EARTH'S DEEP SEAFLOOR: GEOGRAPHY

NEWS: 99.999% of earth's deep seafloor yet to be observed

WHAT'S IN THE NEWS?

A recent study reveals that only 0.001% of the deep ocean has been mapped since the 1950s, highlighting geographical bias and data gaps in deep-sea exploration. This underscores the need for global engaPgement in ocean research, especially with rising climate and strategic challenges.

What is the Deep Sea?

- The deep sea is generally defined as the portion of the ocean that begins at a depth of around 200 metres or more below sea level, where sunlight starts to significantly diminish.
- It covers two-thirds of the Earth's surface, making it the largest ecosystem on the planet.
- Despite its vastness, the deep sea remains the least explored area on Earth due to technological and financial constraints.

Recent Study Findings on Deep-Sea Exploration

- Only 0.001% of the deep ocean floor has been mapped using modern imaging technology since the 1950s.
- Geographic Imbalance:
    - Around 65% of deep-sea observations come from regions close to three countries: the United States, Japan, and New Zealand.
- Feature Representation Bias:
    - Oceanic features like canyons and escarpments are overrepresented in current observations.
    - In contrast, abyssal plains, which actually cover most of the ocean floor, are significantly underrepresented.
- This skewed dataset leads to an incomplete and possibly distorted understanding of the deep-sea ecosystem.
- The study highlights the need for equitable global participation in deep-sea exploration to improve scientific understanding.

Significance of Expanded Deep-Sea Research

- Climate Regulation & Environmental Balance:
    - The deep ocean plays a critical role in stabilising the Earth's climate and supporting ecological balance through processes like carbon sequestration.
    - Understanding these processes is vital amid challenges like climate change and ocean warming.
- Evidence-Based Marine Policy-Making:
    - Improved data and research from deep-sea exploration can aid in formulating science-based marine protection policies.
    - Can help design international regulations for activities like deep-sea mining, ensuring sustainability and conservation.
- Biodiversity Discovery & Conservation:
    - The deep sea is a habitat for rich and often unknown biodiversity, including species adapted to extreme pressure and darkness.
    - Some organisms might have biomedical or biotechnological applications (e.g., enzymes, antibiotics).
    - Mapping these life forms can aid species conservation and ecological balance.
- Resource Potential of the Deep Sea:
    - Contains valuable minerals such as:
        - Polymetallic nodules (rich in manganese, nickel, cobalt, etc.)
        - Gas hydrates (potential source of methane)
        - Rare earth elements critical for electronics and green technologies.
    - Also has reserves of oil and natural gas, which could support future energy needs.
- Strategic and Geopolitical Importance:
    - Undersea fibre-optic cables responsible for over 95% of the world's internet traffic pass through deep-sea regions.

- These infrastructures are vulnerable to sabotage or interference, necessitating protection and monitoring.
- Deep-sea research supports national security, especially with countries like China developing underwater military technologies.
- It also reinforces a nation's claim over Exclusive Economic Zones (EEZs), as recognised under the United Nations Convention on the Law of the Sea (UNCLOS).

India's Initiative: Deep-Sea Mission 'Samudrayaan'

- India plans to launch its first deep-sea mission, Samudrayaan, by 2026.
- It will involve sending scientists 6000 metres below the ocean surface.
- Key features:
  - The mission will use 'Matsya', a 25-tonne titanium-hulled submersible designed to withstand extreme deep-sea pressure.
  - Objectives include:
    - Collecting biological and geological samples
    - Conducting environmental monitoring
    - Exploring seabed mineral resources crucial for future technologies like batteries and electronics.
- Samudrayaan marks India's strategic push into the blue economy and deep-ocean research leadership.

Source: https://www.thehindu.com/sci-tech/science/99999-of-earths-deep-seafloor-yet-to-be-observed/article69563694.ece