Effects of Monsoon Fluctuations on Marine Life in Bay of Bengal

Prelims (GS I) - *Indian and World Geography-Physical, Social, Economic Geography of India and the World.*

Mains (GS I) – *Geographical features and their location-changes in critical geographical features (including water-bodies and ice-caps) and in flora and fauna and the effects of such changes.*

Why in news?

A recent study published in the journal Nature Geoscience has revealed how monsoon patterns significantly impact marine productivity in the Bay of Bengal.

> *Despite covering less than 1% of the world's ocean area, the Bay of Bengal it provides nearly 8% of global fishery production.*

Key Findings of the study

- **Extreme Monsson conditions** – The study found that both abnormally strong and weak monsoons throughout history caused *major disruptions in ocean mixing*.
- This mixing play important role in climate, marine life, and cycles carbon and oxygen in the ocean.

Ocean mixing
• **Ocean mixing** - It is the process of warm, sun-filled surface water mixing with cold, nutrient-rich water near the bottom of the ocean. • Winds, ocean currents, and tides are responsible for most ocean mixing. **Types of Ocean Mixing** • **Vertical Mixing** – It occurs when water from different depths mixes, often driven by Wind, Turbulence, Convection. • **Horizontal/Lateral Mixing** – Driven by ocean currents. • **Diapycnal Mixing** – Mixing across density surfaces, often due to *turbulence or internal wave breaking*. • **Tidal Mixing** – Tides interacting with seafloor features (e.g., seamounts, continental shelves) generate internal waves and turbulence.

- **Reduced food availability** – Up to 50% reduction in food availability for marine life in surface waters.
- **Historical trend** – Significant declines happened in certain period when extreme monsoon weather was observed.
    - Heinrich Stadial 1 (a cold phase between 17,500 and 15,500 years ago).
    - Early Holocene (about 10,500 to 9,500 years ago).
- **Impact on plankton growth** – The ability of the ocean to support plankton growth is reduced which forms the base of the marine food chain.
- **Impact on food security** – The decline in ocean productivity reduces fish stocks and impacts food security for coastal communities.

Reasons for Disruption

- **During strong monsoons** – Increased rainfall leads to greater river runoff into the Bay and this excess freshwater creates a buoyant surface layer which prevents nutrient mixing from deeper waters.

  Buoyant surface layer formed as a result of difference in density of water where warm, less dense water floats on top of cooler, denser water.

- **During weak monsoons** – Due to reduced wind-driven mixing that limits the upwelling of nutrient-rich deep waters.
  - Surface waters become starved of essential nutrients.

Reference

The Hindu| Changes in monsoon affect marine productivity