



Genome Mapping in Indian Ocean

Why in News

[National Institute of Oceanography \(NIO\)](#) is going to launch the **first-of-its-kind project of Genome Mapping** in the **Indian Ocean**.

- Indian Ocean is the third largest water body in the world, covering about 20% of the Earth's water surface.



Key Points

- **Aim:**
 - To **gather samples** for **genome mapping of microorganisms** in the Indian Ocean.
 - To **understand the biochemistry** and the **response of the ocean to [climate change](#), nutrient stress** and [increasing pollution](#).
- **Project Cost & Duration:**

- Rs. **25 crore** and will take **three years** to complete.

▪ **About:**

- A team of scientists and researchers from the NIO on board its research vessel **Sindhu Sadhana** will spend 90 days traversing the course of over **10,000 nautical miles** in the Indian Ocean on the research project to **reveal the internal working of the body of the ocean at a cellular level.**
- They will course the Indian Ocean **from India's east coast**, Australia, Port Louis in Mauritius and up **to the border of Pakistan, off India's west coast.**

▪ **Genome Collection:**

- The researchers will **collect samples** from various stretches of the ocean at an **average depth of about 5 km.**
- Just like **gene mapping** is carried out on blood samples collected from humans, the scientists will map these **in the bacteria, microbes found in the ocean.**
- The mapping of the **Deoxyribose Nucleic Acid (DNA)** and **Ribonucleic Acid (RNA)** will show the nutrients present in them, and also those lacking in different parts of the ocean.

▪ **Studying Trace Elements:**

- Trace metals like **cadmium or copper** are supplied to oceans via continental run-offs, atmospheric deposition, hydrothermal activities and continental shelf interaction.
- They are **essential for ocean productivity.**
- It is important to understand the **interactions of trace metals with marine biota** "for having a holistic understanding about nutrient cycling and productivity of the oceans".
- Apart from their reactions on marine life, **isotopic forms of trace metals can be utilised to track the movement of water masses** responsible for ocean circulation and as tools to study the biological, geochemical and ecosystem processes and food web analyse.
- The NIO's project is expected **to generate new information about trace metals from underexplored regions** of the Indian Ocean.

▪ **Benefits:**

◦ **Understanding Ecosystem:**

- It will help scientists understand the internal **working of the ecosystem** of the Indian Ocean.

◦ **Understanding Factors Causing Change:**

- The research will enable scientists to identify the **factors controlling the changes in RNA, DNA in the oceans**, and various stressors impacting them.

◦ **Identifying Mineral Concentration:**

- The ocean has several **micronutrients** like nitrates, sulphates and silicates, **minerals** like iron ore and zinc, and **trace metals** like cadmium or copper.
- The genome mapping will show the **presence of which these microbes have adapted to**, in addition to their reaction to atmospheric carbon dioxide.
- This will help in **identifying which part of the ocean has a greater concentration of which mineral or element.**
- Scientists will then use these as tracers to tackle the causative factors for excess or lack of a certain mineral or element and **suggest possible solutions for their mitigation.**

◦ **Human Benefit:**

- The **large pool of RNA, DNA library of the oceans** will be utilised for using the Indian Ocean to **human benefit in the future.**

◦ **Increased Biotechnology Application:**

- Genome mapping will enable an increase in the **growing number of commercial biotechnology applications**, extending from multiple anticancer treatments to cosmetics and industrial enzymes, to antiviral molecules.
- **Optimization of Conservation Efforts:**
 - Exploration of the ocean at a genetic level will result in **new insights into taxonomy** and adaptive capacity that can help optimize conservation efforts.

Genome

- A genome is the complete set of DNA (or RNA in RNA viruses) of an organism.
- Each genome contains **all of the information needed to build and maintain that organism**.
- In humans, a copy of the entire genome contains more than 3 billion DNA base pairs.

Genome Mapping

- It describes the methods used to identify the locus of a gene and the **distances between genes**. Gene mapping can also describe the distances between different sites within a gene.
- Taking inspiration from the Human Genome Project, the Department of Biotechnology (DBT) initiated the ambitious **“Genome India Project” (GIP)** in January 2020. The GIP aims to collect 10,000 genetic samples from citizens across India, to build a reference genome.

National Institute of Oceanography

▪ About:

- It is a **multi-disciplinary oceanographic research institute** and is one of the constituent laboratories of the **Council of Scientific & Industrial Research (CSIR)**, New Delhi.

▪ Headquarter and Other Centres:

- Its **headquarters is at Dona Paula, Goa** with regional centres at Kochi (Kerala), Mumbai (Maharashtra) and Visakhapatnam (Andhra Pradesh).

▪ Established:

- It was established on **1st January 1966** following the **International Indian Ocean Expedition (IIOE)** in the 1960s.

▪ Research Areas:

- The principal focus of research has been on **observing and understanding special oceanographic characteristics of the Indian Ocean**.
- The major research areas include the four traditional branches of oceanography - **biological, chemical, geological/geophysical and physical**, as well as **ocean engineering, marine instrumentation and marine archaeology**.

Source:IE