Marine Heat Wave (MHW)

Mains: GS I - *Important Geophysical Phenomena such as earthquakes, Tsunami, Volcanic activity, cyclone etc., | 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?

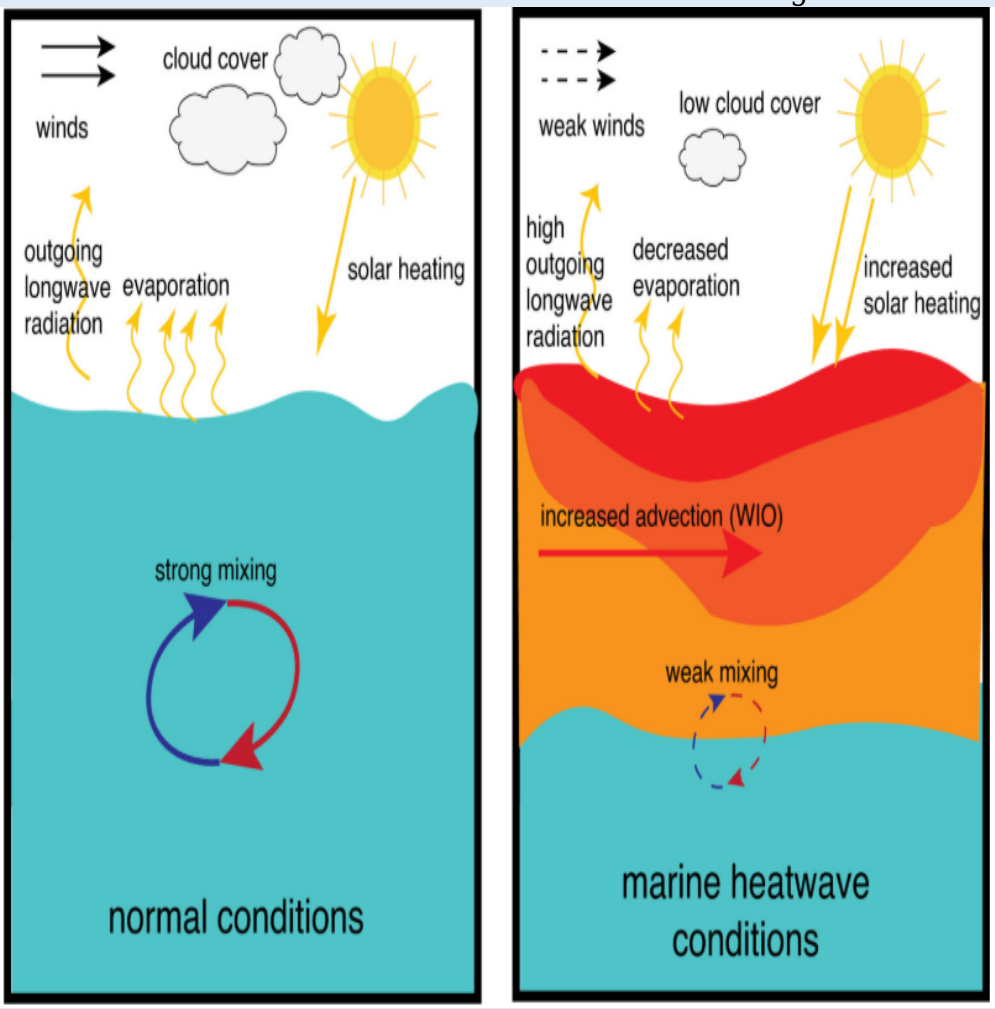
Recently, Mediterranean Sea has undergone an extremely intense marine heatwave, which scientists say could be a one-in-a-billion climatological event.

What is marine heat wave?

- **Definition** – As per IPCC 6th Assessment Report, marine heatwave are "a period during which ***water temperature is abnormally warm*** for the time of the year relative to historical temperatures, with that extreme warmth persisting for days to months.
- It is a condition, where the *temperatures of the surface and sub-surface of a sea are much higher* than the normal for extended periods of the time.
- They are defined based on differences in current temperature with expected temperatures for the location and time of year.
- **Occurrence** - It can *occur during summer or winter*.
- **Recent changes** - They have ***tripled in frequency in the last 40 years*** and last 50% longer.

Causes of Marine Heat Wave

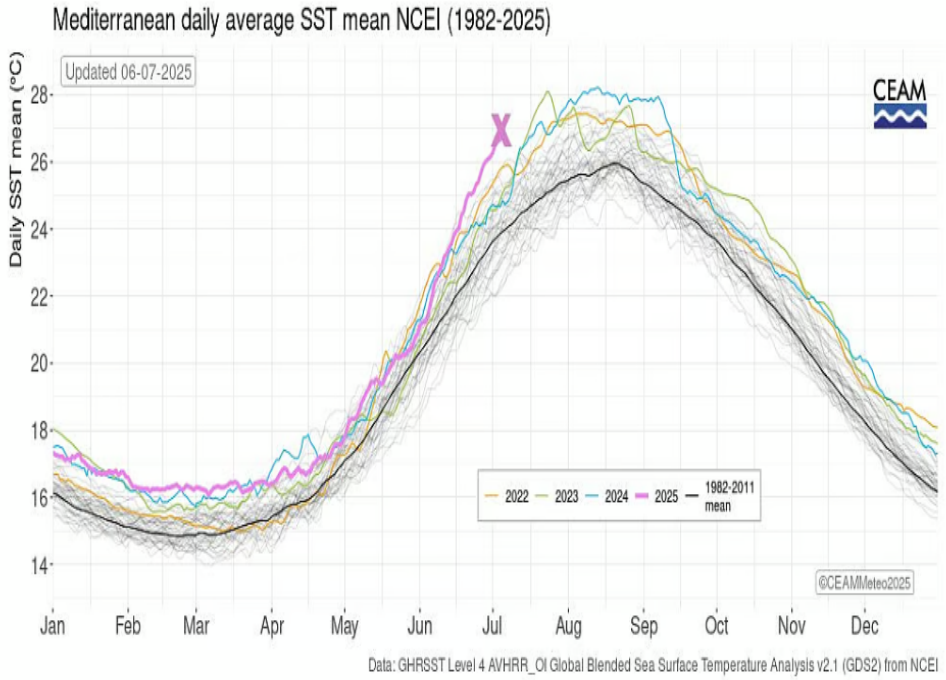
• **Global warming -** More frequent and intense heat waves are caused due to rise in atmospheric and ocean temperatures.
- Rapid warming over last 2 years likely caused *240% increase in marine heatwaves globally.*
• **Ocean Currents -** Local temperatures are influenced by Changes in ocean currents.
- ***For example**, if* warm *water is transported to a particular region, it can lead to increased sea surface temperatures.*
• **Winds** - Winds can increase or decrease the warming that occurs during an MHW.



• **El Nino** - EL Nino typically leads to warmer ocean conditions, which *can trigger MHWs*.
• **Anthropogenic activities** - Human activities, such as *coastal development, pollution, and overfishing,* alter local ecosystems and contribute to temperature increases.
- *87 % of MHW*s are attributable to human-induced warming.

Why intense marine heatwave in Mediterranean?

- **Intense marine heatwave** – The month of July, 2025 marked the most extreme Mediterranean heatwave in relative to same month other years so far.
  - Peak anomalies +8°C now off France / Italy with absolute peak temps near 31°C.
- **Higher deviation in temperature** - Overall deviation of the sea surface temperatures (SST) in the Mediterranean is 6 standard deviations from the normal for this time of the year.



- **Causes** - The *near surface temperatures in Europe* have been higher than normal from the beginning of 2025.
- A *heat dome that developed in June* has increased the temperatures drastically over Mediterranean Sea, becoming more adverse in July.
- **Mediterranean heat dome** – It is a continuation of a large *high-pressure ridge across the Atlantic basin*.

> ***Heat Dome*** *is a large region of high pressure area in the atmosphere, the air sinks downward heating up the air. Unless an external weather system breaks the continuity of the dome, the extreme heat builds up within increasing temperatures, causing both atmospheric and marine heatwaves.*

- **Climate change** – It causes circulation changes, and some excess heat is also from reduced aerosols.
- **Immediate cause** – *Lower wind activity* and *less mixing of water among the layers of the sea*, mainly due to the formation of a heat dome.

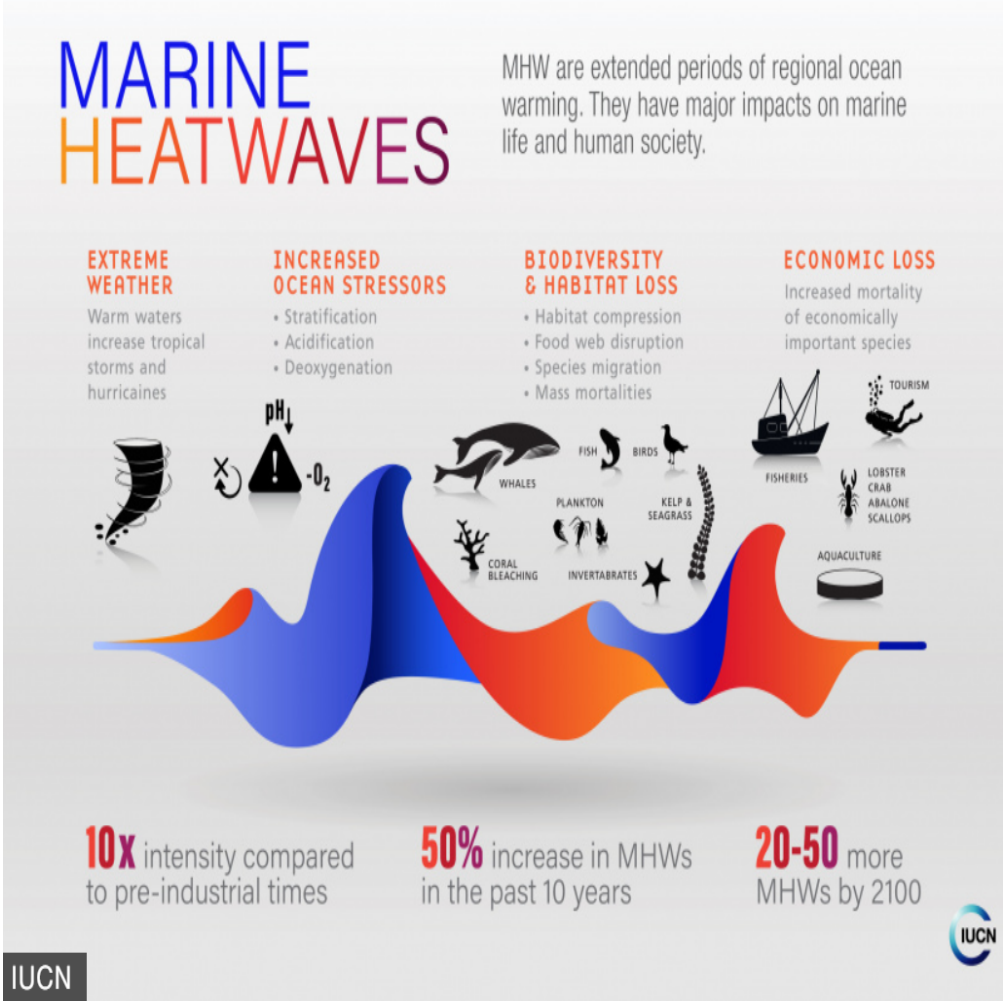
What are its impacts?

- **Impacts** - In the western Mediterranean, the higher increases in temperatures were observed in Balearic Sea and the Tyrrhenian Sea.
  - **Worst-affected are parts** - Western Mediterranean Sea
  - **Severely impacted** - Central region of Mediterranean.
- **Affects livelihood of people** – It has the potential to kill or reduce the productivity of *economically important species* as farmed aquatic species can be susceptible to warm temperatures.
  - Fishing areas in the Spanish part of the Mediterranean show a steady temperature increase of 0.75 C per decade.

- **Mass mortality** - There were 5 consecutive mass mortality events, between 2015 and 2019, that included thousands of kilometres of coastline and a range of marine habitats
- **Loss of life and property** – It is due the torrential rainfall that can lead to flash floods and landslides.
- **Catastrophic rainfall** - Higher heat increase the moisture in the atmosphere, which could lead to more intense storms.
- Higher sea temperatures keep the air temperature dew points higher, resulting in more moisture for excessive and intense rainfall events.

> *A **dew point** is the temperature to which ambient air needs to be cooled for it to be 100% saturated.*

- **Increased thunderstorms** - High moisture translates into higher temperature dew points, thus more convective energy to fuel thunderstorms.
- **Impacts tourism potential** - It can also *harm regional tourism* which serves as one of the important sources of income and livelihood of local communities.



What lies ahead?

- Close monitoring of the extremely warm Sea during summer can be enhanced.

- Development of early warning and *forecast systems* could help in better prediction of risks and mitigation measures
- *Efforts can be increased to reduce fossil-fuel-based emissio*ns to limit the impacts of the Global warming and climate change.
- Strengthening the capacity and resilience of the local people can help in the protection of communities and ecosystems from MHWs.

Reference

Down To Earth | Marine Heatwave in Mediterranean