



Depleting Coral Cover in Lakshadweep

For Prelims: [Coral Reefs](#), [Coral Bleaching](#), [Marine Heatwaves](#), [El Nino](#), [Algal Bloom](#), [Biorock Technology](#), [Mangroves](#), [Seagrasses](#), [Marine Protected Areas](#)

For Mains: About coral reefs and coral bleaching, Causes of coral bleaching and its implications, Strategies needed to preserve coral reefs.

[Source: TH](#)

Why in News?

A study tracking coral health at **three major atolls —Agatti, Kadmat, and Kavaratti—**has revealed alarming findings, showing a **50% decline in [coral cover](#)** in the **Lakshadweep reefs**, from 37.24% in 1998 to 19.6% in 2022.

What are the Key Findings of the Study on Coral Reefs?

- **Drastic Decline in Coral Cover:** Repeated [marine heatwaves](#) triggered by [El Nino](#) events in 1998, 2010, and 2016, along with **climate change**, are the main drivers of **coral loss**.
 - These stressors have slowed **reef recovery**, with improvement only after over **six consecutive years without coral bleaching**.
- **Distinct Coral Response Clusters:** Corals displayed **six distinct response patterns** based on [heatwaves](#) impact, **recovery rate**, **depth**, and **wave exposure**.
 - While local efforts like [coral gardening](#) aid restoration, only **global emission cuts** can provide the **critical recovery time** reefs need to survive.

Coral Reefs

(Rainforests of the seas)



About

- ✦ **Large underwater structures** – made of skeletons of **colonial marine invertebrates** ‘coral’ – individually called **polyp**
- ✦ **Symbiotic Relationship** with **algae** ‘**zooxanthellae**’ (responsible for beautiful colours of corals)
- ✦ Support over 25% of marine biodiversity

Hard Corals vs Soft Corals

- ✦ **Hard Corals** - Rigid skeleton **made of CaCO_3** - **reef-building** corals
- ✦ **Soft Corals** - Non reef-building

Great Barrier Reef (Australia)

- ✦ Largest Coral Reef in the World
- ✦ World Heritage Site (1981)
- ✦ Endures Mass Coral Bleaching



Corals in India

- ✦ Present in the areas of Gulf of Kutch, Gulf of Mannar, Andaman & Nicobar, Lakshadweep Islands and Malvan



Significance

- ✦ Coral reefs **protect coastlines from storms/erosion**, provide jobs, offer opportunities for recreation
- ✦ Source of **food/medicines**

Threats

- ✦ **Natural:** Temperature, Sediment Deposition, Salinity, pH, etc.
- ✦ **Anthropogenic:** Mining, Bottom Fishing, Tourism, pollution, etc.

Coral Bleaching

- ✦ Corals under stress - expel algae – thus turning white (bleached)
- ✦ Bleached corals - not dead – but, more risk of starvation/disease



Initiatives to Protect Corals

Technology

- ✦ **Cyromesh:** Storage of the coral larvae at (-196°C) - Can be later reintroduced to the wild
- ✦ **Biorock:** Creating artificial reefs on which coral can grow rapidly



Global

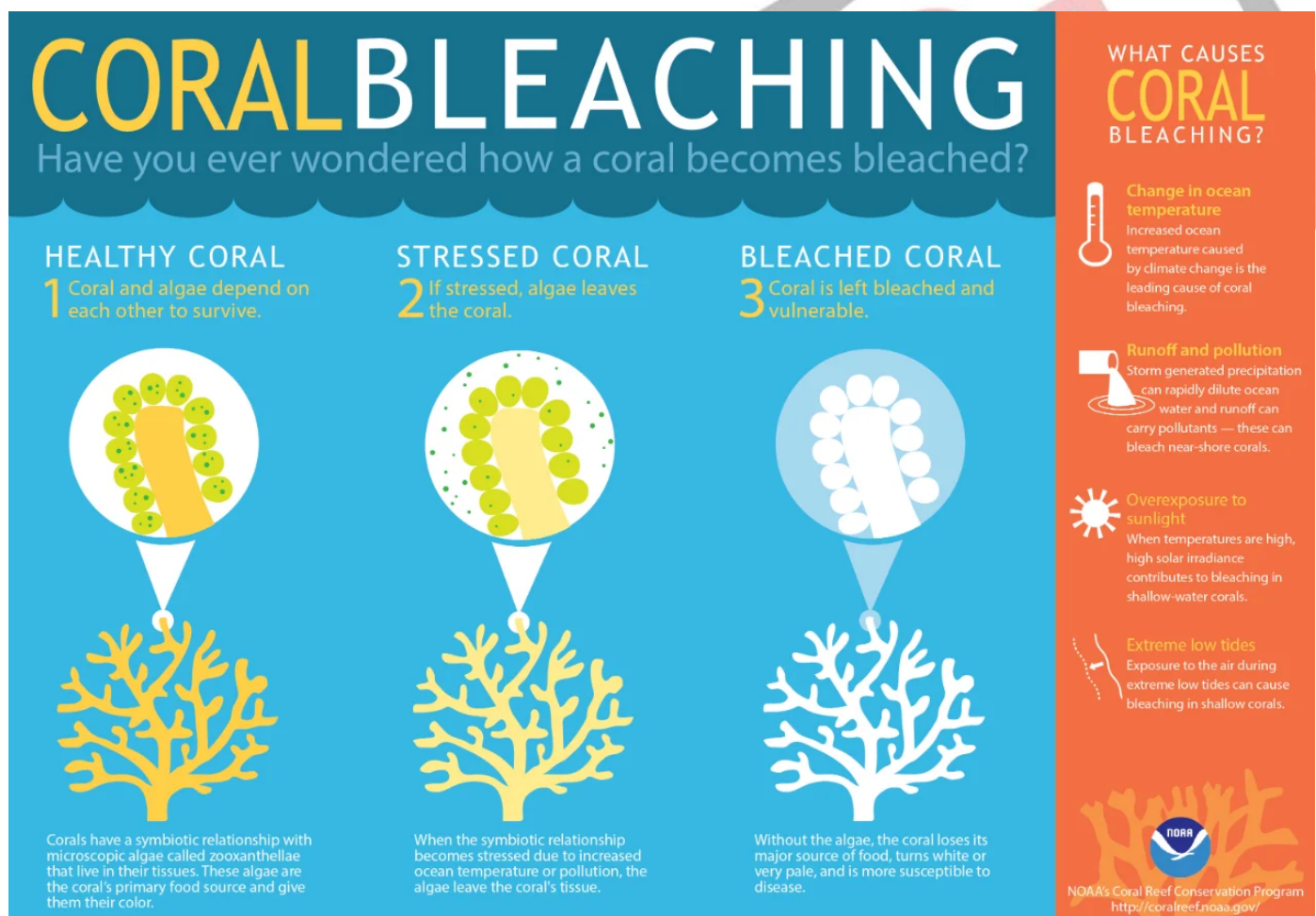
- ✦ International Coral Reef Initiative
- ✦ The Global Coral Reef R&D Accelerator Platform

Indian

National Coastal Mission Programme

What are the Key Reasons for the Depletion of Coral Reefs?

- **Rising Sea Temperatures:** Marine heatwaves disrupt the **symbiotic relationship between corals and algae**, leading to bleaching. Climate change and El Nino events are intensifying **ocean warming**, making bleaching **more frequent and severe**.
 - **High UV radiation** and **thermal stress** worsen coral heat stress and increase vulnerability to **infections like white band disease**, raising the risk of **future bleaching**.
- **Ocean Acidification:** Increased **CO₂ absorption** by oceans leads to **lower pH levels**, which **weakens coral skeletons** and **slows their growth**.
 - This hampers corals' ability to form **calcium carbonate structures**, making them **more susceptible to bleaching**.
- **Pollution & Runoff:** **Agricultural and urban runoff** containing **fertilizers and sewage** promotes algal blooms that smother corals. **Sedimentation from coastal development** blocks **sunlight**, depriving corals of essential energy for survival.
- **Human Activities:** **Destructive fishing methods** such as **dynamite or cyanide** cause direct coral mortality, while **tourism activities** like **anchoring and snorkeling/diving** also contribute to coral damage.



What are the Implications of Coral Depletion?

- **Loss of Marine Biodiversity:** Coral reefs support **25% of marine life**, but **bleaching-driven coral death** threatens ecosystems, causing **fish population declines**, **species extinction**, and marine food web disruption.
- **Economic Consequences:** Reef collapse can reduce **fish stocks**, endangering the reef

fishery industry and global **seafood security**.

- **Bleaching also hurts tourism**, leading to **job losses** and **economic decline** in coastal communities reliant on reef-based activities.
- **Reduced Coastal Protection: Coral reefs serve as natural barriers**, shielding coastlines from **erosion, storm surges, and flooding**.
 - Without them, **coastal communities**, especially in **low-lying regions** like the **Lakshadweep** and **Maldives**, face greater **risk from hurricanes, sea-level rise, and costly artificial defenses**.
- **Decline in Scientific Discoveries: Coral reefs offer potential medicines** for diseases like **cancer and arthritis**, but **bleaching destroys unexplored species**, limiting **future medical discoveries**.
- **Water Quality and Climate Regulation: Coral reefs function as natural water filters**, with organisms like **sponges removing toxins** and supporting **photosynthetic plants** that absorb **CO₂** and release **oxygen**.
 - When reefs die, these functions are lost, leading to **poor water quality, algal blooms, and weakened ocean carbon cycling**.

What are the Various Initiatives to Protect Coral Reefs?

- **International Coral Reef Initiative (ICRI):** It is a **global partnership of nations and organizations** dedicated to the **conservation of coral reefs and related ecosystems**.
- **Global Fund for Coral Reefs (GFCR):** It is a **blended finance platform** that mobilizes **grants and private capital** to **protect and restore coral reefs** and support **dependent communities**.
 - It brings together **UN agencies, governments, philanthropies, investors, and others** to advance **ecological, social, and economic resilience**.
- **Technological Interventions:**
 - **Biorock Technology:** [Biorock technology](#) is an innovative **mineral accretion method** that creates **natural building structures underwater**, aiding in **coral restoration** (e.g., in the **Gulf of Kachchh**).
 - **Super corals:** They are developed through **ex-situ breeding** using **human-assisted evolution** to enhance **resistance to high temperatures**.
 - **Frozen Coral:** Scientists have used **cryomesh technology** to **freeze and preserve coral larvae** more effectively, allowing storage at **-196°C** for long-term conservation.

What Measures Can be Taken to Protect Coral Reefs?

- **Tackle Climate Change:** To curb **ocean warming** and **acidification**, reduce **carbon emissions** by shifting to **renewable energy sources**, in line with the **1.5°C target** set by the **Paris Agreement**.
 - Secure **international funding** (e.g., [Green Climate Fund](#)) and expand **clean technology access**; protect **blue carbon ecosystems** like [mangroves](#), [seagrasses](#), and **salt marshes** to absorb **CO₂** and shield **coral reefs**
- **Reduce Local Stressors:** Curb **pollution** by reducing **agricultural runoff** and improving **wastewater treatment** to protect reefs from algal blooms and contamination.
 - **Ban destructive fishing**, enforce [marine protected areas](#), and **regulate coastal development** by restricting **dredging, and mining** along coasts.
- **Active Reef Restoration:** **Grow and transplant heat-resistant corals**, deploy **reef balls or 3D-printed habitats**, and develop **super-corals** to survive rising temperatures.
- **Community-Led Conservation:** Promote **eco-tourism** by **training local guides** in **reef-safe snorkeling/diving practices** and encouraging **reef-friendly sunscreen** use.
 - Support **alternative livelihoods** like **aquaculture** and **reef monitoring** to reduce **fishing pressure**.

Conclusion

The **Lakshadweep coral study** highlights a **50% decline in reefs** due to **climate-driven heatwaves**, stressing the need for **global emission cuts** alongside **local restoration**. Without **urgent action**, reefs face **collapse**, threatening **biodiversity**, **coastal economies**, and **climate resilience**. Solutions like **Marine Protected Areas (MPAs)**, **super-corals**, and **pollution control** must **scale up** to avert **irreversible loss**.

Drishti Mains Question:

How does climate change impact coral reef ecosystems? Suggest suitable mitigation strategies.

UPSC Civil Services Examination, Previous Year Question (PYQ)

Prelims

Q. Consider the following statements: (2018)

1. Most of the world's coral reefs are in tropical waters.
2. More than one-third of the world's coral reefs are located in the territories of Australia, Indonesia and Philippines.
3. Coral reefs host far more number of animal phyla than those hosted by tropical rainforests.

Which of the statements given above is/are correct?

- (a) 1 and 2 only
- (b) 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

Ans: (d)

Q. Which of the following have coral reefs? (2014)

1. Andaman and Nicobar Islands
2. Gulf of Kachchh
3. Gulf of Mannar
4. Sunderbans

Select the correct answer using the code given below:

- (a) 1, 2 and 3 only
- (b) 2 and 4 only
- (c) 1 and 3 only
- (d) 1, 2, 3 and 4

Ans: (a)

Mains

Q. Assess the impact of global warming on the coral life system with examples. (2019)

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