



Marine Heatwave and its Impacts

For Prelims: [Marine Heatwave](#) its Impact, [Bay of Bengal](#), [Coral Bleaching](#), [Ocean Currents](#), [El Nino](#), [Somali Jet](#).

For Mains: Marine Heatwave its Impact.

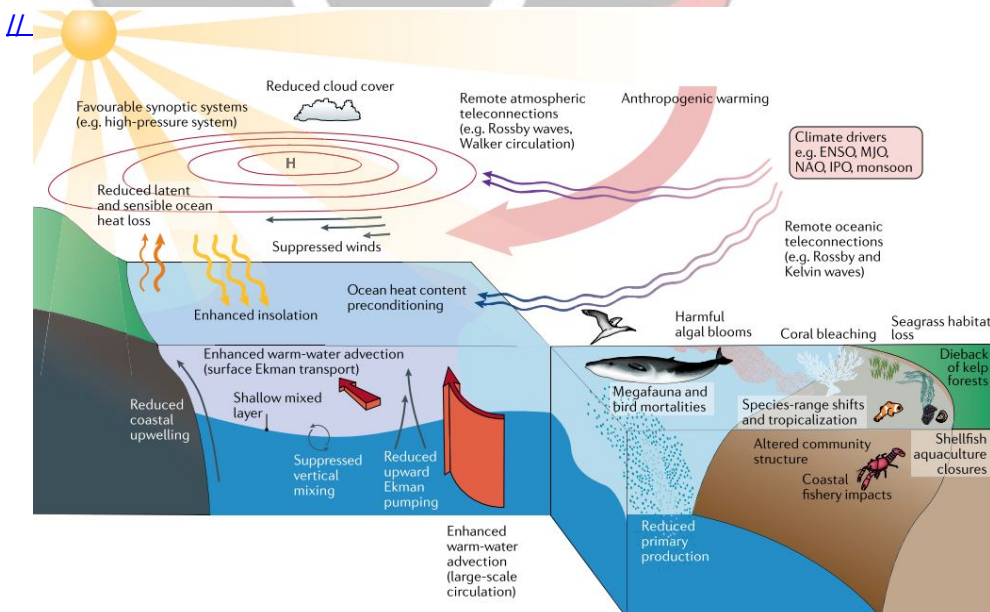
Source: DTE

Why in News?

The northern [Bay of Bengal](#) has been experiencing an intense **Marine Heatwave** since 28th June 2023, leading to India's **usually arid northwest receiving extreme rainfall**.

What is Marine Heatwave?

- Marine Heatwaves are **prolonged periods** of anomalously high **Sea Surface Temperature (SST)**.
- These events are linked to [coral bleaching](#), [seagrass destruction](#), and **loss of kelp forests**, **affecting the fisheries sector** adversely.
- The most common drivers of marine heatwaves include [ocean currents](#) which can build up **areas of warm water** and air-sea heat flux or warming through the ocean surface from the atmosphere.
 - Winds can enhance or suppress the warming in a marine heatwave, and **climate modes like El Niño** can change the likelihood of events occurring in certain regions.



How does Marine Heatwave Impact Rainfall in Northwest India?

- The marine heatwave in the Bay of Bengal **increased sea surface temperatures, causing higher evaporation rates** and a greater moisture supply in the atmosphere. This surplus of moisture contributed to above-average rainfall in northwest India.
- The marine heatwave likely **influenced the formation and behavior of depressions** in the Bay of Bengal, which may have contributed to an **increase in the frequency and intensity of depressions**, particularly on faster timescales (3-10 days).
 - Depressions, which are low-pressure systems, play a significant role in the monsoon and rainfall patterns.
- The marine heatwave, along with changing timescales of depressions, **affected the path and trajectory of these weather systems**. Depressions tended to move more towards northwest India rather than **north-central India, causing a higher concentration of rainfall in the northwest region**, leading to **above-average rainfall** in that area.

What are the other Impacts of Marine Heatwaves?

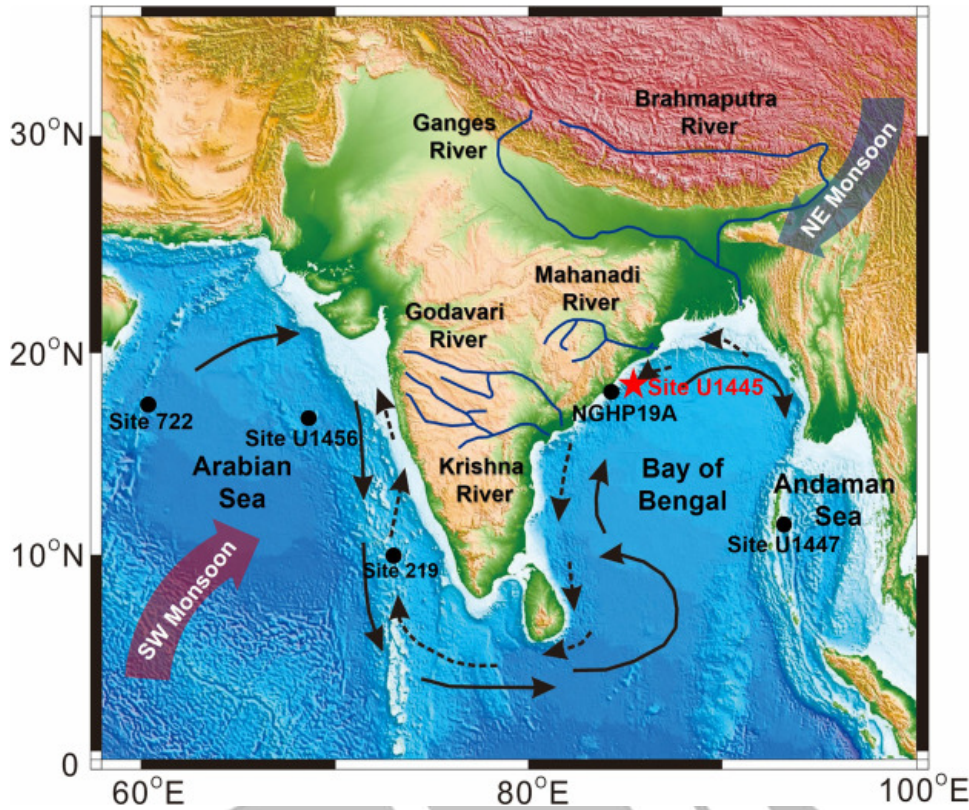
- **Affect Ecosystem Structure:**
 - Marine heat waves **affect ecosystem structure**, by supporting certain species and suppressing others.
 - It has been associated with the mass mortality of marine invertebrates and may force species to change behaviour in a way that puts wildlife at increased risk of harm.
- **Change Habitat Ranges of Certain Species:**
 - Marine heatwaves can change the **habitat ranges of certain species**, such as the spiny sea urchin off southeastern Australia which has been expanding southward into Tasmania at the expense of kelp forests which it feeds upon.
- **Economic Losses:**
 - Marine heatwaves can cause **economic losses through impacts on fisheries** and aquaculture.
- **Affect Biodiversity:**
 - Biodiversity can be drastically affected by marine heatwaves.
 - A **study from 2020 (Genesis and Trends in Marine Heatwaves Over the Tropical Indian Ocean and Their Interaction With the Indian Summer Monsoon)** reveals that a previous marine heatwave led to **bleaching of 85% of corals in the Gulf of Mannar** near the Tamil Nadu coast.
- **Increase the Risk of Deoxygenation and Acidification:**
 - Often, they occur alongside other stressors such as **ocean acidification**, deoxygenation, and overfishing.
 - In such cases, MHWs not only further damage habitats, but also increase the risk of deoxygenation and acidification.

How does the Bay of Bengal Impact Monsoon?

- **Moisture Source:**
 - The warm and humid air mass over the Bay of Bengal provides the **necessary moisture** that is carried by the monsoon winds towards the Indian subcontinent.
- **Heat Exchange:**
 - The Bay of Bengal has warm sea surface temperatures, especially in its northern part. During the monsoon season, the landmass of the Indian subcontinent gets heated up, **creating a low-pressure area**. The warm air rises, and cooler air from the Bay of Bengal rushes in to replace it, **causing a pressure gradient**. This pressure gradient helps draw in **moisture-laden winds from the Bay of Bengal**, contributing to the monsoon rainfall.
- **U-Turn of Monsoon Currents:**
 - The monsoon winds **blowing from the southwest over the Arabian Sea** cross over into the Bay of Bengal. When they reach the Bay of Bengal, they make a U-turn and start moving towards the northeast, eventually bringing rainfall to different parts of India.
 - The warm temperatures in the Bay of Bengal facilitate this **U-turn and the transport of moisture to the Indian subcontinent**.

▪ **Low-Level Jet Stream:**

- The Bay of Bengal also influences the formation and intensity of the low-level jet stream, known as the **Somali Jet**.
- This jet stream plays a crucial role in the transport of moisture from the equatorial Indian Ocean to the Indian subcontinent.
- The warm sea surface temperatures in the Bay of Bengal contribute to the **strengthening of this low-level jet, enhancing the moisture supply during the monsoon season.**



UPSC Civil Services Examination, Previous Year Question (PYQ)

Mains:

Q: How far do you agree that the behaviour of the Indian monsoon has been changing due to humanizing landscape? Discuss. **(2015)**

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