Microplastic Infiltration in Oceans

Source: DTE

Why in News?

A recent study published in ***Nature*** reveals that **microplastics** are not just surface pollutants but are now **embedded deep within the ocean**, impacting the **planet's biogeochemical and carbon cycles** .

What are Key Findings of the Study?

- **Microplastic Infiltration:** Microplastics are **widespread across the ocean**, dominating marine ecosystems and **reaching depths of up to 100 metres** in ocean gyres.
    - While **larger plastic** fragments (100 to 5,000 micrometres) were typically concentrated near the **ocean surface**, **smaller particles** were discovered embedded as deep as **100 metres** within ocean gyres.
    - **Gyres**, slow-moving, circular ocean currents, **trap and concentrate plastics.**
- **Quantity:** The **total plastic input from 1950–2015** was estimated at **17–47 million metric tonnes.**
    - Fishing gear made of **nylon and polyester** is a key source of dense plastics like Polyethylene Terephthalate (PET) in the ocean, with over **56 polymer types** detected.
- **Impacts:** The water column, vital for **biogeochemical cycling**, is increasingly affected by **microplastics**, potentially **disrupting** the ocean's **carbon cycle**.
    - **Carbon Cycle Interference:** Plastic pollution adds **external carbon (called allochthonous carbon)** to marine ecosystems, with **microplastic carbon** rising from **0.1% of total particulate organic carbon (POC) at 30 m** to **5% at 2,000 m** in subtropical gyres.
        - It could make marine samples appear **420 years older.**
    - **Biogeochemical Impacts:**
      Microplastics alter **microbial nitrification and denitrification** and release **metabolites** that disrupt **nutrient cycles.**

What are Microplastics?

- **About: Microplastics**, defined as plastics less than **five millimetres** in diameter, can be **harmful to oceans** and **aquatic life.**
    - **Solar UV radiation, wind, and ocean currents** break down plastics into **microplastics (<5 mm)** and **nanoplastics (<100 nm)**.
- **Classification:**
    - **Primary microplastics:** They are tiny particles made for **commercial use**, like **microbeads**, **plastic pellets**, and **microfibers** from clothing.
    - **Secondary microplastics:** They form when larger plastics like bottles **break down** due to **sunlight** and **ocean currents.**
- **Concerns: Microplastics** can attach to red blood cells, **reducing oxygen transport**, and have been found in **placentas** and **fetal organs**.
    - They can **damage human cells**, and **young children** are especially vulnerable to such

exposure.

- **Applications:** It is used in **drug delivery**, **industrial cleaning**, and as **exfoliants in personal care products** like scrubs and toothpaste.
- **Regulations Related to Microplastics:**
  - **Global: United Nations Environment Programme (UNEP) Plastics Treaty**
  - **India: Ban on Single-Use Plastics, Plastic Waste Management Rules, 2016, Plastic Waste Management (Amendment) Rules, 2024.**

UPSC Civil Services Exam, Previous Year Questions (PYQ)

Q. Why is there a great concern about the 'microbeads' that are released into environment? (2019)

(a) They are considered harmful to marine ecosystems.

(b) They are considered to cause skin cancer in children.

(c) They are small enough to be absorbed by crop plants in irrigated fields.

(d) They are often found to be used as food adulterants.

Ans: (a)