



CORAL BLEACHING - GS III MAINS

Q. What is coral reef bleaching? What are the impacts faced by the natural ecosystem in the backdrop of rising instances of mass coral bleaching. (15 marks, 250 words)

News: *Fourth global mass coral bleaching triggered: What are corals and why are they important?*

What's in the news?

- According to the US National Oceanic and Atmospheric Administration (NOAA), the fourth global mass coral bleaching event has been triggered by extraordinary ocean temperatures.

Key takeaways:

- According to the EU Copernicus Climate Change Service (C3S), the average sea surface temperature (SST) has been increasing and it has reached a record monthly high of 21.07 degree Celsius.
- This fourth mass coral bleaching could have serious consequences for ocean life and millions of people who rely on reefs for food, jobs, and coastal defence.

Coral Bleaching:

- When corals are stressed by changes in conditions such as temperature, light, or nutrients, they expel the symbiotic algae (zooxanthellae) living in their tissues, causing them to turn completely white. This is called coral bleaching.

Coral Death:

- Bleached corals can survive depending on the levels of bleaching and the recovery of sea temperatures to normal levels.
- If heat-pollution subsides in time, over a few weeks, the zooxanthellae can come back to the corals and restart the partnership.
- But in cases of severe bleaching and prolonged stress in the external environment can lead to coral death.

Concerns at Present:

- Fourth global bleaching event is currently underway. Nearly 54 countries, territories and local economies - from Florida, the US, Saudi Arabia to Fiji have confirmed bleaching.
- Bleaching has been confirmed in the Western Indian Ocean, including Tanzania, Kenya, Mauritius, Seychelles, and off the western coast of Indonesia.

Causes of Coral Bleaching:

1. Rise in Sea Temperature:



- The rise in global warming has led to an increase in the sea temperatures which has resulted in the destruction of corals.

2. Ocean Acidification:

- Due to rise in carbon dioxide levels, oceans absorb more carbon dioxide.
- This increases the acidity of ocean water and inhibits the coral's ability to create calcareous skeletons, which is essential for their survival.

3. Solar Radiation and Ultraviolet Radiation:

- Changes in tropical weather patterns result in less cloud cover and more radiations which induce coral bleaching.

4. Infectious Diseases:

- Penetration of bacterium like vibrio shiloi inhibits photosynthesis of zooxanthellae.
- These bacteria become more potent with elevated sea temperatures.

5. Chemical Pollution:

- Increased nutrient concentrations affect corals by promoting phytoplankton growth, which in turn supports increased numbers of organisms that compete with coral for space.

6. Human Induced Threats:

- Overfishing, pollution from agricultural and industrial runoff, coral mining, development of industrial areas near coral ecosystems also adversely impact corals.

CORAL BLEACHING

Have you ever wondered how a coral becomes bleached?

HEALTHY CORAL

1 Coral and algae depend on each other to survive.

Coral has a symbiotic relationship with microscopic algae called zooxanthellae that live in their tissues. These algae are the coral's primary food source and give them their color.

STRESSED CORAL

2 If stressed, algae leaves the coral.

When the symbiotic relationship becomes stressed due to increased ocean temperature or pollution, the algae leave the coral's tissue.

BLEACHED CORAL

3 Coral is left bleached and vulnerable.

Without the algae, the coral loses its major source of food, turns white or very pale, and is more susceptible to disease.

WHAT CAUSES CORAL BLEACHING?

- Change in ocean temperature**
Increased ocean temperature caused by climate change is the leading cause of coral bleaching.
- Runoff and pollution**
Storm generated precipitation can rapidly dilute ocean water and runoff can carry pollutants -- these can bleach near-shore corals.
- Overexposure to sunlight**
When temperatures are high, high solar irradiance contributes to bleaching in shallow-water corals.
- Extreme low tides**
Exposure to the air during extreme low tides can cause bleaching in shallow corals.

NORRIS Coral Reef Conservation Program
<http://coralreef.noaa.gov>

Consequences of Coral Bleaching:

1. Affecting the Food Chain:

- Changes in coral communities can affect the species that depend on them, such as the fish and invertebrates that rely on live coral for food, shelter. Loss of such marine animals can disturb the entire food chain.

2. Loss of Biodiversity:

- Declines in genetic and species diversity occur when corals die as a result of bleaching.



3. Economic Decline:

- Bleached and degraded reefs can discourage tourism, which can affect the local economy.

4. Affects Food Availability:

- Coral bleaching can cause large shifts in fish communities.
- This can translate into reduced catches for fishers, which in turn impacts food supply and associated economic activities.

5. Impact on Coastal Protection:

- Coral reefs protect coastlines by absorbing constant wave energy from the ocean, thereby protecting people living near the coast from increased storm damage, erosion and flooding.

Initiatives to Protect Corals:

1. Institution of International Organisations:

- The International Coral Reef Initiative, Global Coral Reef Monitoring Network (GCRMN), Global Coral Reef Alliance (GCRA) and The Global Coral Reef R&D Accelerator Platform have been established to deal with the issue.

2. Biological Restoration:

- It uses methods for coral growth and transplanting to assist the restoration of a coral reef.
- It includes Asexual propagation and Coral Gardening.

3. Structural Restoration:

- It involves the construction of artificial reefs, or relocation of rocks/dead coral heads.
- The goal is to increase the amount of reef structure and habitat available for the corals and other reef organisms to grow on.
- For example - Bio rock technology.

4. Physical Restoration:

- It addresses the conditions in which the corals are growing to improve their health, growth rates, or reproductive ability.

Way Forward:

1. Halting Unplanned Development:

- Halting unplanned coastal development would play a significant role in reversing the decline of reefs in some locations.

2. Promotion of Sustainable Fishing:

- Promoting sustainable fishing and providing opportunities for ecotourism can help conserve corals.



3. Minimal Use of Chemical Fertilisers:

- There is a need to minimise the use of chemically enhanced fertilizers, insecticides, pesticides, and herbicides which are non degradable and harm corals.

4. Measures for Prevention of Global Warming:

- Taking all possible measures to prevent actions that worsen global warming since Climate change is the greatest global threat to coral reef ecosystems.

5. Monitoring and Early Warning Systems:

- Establish monitoring programs and early warning systems to detect and respond to coral bleaching events promptly, allowing for targeted conservation interventions and adaptive management approaches.

6. Research and Innovation:

- Invest in research and innovation to develop new technologies, tools, and strategies for mitigating coral bleaching and enhancing the resilience of coral reef ecosystems in the face of climate change and other stressors.

Go back to basics:

1. First Mass Bleaching:

- It occurred in 1998 when the El Niño weather pattern caused sea surfaces in the Pacific Ocean to heat up.
- This event led to the death of 8% of the world's coral.

2. Second Mass Bleaching:

- This event took place in 2010. It led to increased destruction of 35% coral reefs.

3. Third Mass Bleaching:

- The event took place between 2014-17 and affected reefs in Guam in the Western Pacific region, the North, South-Pacific, and the Indian Ocean.
- It affected 56% of coral reefs around the world.

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