



# CURRENT AFFAIRS



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## CRITICAL INDIAN OCEAN TO UNDERSTAND EARTH'S OVERALL RESPONSE TO GHGS AND GLOBAL WARMING

THIS ARTICLE COVERS "DAILY CURRENT AFFAIRS" AND THE TOPIC DETAILS OF "CRITICAL INDIAN OCEAN TO UNDERSTAND EARTH'S OVERALL RESPONSE TO GHGS AND GLOBAL WARMING". THIS TOPIC IS RELEVANT IN THE "GEOGRAPHY" SECTION OF THE UPSC- CSE EXAM.

### Why in the news?

June 8 is celebrated as World Oceans Day, a time to marvel at the intricate beauty of the Indian Ocean, one of the planet's three major oceans located right on our doorstep. Recent focus has turned towards this vast body of water due to its alarming rate of warming and its significant impact on neighbouring oceans. The Indian Ocean plays a role in elucidating how our oceans are responding to the escalating levels of greenhouse gases and global warming, making it imperative for us to delve deeper into its complexities.

### The Indian Ocean is the centre of the deadliest storms:

- The Indian Ocean, renowned for its powerful **monsoon winds** and the life-giving rains they bring, has inspired literature and art for generations. With over a billion people relying on its nourishing moisture for sustenance, fisheries, and agriculture, its significance cannot be overstated.
- During the warm summer months, the Arabian Sea, the Bay of Bengal, and the southern tropical Indian Ocean experience rapid warming, accompanied by a shift in wind direction from land to ocean.
- However, this season also brings the **looming threat of pre-monsoon cyclones**. While the North Indian Ocean generates fewer cyclones compared to the Pacific or Atlantic Oceans, their frequency and intensity have been on the rise.
- Despite their relatively smaller size, these cyclones pose a significant risk to the developing nations along the South Asian, East African, and West Asian coastlines, making them among the deadliest storms in terms of human casualties.
- Yet, amidst these challenges, the warm waters of the Indian Ocean sustain diverse fisheries, ranging from anchovies to tuna, and support marine life such as dolphins and, occasionally, whales.
- The region's breathtaking beaches and coral reefs, stretching from Lakshadweep to the Andaman-Nicobar Islands and beyond to places like Reunion Island and Madagascar, attract tourists seeking natural beauty and adventure.

## Warming Indian Ocean Lead to Extreme Climate



### The uniqueness of the Indian Ocean:

- The Indian Ocean boasts a distinctive geographical makeup, setting it apart from other oceans worldwide. To the north, it is enclosed by the vast Asian landmass, with only narrow connections to the Persian Gulf and the Red Sea.
- In the southern Indian Ocean, its uniqueness is further underscored by the presence of two oceanic channels linking it to the Pacific and Southern Oceans.
- Through the first channel, known as the Indonesian seas, the Pacific Ocean channels a staggering volume of water—up to 20 million cubic meters per second—along with a significant amount of heat into the eastern Indian Ocean.
- This influx termed the Indonesian Throughflow, predominantly remains within the top 500 meters of the ocean, shaping circulation patterns and influencing temperature and salinity as it traverses towards Madagascar.
- The second channel facilitates a two-way exchange between the Indian Ocean and the Southern Ocean. Here, colder, saltier, and denser waters from the Southern Ocean flow into the Indian Ocean below approximately 1 kilometre in depth.
- Due to the Indian Ocean's closed northern boundary, these waters gradually mix upward, interacting with the Pacific waters. Ultimately, the mixed waters, spanning the top 1 kilometre, exit to the south.
- This intricate interplay of heat and water masses within the Indian Ocean confers significant influence over the global oceanic heat distribution, highlighting its pivotal role in the Earth's climate system.

### SIMMERING WARM BATHTUB:

- Often overlooked, the Indian Ocean emerges as a powerhouse in global climate dynamics, earning its title as the “little ocean that could.” Despite its relatively small size, its warming trends are undeniable, driven not only by the interplay of oceanic currents but also by atmospheric influences, particularly those stemming from the Pacific Ocean.
- The atmospheric circulation patterns, centred around a significant rainfall zone over the Maritime Continent, predominantly foster sinking air masses over the Indian Ocean, gradually warming its waters year by year.

- This atmospheric interaction, coupled with increased heat transfer from the Pacific Ocean and a decline in the chilling effect of Southern Ocean currents, has propelled the Indian Ocean into one of the fastest-warming bodies of water on the planet.
- The repercussions of this warming trend are far-reaching, amplifying heatwaves and extreme rainfall events across the Indian subcontinent and posing significant threats to marine ecosystems, including corals and fisheries, through marine heatwaves.
- Moreover, the Indian Ocean's warming dynamics have triggered a ripple effect on global climate systems. By influencing wind patterns and, consequently, the Pacific Ocean's capacity to absorb heat, the Indian Ocean plays a crucial role in regulating global warming rates.
- Notably, recent research suggests that the Indian Ocean's warming trend may paradoxically enhance the sinking of heat in the North Atlantic, thereby aiding in mitigating global warming effects.
- In essence, despite its modest size, the Indian Ocean's impact on global climate dynamics is profound and undeniable. Its ability to absorb over 90% of the excess heat trapped by greenhouse gases underscores its pivotal role in the Earth's climate system, making it a force to be reckoned with on the world stage.

#### **Impact on human evolution:**

- Approximately three million years ago, Australia and New Guinea were positioned far south of the equator, while the Indian Ocean directly connected with the Pacific Ocean, forming what scientists refer to as a 'permanent El Niño' state. This climatic condition was characterised by abundant rainfall and lush forests over East Africa, contrasting starkly with its current arid state.
- The gradual northward drift of Australia and New Guinea, an ongoing process, led to the separation of the Indian and Pacific Oceans around three million years ago. Consequently, the eastern Pacific Ocean cooled, transitioning the El Niño phenomenon from a permanent to an episodic occurrence.
- This climatic shift resulted in the aridification of East Africa, transforming its once-verdant rainforests into grasslands and savannahs.
- Researchers speculate that these environmental changes compelled our ancestors, including chimpanzees and gorillas, to adapt by moving longer distances and developing faster locomotion.
- The abundant rainforests had ample food and shelter, thus eliminating the need for extensive travel. This evolutionary pressure may have contributed to the emergence of bipedal movement, a more energy-efficient mode of locomotion over greater distances compared to quadrupedalism.

#### **PRELIMS BASED QUESTION:**

##### **Q. Regarding the Indian Ocean Dipole (IOD) and El Niño:**

1. El Niño results in the warming of the surface of the Pacific Ocean, while IOD leads to warming in the Indian Ocean.
2. El Niño consistently brings deficient rainfall in India, while IOD consistently brings more rainfall in India.

##### **Which of the above statements is/are correct?**

1. 1 Only
2. 2 Only
3. Both 1 and 2
4. Neither 1 nor 2

**Answer: D**

**Mains based Question:**

**Q. Rapid warming in the Indian Ocean may cause biodiversity loss and livelihood. How can we mitigate and adapt to rising sea levels and climate change?**

**Vishal Yadav**

