



Impact of Ocean Warming on Marine Sector of India

Kowshika. N¹, Sankar.T^{2*} and V. Guhan³

Article ID: 100

Tamil Nadu Agricultural University, India

Corresponding author: sankaragriculture94@gmail.com

Introduction:

Earth is 71 per cent covered with water on its surface where the marine biosphere accounts for 95 per cent of the ecology. Due to its role as a source and sink in all physical, chemical and biological cycles it plays a critical role in climate change, especially on the global circulations. Heat capacity, dissolution of gases, distribution of thermal heat and change of physical states are the factors accounting for the climatological changes (Parmesan *et al.*, 2003; Rosenweig *et al.*, 2008). Climate change effects have well been felt in the oceans as warming, acidification, raising sea levels due to sea ice melt, lowered levels of dissolved oxygen and accelerated weather extremes (Kim *et al.*, 2009). Even the biological system is completely affected from bleaching of corals to migration of fish soles (Brierley *et al.*, 2009). This paper provides insight on the effects of ocean warming on marine life of India.

Sea level rise:

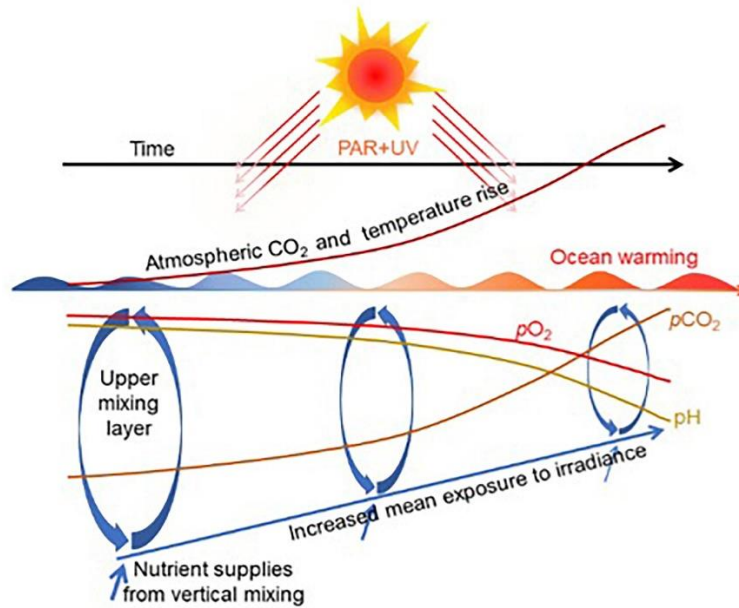
Melting glaciers and increased river run-offs have thrown burden on the sea level rise and nutrient leaching. More water into oceans could make the fish soles devoid of optimum temperature for growth due to the thermal differences. Nutrient leaching by the rivers may lead to eutrophication effect over the shore area and change the phytoplankton cycle (Anisimov *et al.*, 2001).

Changes in concentration of dissolved gases:

Changes in the water temperature and concentration would lead to differential proportions of dissolved gases. Fishes would be forced to adjust with the rising CO₂ levels. The varied response of coral reef fish populations as a resultant of El-Nino Southern Oscillation (ENSO) over the Eastern Pacific region is one such example. This would impart extinctions of local species (aims.gov.au). Reduction in dissolved oxygen could lead to hypoxia which is dangerous for fish survival.

Ocean acidification:

Acidification is the next level of increasing CO₂ levels where the pH would drop. Reduction in pH could be more pronounced in the sub-Arctic and Arctic oceans (Bellerby *et al.*, 2005).



Source: Hutchins *et al.* (2017)

Coral bleaching

Calcifying species such as molluscs, crustaceans, echinoderms, corals, calcareous algae, foraminifera and few phytoplankton could face the severe crunches of ocean acidification due to lack of calcifying substances. Under environmental stress conditions involving temperature, light or nutrient depletion corals expel the symbiotic algae present in the tissues leading to coral bleaching (noaa.gov). Gulf of Mannar, Gulf of Kachch, Palk Bay, Andaman Sea and Lakshwadeep Sea are the Indian coral reefs, which have experienced 29 bleaching events since 1989, while the intense terms were between 1998 and 2002 due to high ocean temperatures (Vivekanandan *et al.*, 2009)



Source: <https://www.smh.com.au/>

Fish soles

Researches from IITM have evidenced a 20 per cent reduction in the phytoplanktonic production in the past six decades over the Indian Ocean. Stratification of warmer ocean levels leaves the oceans without mixing the nutrients, thus productivity of phytoplanktons a



rapidly affected. Chand *et al.* (2012) have stated that sea water inundation is risking the fresh water fisheries of Sundarbans, however opening the avenues of brackish water aquaculture. There is a zonal shift in the oil Sardine catch from 8N and 14N through the Malabar upwelling zone from 1985 to the 14N and 20N latitudes in 2006 (Vivekanandan *et al.*, 2009) owing to the higher Sea Surface Temperatures. Indian mackerel fishes are descending from the subsurface waters into the bottom trawlers as a result of warming (CMFRI, 2008). Spawning activities of fish species have relatively shifted from the warmer months (April-September) into the cooler months (October-March) (Vivekanandan and Rajagopalan, 2009)

References

- Anisimov O, Fitzharris B (2001) Polar Regions (Arctic and Antarctic). In: Climate change 2001. Impacts, adaptation, and vulnerability. Contribution of working group II to the third assessment report of the NZRSTCV-092009 Inter Governmental Panel on climate change, WMO and UNEP. Cambridge University Press, Cambridge, pp 801–841
- Brierley AS, Kingsford MJ (2009) Impacts of climate change on marine organisms and ecosystems. *Curr Biol* 19:R602–R614
- Chand, B.K., Trivedi, R.K., Dubey, S. K. and Beg, M. M. (2012) Aquaculture in changing climate of Sundarban survey report on climate change vulnerabilities, aquaculture practices and coping measures in Sagar and Basanti Blocks of Indian Sundarban. West Bengal University of Animal & Fishery Sciences, Kolkata, India.
- CMFRI (2008): Research Highlights 2007-2008. Central Marine Fisheries Research Institute, Cochin, India, pp. 36.
- https://oceanservice.noaa.gov/facts/coral_bleach.html#:~:text=When%20water%20is%20too%20warm,and%20are%20subject%20to%20mortality.
- <https://www.aims.gov.au/docs/research/biodiversity-ecology/fish/fish-and-climate-change.html>
- <https://www.smh.com.au/opinion/global-warming-barrier-reef-under-threat-of-coral-bleaching-and-the-blob-20151013-gk80ux.html>
- Hutchins, D. A., Fu, F.-X., Walworth, N. G., Lee, M. D., Saito, M. A., and Webb, E. A. (2017). Comment on “The complex effects of ocean acidification on the prominent N₂-fixing cyanobacterium *Trichodesmium*”. *Science* 357:eaao006. doi: 10.1126/science.aao0067
- Kim HM, Webster PJ, Curry JA (2009) Impact of shifting patterns of Pacific Ocean warming on North Atlantic tropical cyclones. *Science* 325:77–8010.
- Parmesan C, Yohe G (2003) A globally coherent fingerprint of climate change impacts across natural systems. *Nature* 421:37–422.
- Rosenzweig C, Karoly D, Vicarelli M *et al* (2008) Attributing physical and biological impacts to anthropogenic climate change. *Nature* 453:353–357
- Vivekanandan, E., Hussain Ali, M., Rajagopalan, M. (2009) Vulnerability of corals to seawater warming. In: Aggarwal, P.K. (ed) Impact, Adaptation and Vulnerability of Indian agriculture to climate change, Indian Council of Agricultural Research, New Delhi.