

## OCEAN ACIDIFICATION: GEOGRAPHY

**NEWS:** Ticking timebomb': sea acidity has reached critical levels, threatening entire ecosystems – study

### WHAT'S IN THE NEWS?

Ocean acidification, caused by increased CO<sub>2</sub> absorption, has crossed its planetary boundary, threatening marine biodiversity and global climate stability. This decline in ocean pH severely impacts calcifying species, carbon sequestration, fisheries, and coastal livelihoods.

#### Context

- A recent global study highlights that **ocean acidification has crossed its planetary boundary**, threatening the stability of marine ecosystems and Earth's climate systems.
- This breach represents a **critical environmental tipping point**, beyond which the ocean may not be able to maintain its ecological functions.

#### What is Ocean Acidification?

- It is the **continuous decline in the pH level of ocean water**, driven primarily by **absorption of atmospheric CO<sub>2</sub>**.
- CO<sub>2</sub> reacts with seawater to form **carbonic acid**, which further dissociates to release hydrogen ions, **lowering pH and reducing carbonate ion concentration**.
- **Calcium carbonate**, crucial for marine organisms to build shells and skeletons, becomes less available in acidic conditions.

#### Planetary Boundary Breach

- **Planetary boundaries** define the safe operating limits for Earth's vital systems.
- The study found that by **2020**, the average global ocean had dropped **20% below pre-industrial calcium carbonate saturation levels**.
- At a depth of **200 metres**, over **60% of ocean waters** had surpassed the safe acidification limit.
- This signals a systemic breakdown in ocean chemistry with **potentially irreversible ecological impacts**.

#### Impacts of Ocean Acidification

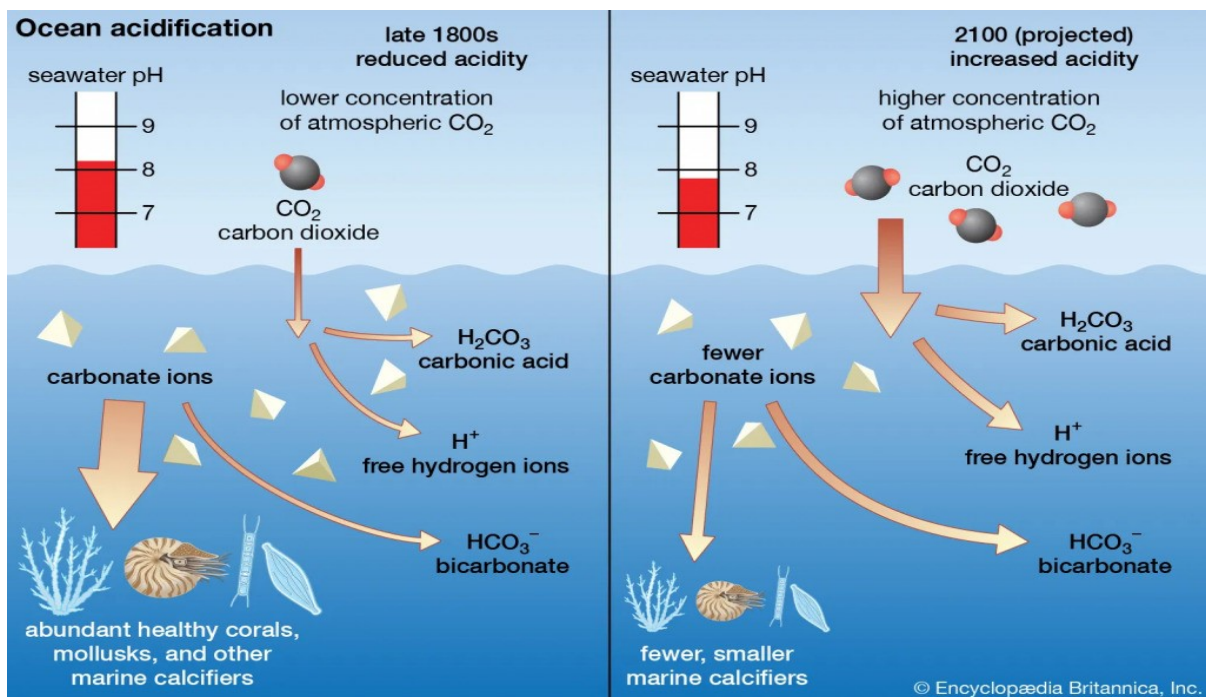
- **On Calcifying Species:**
  - Species like **corals, mussels, oysters, and pteropods (sea butterflies)** are most vulnerable.
  - Acidification causes **thinner shells, weakened skeletons, lower reproduction rates, and higher mortality**.

- **On Fisheries and Livelihoods:**
  - Acidification disrupts **fish nursery grounds**, affecting **fish stocks**.
  - **Coastal communities** relying on marine fisheries face **economic insecurity** and **food shortages**.
- **On Coral Reefs and Tourism:**
  - Coral bleaching and reef destruction hurt **tourism industries**, especially in island and tropical nations.
- **On Climate Feedbacks:**
  - Ocean plankton and ecosystems act as **natural carbon sinks**.
  - Acidification may reduce oceanic **carbon sequestration**, thereby **amplifying global warming**.
- **On Society and Geopolitics:**
  - **Livelihood loss and migration** from affected coastal zones may increase **geopolitical tensions**.
  - Unemployment in marine sectors could cause **local unrest and social instability**.

### **Key Global Initiatives to Tackle Ocean Acidification**

- **Global Ocean Acidification Observing Network (GOA-ON):**
  - A **collaborative network with 367 members from 66 countries**.
  - Supports **monitoring of pH, CO<sub>2</sub>, and carbonate chemistry** in oceans.
- **UN Decade of Ocean Science for Sustainable Development (2021–2030):**
  - Aims to **reverse ocean health decline** by promoting scientific research and innovation.
  - Supports achievement of **SDG-14 (Life Below Water)**.
- **Intergovernmental Oceanographic Commission (IOC) of UNESCO:**
  - Operates the **Global Ocean Observing System (GOOS)**.
  - Provides **real-time ocean data**, including CO<sub>2</sub> and pH measurements.
- **Blue Carbon Initiatives:**
  - Focus on **carbon storage in coastal ecosystems** like **mangroves, seagrasses, and salt marshes**.

- Promote **conservation financing, policy integration, and scientific research.**



## Way Forward

- **Policy and Governance Reforms:**
  - Integrate **ocean acidification in national climate strategies** and marine policies.
  - Adopt **Marine Spatial Planning (MSP)** and **Integrated Coastal Zone Management (ICZM)**.
- **Local Adaptation and Conservation:**
  - **Protect and restore blue carbon ecosystems** like mangroves and seagrasses.
  - Establish and expand **Marine Protected Areas (MPAs)** in vulnerable zones.

## Concluding Remarks

- Ocean acidification is a **silent yet serious crisis** with wide-ranging implications across biodiversity, food systems, economies, and climate action.
- It requires **urgent, coordinated global and national responses**, combining **science, policy, community action, and international cooperation.**

Source: <https://www.theguardian.com/environment/2025/jun/09/sea-acidity-ecosystems-ocean-acidification-planetary-health-scientists>