

Current dimensions: Coral bleaching & Biorocking

Content:

Coral reefs:

- Coral reefs are **large underwater structures composed of the skeletons of colonial marine invertebrates** called coral.
- The coral species that build reefs are known as **hermatypic, or “hard” corals** because they extract calcium carbonate from seawater to create a hard, durable exoskeleton that protects their soft, sac-like bodies.
- Other species of corals that are not involved in reef building are known as **“soft” corals**.
- These types of corals are flexible organisms often resembling plants and trees and include species such as sea fans and sea whips.
- **Each individual coral is referred to as a polyp.**
- Coral polyps live on the calcium carbonate exoskeletons of their ancestors, adding their own exoskeleton to the

existing coral structure.

- As the centuries pass, the coral reef gradually grows, until they become massive features of the marine environment.
- Corals are **found all over the world's oceans.**
- The best suited environment for coral reefs are **clear, shallow waters of the tropics and subtropics.**
- The **largest** of these coral reef systems, the **Great Barrier Reef in Australia** which is more than 2,400 kilometers.

The **three main types of coral reefs** are fringing, barrier, and atoll.



The most common type of reef is the **fringing reef** which **grows seaward directly from the shore.** They **form borders along the shoreline** and surrounding islands.

When a **fringing reef continues to grow upward from a volcanic island that has sunk entirely below sea level, an atoll is formed.** Atolls are usually circular or oval in shape, with an open lagoon in the center.

Barrier reefs are similar to fringing reefs in that they also border a shoreline; however, instead of growing directly out from the shore, **they are separated from land by an expanse of water.** This creates a lagoon of open, often deep water between the reef and the shore.

Threats to coral reefs:

Climate change: Corals cannot survive if the water temperature is too high. Global warming has already led to increased levels of coral bleaching.

Destructive fishing practices: These include cyanide fishing, blast or dynamite fishing, bottom trawling, and muro-ami

(banging on the reef with sticks). Bottom-trawling is one of the greatest threats to cold-water coral reefs.

Overfishing: This affects the ecological balance of coral reef communities, altering the food chain and causing effects far beyond the directly overfished population.

Overfishing can alter food-web structure and cause cascading effects, such as reducing the numbers of grazing fish that keep corals clean of algal overgrowth.

Careless tourism: Careless boating, diving, snorkeling and fishing happens around the world, with people touching reefs, stirring up sediment, collecting coral, and dropping anchors on reefs.

Some tourist resorts and infrastructure have been built directly on top of reefs, and some resorts empty their sewage or other wastes directly into water surrounding coral reefs.

Pollution: Urban and industrial waste, sewage, agrochemicals dumped directly into the ocean or carried by river systems from sources upstream and oil pollution are poisoning reefs.

Some pollutants, such as sewage and runoff from farming, increase the level of nitrogen in seawater, causing an overgrowth of algae, which 'smothers' reefs by cutting off their sunlight and interfere with their ability to feed, grow, and reproduce.

Degraded plastics and microplastics (e.g., beads in soap) can be consumed by coral, fish, sea turtles, and other reef animals, blocking their digestive tracts and potentially introducing toxics.

Coral mining: Live coral is removed from reefs for use as bricks, road-fill, or cement for new buildings. Corals are also sold as souvenirs to tourists and to exporters and harvested for the live rock trade. Coral harvesting for the

aquarium trade, jewelry, and curios can lead to over-harvesting of specific species, destruction of reef habitat and reduced biodiversity.

Coral bleaching:

Warmer water temperatures can result in coral bleaching. When water is too warm, corals will expel the **algae (zooxanthellae)** living in their tissues causing the **coral to turn completely white** because the loss of algae reveals the white color of the calcium carbonate structure underlying the polyps. This is called **coral bleaching**.

The **2014-2017 global-scale coral bleaching** event killed several reefs, including large tracts of Australia's Great Barrier Reef.

Severe or prolonged bleaching can kill coral colonies or leave them more vulnerable to other threats such as infectious disease.

When a coral bleaches, it is not dead. Corals can survive a bleaching event, but they are under more stress and are subject to mortality.



Not all bleaching events are due to warm water. In January 2010, **cold water temperatures in Florida, USA caused a coral bleaching event** that resulted in some coral death.

Other climate impacts such as sea level rise, increased frequency and intensity of tropical storms and altered ocean circulation patterns can also affect coral reefs.

Biorocking:

- Biorock technology is an innovative process **originally invented in 1976 by Professor Wolf Hilbertz** to **produce natural building materials in the sea.**

- Biorock materials are the **only marine construction material that grow, get stronger with age and are self-repairing.**
- Biogeochemist **Dr Tom Goreau and Wolf** worked together to develop applications for coral reef restoration.
- They called the technology Biorock because it not only grew hard limestone rock for structural purposes, but also it greatly **increased the growth of corals and all marine organisms.**
- They founded the **Global Coral Reef Alliance** to pursue R&D of Biorock Technology.



- Biorock technology has **been successfully applied to fish and shellfish mariculture** as well as to **grow limestone breakwaters** to protect islands and coastal areas from erosion and rising sea levels.
- It is a unique method that allows coral reefs and other marine ecosystems including seagrass, salt marsh, mangroves and oyster reefs to **survive and recover from damage caused by excessive nutrients, climate change and physical destruction.**
- It greatly increases the settlement, growth, survival, and resistance to stresses, including high temperature and pollution of all marine organisms.
- Hence it **keeps ecosystems alive** when they would otherwise die from severe stress, and restore them at record rates.
- Around 500 Biorock reef structures have been built in around 40 countries all around the world, with around 400 of them in Indonesia.
- Biorock technology **can be powered by energy from the sun, winds, waves and ocean currents,** generated directly at the site.