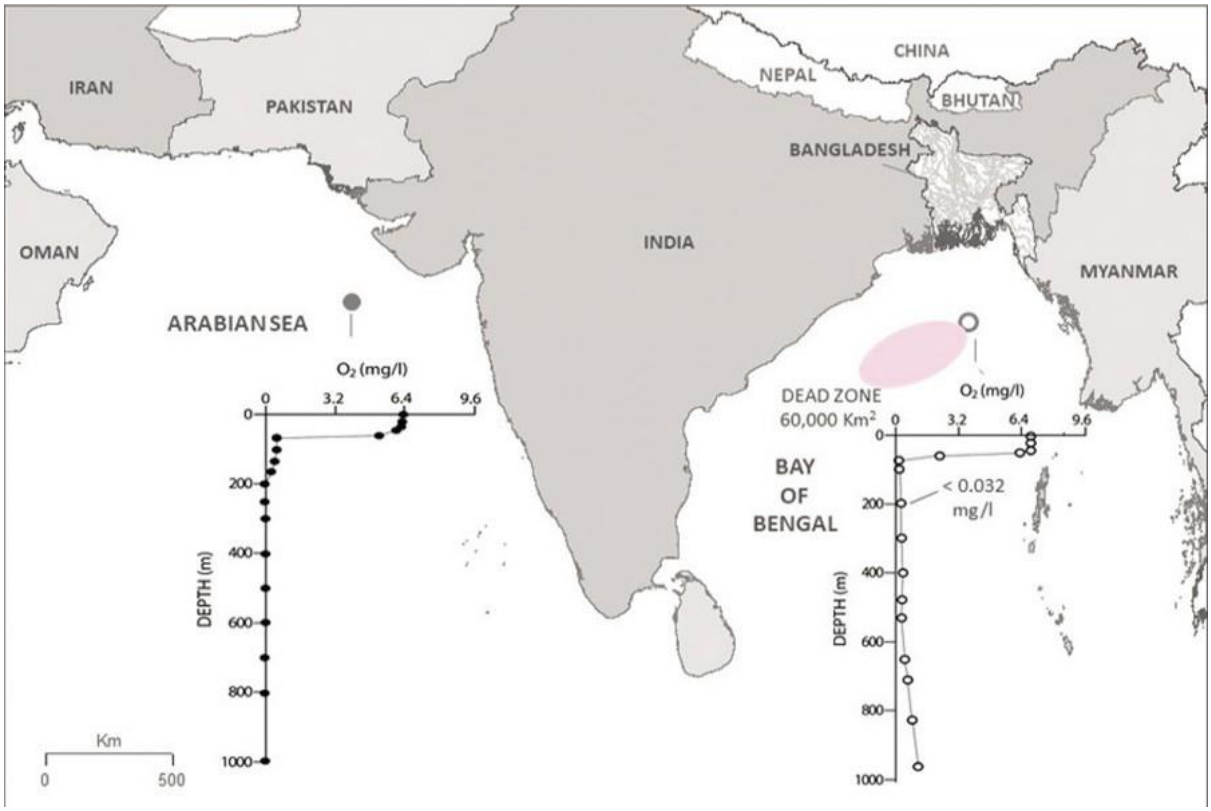
Dead Zone in Bay of Bengal is a Concern



The depletion of dissolved oxygen in coastal waters creates a dead zone, the most detrimental anthropogenic threat to marine ecosystems worldwide. Consequently, it disturbs the supporting processes of the marine ecosystem threatening marine lives, including other ecosystem and ecological services such as socioeconomic aspects, fisheries production, water filtration and nutrient cycling. Climate change inducing variables such as temperature, ocean acidification, precipitation, sea-level rise, and wind and storm pattern significantly contribute to the increase of dead zones.

Experts reports that 94% of dead zones are in vulnerable climate areas where an increase of 2? C temperature has been predicted by the end of the century. Besides climate drivers, hydrography, nutrient load influencing factors or eutrophication, metabolic effects, stratification, and lower oxygen solubility act through multiple pathways affect the oxygen dynamics of a dead zone.

Ocean researchers link the creation of a dead zone to the over-enrichment of the nutrients termed eutrophication, which causes hypoxia, initiating the enormous bacterial activity using oxygen on the seafloor. The increasing use of fossil fuels emitting nitrogen and phosphorous to the atmosphere and sewage plant runoff lead to more significant nutrient emissions into water. The early arrival of summer and extended summertime stratification caused by long term climate change is also predicted to stretch seasonal hypoxia. Dead zones, in addition, are considered to be the hotspot of ocean acidification.

A group of multinational scientists led by Bristow has discovered a "Dead Zone" about half of the size of Bangladesh at depths 70m and below in the Bay of Bengal. This is the third-largest Oxygen Minimum Zone (OMZ) globally, following the OMZs in the Eastern Tropical Pacific Ocean and the Arabian Sea. The presence of slight oxygen (0.032-0.064 mg/l), although it is below the required oxygen level (5 mg/l) to support the aquatic lives, minimal presence has made it different from others. Contrary, the absence of oxygen in the Arabian Sea has been causing devastating effects on its ecosystem and losing its Nitrogen balance.

The Arabian Sea OMZ contributes 20%of the global ocean denitrification (loss of nitrogen) budget and has been recognized as a hotspot of oceanic efflux of N2O, a greenhouse gas. The south-westerly summer monsoon winds trigger the upwelling circulations and bring the nutrient-rich and oxygen-depleted bottom ocean water into the shore of the Arabian Sea. The Bay of Bengal OMZ is at the tipping point and has been expanding alarmingly mainly due to global warming, changing river runoff and circulation patterns.

Anthropogenic inputs of nutrients, such as Nitrogen, Phosphorus, and organic Carbon, get released into the Bay of Bengal by the rivers across the region, having adverse effects on the OMZs. Meanwhile, the nutrients inputs to the Bay are increasing at a higher rate due to the heavy use of fertilizers to ensure excessive food demand through modernized farming practices. Industrial and urban waste discharge containing polyphosphate detergents contribute more significantly. A noticeable lack of awareness among the policymakers in Bangladesh about the consequence of the dead zone has become a matter of concern lately.

Socio-economic impacts: Millions of people around the Bay of Bengal (BoB) solely depend on it for livelihood and food security. Extreme OMZ has an intense impact on the overexploited commercial species, which eventually affects the earnings of the fisher folks. The upwelling process brings the low oxygen water near the coastal shore and affects the aquatic organisms and economic stability. This might be a substantial health risk for the shore community.

Ecological consequences: Upwelling oceanic circulation attributes to the limited coastal hypoxia in the BoB than in the Arabian Sea, where oxygen level has gone down to zero. Hitherto, a slight deviation from the present oxygen level leads to a devastating effect on the ecosystem of BoB, which may occur intense denitrification like the Arabian Sea. This imbalanced food chain could be worsened by intense fishing of targeted high-value fishes, scientifically known as "trophic cascading".

The migration of faunal biodiversity from the low oxygen region in search of food and oxygen or their death causes severe ecosystem damage. The river waters from the Ganges-Brahmaputra-Meghna (GBM) system stay on the surface while the heavier seawater remains on the sea bottom, making the water column stable and stratified. Therefore, the monsoon winds cannot trigger upwelling circulation, and thus the oxygen-depleted, nutrient-rich seawater does not come into the shore. However, the GBM system brings tons of sediments containing organic matters and nutrients which require dissolved oxygen from ocean water.

By good luck, the sediments with organic carbons do not get enough time to consume dissolved oxygen from the water column and quickly settle on the bottom. It eventually makes a dynamic balance of oxygen, keeping a tiny trace of oxygen in the dead zone of BoB. Being

connected to the Indian Ocean, the sea level rise, ocean acidification and climate change, and faster warming up of the Indian Ocean than any other ocean have made BoB more susceptible to the alterations.

Therefore, the increase of organic matters in OMZ would break the oxygen balance making the hypoxic zone anoxic and accelerating the denitrification process in the BoB. It also causes a greenhouse gas discharge (N2O) in the atmosphere like the Arabian Sea. The depletion of oxygen may kill marine aquatic lives, including commercial fishes and destroy the ecosystem functions as it happened in the Arabian Sea.

Concern for Bangladesh: Now, is there really any concerning issue for Bangladesh to be worried about? If yes, then what could be the possible impacts on us? What is the expansion rate of OMZ in the Bay of Bengal? How does Bangladesh contribute to the intensification of OMZ in the BoB? Hence, so many questions are there but answers are nowhere. Obviously, Bangladesh is a minimal contributor to climate change, yet many other marine pollution sources originating from Bangladesh might play a role in this regard. Despite this, we are not out of danger. We must control the OMZ regulating physical and biogeochemical factors.

Recommendation: A detailed research framework must be outlined where oxygen and nutrient cycling and organic carbon cycling across the BoB will be addressed. It is important to know how the hypoxic ecosystem functions and how the key biogeochemical phenomena will respond to the projected environmental change in the future (IPCC) and fit into the Bangladesh Delta Plan 2100 and the Blue Economy ambition.

A flawed policy, over-exploitation, unsustainable forms of waste management and climate change intensify the impacts in unpredictable ways that seek proper attention. It is high time to go for a planned research protocol to determine the causal factors behind creating a dead zone in BoB and how to reserve or get back to suitable ecosystem conditions. Regional cooperation and collective research could keep the dynamic balance in the dead zone of BoB.

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