



Coral Reefs as Indicators of Rising Sea Levels

For Prelims: [Coral Reefs](#), [Coral Bleaching](#), [Marine Heatwaves](#), [El Nino](#), [Algal Bloom](#), [Mangroves](#), [Coral Microatolls](#)

For Mains: About Coral Reefs and Coral bleaching, Coral Micro-atolls as Natural Recorders of Sea Level Rise, Causes & Impact of Sea Level Rise, Way Forward

[Source: TH](#)

Why in News?

A study on **coral microatolls** in the **Maldives** shows that [sea-level rise](#) in the central **Indian Ocean** began earlier and progressed faster than previously thought, challenging the belief that significant rise started in the **1990s**, with major implications for climate science and coastal policy.

How Coral Micro-atolls are the Natural Recorders of Sea Level Rise?

- **Natural Recorders:** [Coral microatolls](#) are disk-shaped coral colonies that stop growing upwards once constrained by the lowest tide levels. Their upper surface directly reflects long-term sea-level changes, making them natural recorders of past sea levels.
- **Longevity and Accuracy:** Coral microatolls can survive for **decades** or even **centuries**, providing **high-resolution, continuous data** on sea-level fluctuations.
 - The study conducted on the **Mahutigalaa reef** in the **Huvadhu Atoll** of the **Maldives** studied a **Porites microatoll** to measure sea levels from **1930 to 2019**.
- **Acceleration of Sea-Level Rise in the Indian Ocean:** The research shows that sea levels in the Indian Ocean have risen by approximately **0.3 meters** over the last 90 years.
 - **Rates of Rise:**
 - **1930-1959:** 1-1.84 mm/year
 - **1960-1992:** 2.76-4.12 mm/year
 - **1990-2019:** 3.91-4.87 mm/year
- **Key Revelation:** Sea-level rise in the region began much earlier than previously thought, starting in the **late 1950s** rather than around **1990** as assumed.
 - Over the last **50 years**, **Maldives**, **Lakshadweep**, and **Chagos** have experienced a **30-40 cm** increase in sea levels, increasing the risks of **flooding** and **coastal erosion**.
- **Coral Growth:** Coral micro-atolls are influenced by **environmental factors** like **El Niño**, the [Indian Ocean Dipole \(IOD\)](#), and the **18.6-year lunar cycle**.
 - These factors can affect the coral growth patterns, which, in turn, provide data on sea-level fluctuations.
 - By studying the **growth bands** in coral micro-atolls, scientists can reconstruct **sea-level history**, tracking past fluctuations and understanding the **acceleration** of sea-level rise in specific regions like the **Maldives** and **Lakshadweep**.

What is Sea-Level Rise (SLR) and Its Impact on Island Nations?

- **About: Sea-Level Rise (SLR)** refers to the **gradual, long-term increase in ocean levels**.
 - While the global average rise is **approximately 3.2 mm per year**, the **Indian Ocean** is experiencing a faster rate at **3.3 mm per year**, intensifying challenges such as coral bleaching in regions like the **Maldives, Lakshadweep, and the Chagos Archipelago**.
- **Causes of Sea-Level Rise:**
 - **Melting of Glaciers and Ice Sheets:**
 - The melting of glaciers and ice sheets adds significant amounts of freshwater to the oceans. **Between 2005-2013**, melting glaciers contributed nearly **twice as much to sea-level rise as thermal expansion**.
 - Specifically, **Greenland's ice loss increased seven-fold** and Antarctica's ice loss nearly quadrupled between 1992 and 2016.
 - **Thermal Expansion of Seawater:**
 - As the Earth's climate warms, seawater absorbs heat, causing it to expand and increase the overall volume of the oceans. This thermal expansion contributes significantly to **sea-level rise**.
 - **Groundwater Depletion and Land Water Shifts:**
 - Groundwater depletion, along with changes in **aquifers, rivers, lakes, and soil moisture**, results in additional water being transferred to the seas, further contributing to rising sea levels.
 - **Since 1880**, global sea levels have risen by approximately **21-24 cm**, with the record high in 2023 being 101.4 mm above 1993 levels.
- **Impact of SLR on Island Nations:**
 - **Loss of Land and Habitats:** Rising seas **inundate coastal areas, cause freshwater salinization, and destroy habitats**. Eg: **Maldives and Tuvalu** face existential threats. **Coral bleaching and mangrove loss** further reduce natural defenses.
 - **Water and Food Insecurity:** Saltwater intrusion **contaminates aquifers and damages agriculture**, while coral reef degradation reduces fish stocks. Eg: **Kiribati and Marshall Islands** are facing severe drinking water shortages.
 - **Extreme Climate Events:** Intensified **cyclones, hurricanes, and floods** devastate infrastructure and economies. Eg: **Hurricane Dorian (2019)** caused USD 3 billion damage to the Bahamas.
 - **Socio-Economic Disruptions:** **Beach erosion and reef destruction** reduce **tourism revenues**, while storm damage diverts budgets from development. Eg: **Barbados** faces declining tourism. Entire communities may be displaced, creating **climate refugees**.
 - **Health and Cultural Risks:** Warmer temperatures spread **vector-borne diseases** (dengue, chikungunya), while **forced migration** leads to cultural erosion and identity loss.

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 **CaCO₃** - **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

Conclusion

Research on **coral microatolls** reveals that **sea-level rise** in the **central Indian Ocean** started earlier and accelerated faster than previously thought. For regions like the **Maldives and Lakshadweep**, this underscores the need for **climate-resilient infrastructure, sustainable coastal policies, emission mitigation**, and improved **adaptation strategies** based on refined **sea-level projections**.

Drishti Mains Question:

How can natural recorders like coral microatolls complement modern scientific tools in understanding climate change and sea-level rise?

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)

Q. How are climate change and the sea level rise affecting the very existence of many island nations? Discuss with examples. (2025)

PDF Refernece URL: <https://www.drishtias.com/printpdf/coral-reefs-as-indicators-of-rising-sea-levels>

