Bay of Bengal Perspectives: Correlation Between Climate Change, Marine Ecosystem and Biodiversity

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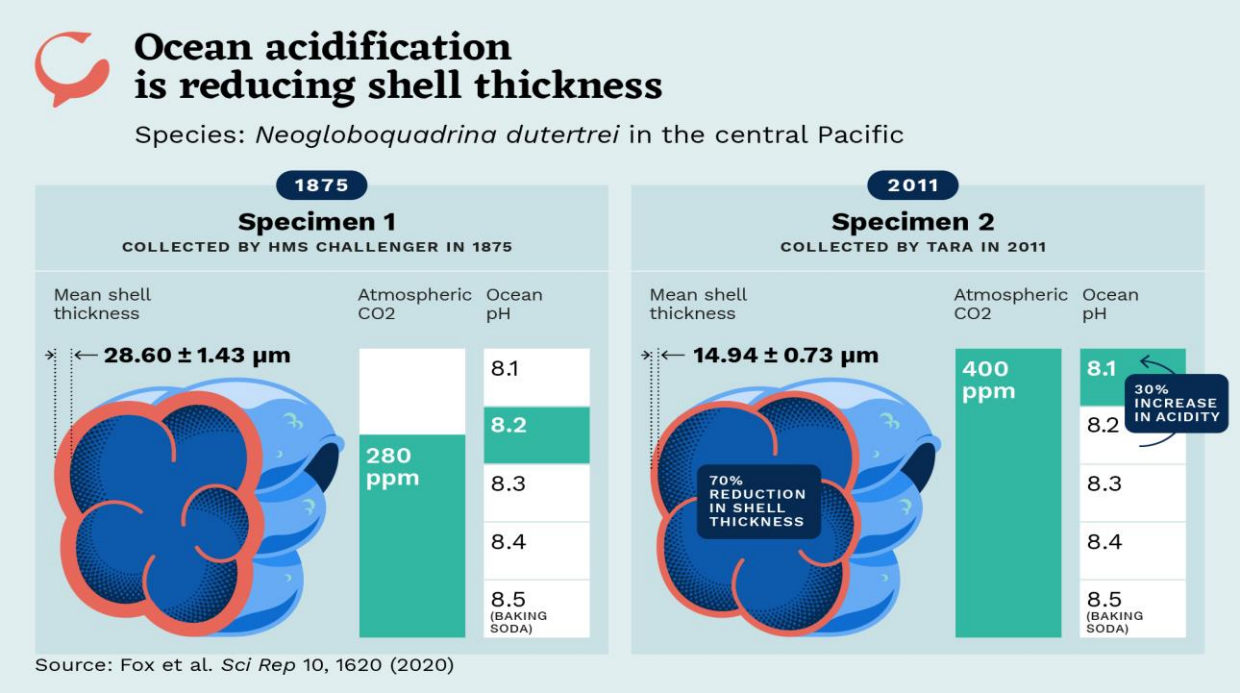
Increased CO_2 and other greenhouse gases from industries, transportation, electricity production, commercial and residential activities, agriculture and deforestation result in climate change and global warming. According to a report published at the International Union for Conservation of Nature (IUCN), World Conservation Congress concluded that oceans have taken up 93% of the warming created by humans since the 1970s. In that perspective, if the heat generated between 1955 and 2010 had gone into the Earth's atmosphere instead of the oceans, temperatures would have jumped by nearly 36.2°C (E&ENews PM, 7 September 2016) (As for reference, the last checked Earth's atmosphere was 14°C at 2.00 pm on 27 October 2021).

Climate change is the most significant global threat to marine ecosystems as it changes ocean chemistry. Global climate change is responsible for sea-level rise, sea surface temperature, ocean heating, ocean acidification, coastal flooding, salinity intrusion etc.

All those factors that occur due to climate change have direct and indirect impacts on marine biodiversity, Direct impacts act on physiology and behaviour and alter distribution, composition, growth, reproductive capacity, recruitment and mortality. Indirect impacts mean the effect on the food web and habitat. Ocean heating, regular cyclone formation and other disaster destroy the feeding, breeding and nursery ground for fishes and other commercially important species.



The warming of ocean water affects water quality parameters such as dissolved O_2, dissolved CO_2, salinity tolerance level, pH level, and sea surface temperature, causing physiological and behavioural changes in fishes. Most fish species have a relatively narrow range of optimum temperatures needed for their primary metabolism and the survival of their food supply. Fishes are poikilothermic animals; even a difference of 1°C temperature or 0.1 unit pH in seawater may affect their physiology, abundance and distribution. More mobile species should adjust their ranges over time, while less mobile and sedentary species may not. Depending on the species, the habitat area it occupies may expand, shrink or be relocated. As a result, the distribution of marine fish will increase in some areas, a decline in others, or shift altogether. These are opposed to everyday natural phenomena. The following figure represents the method of affecting climate change into the ocean.

Some clear examples how climate change mainly affects marine biodiversity are given bellow:

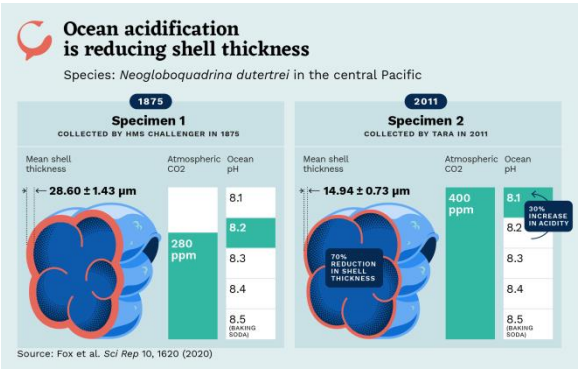
Climate change is responsible for global warming and increases sea surface temperature. The temperature reduces the dissolved oxygen level in the water. When a species does not get enough oxygen, it will suffocate and adapt to low oxygen levels by changing behavioural activities or migrating or dying. In adaptation, if the temperature is lower than the optimum level, fishes stopped/reduced feeding and growth rate hampered. If the temperature is higher than the average level, it affects sexual behaviour and growth rate. Physiological changes, behavioural changes, migration, or death are all signs of a species' extinction in a habitat. As a result of climate change, many commercially important species will become extinct in the long run.

Besides, if we consider the pH level of water, CO_2 absorption reduces the pH level in the water. In consequence, ocean acidification occurs. An acidic ocean is responsible for low primary production (Phytoplankton) that finally affects the food chain's

secondary, tertiary, and quaternary layers. Acidic water increases ocean salinity, which impacts biodiversity by disrupting the habitat's standard parameters.

Our primary concern is the Bay of Bengal. Generally, when we talk about marine biodiversity, it mainly indicates fish. Bangladesh catches 7 lakh MT/yr fishes from the Bay of Bengal, whereas the possible exploration rate is 80 lakh MT/yr. About 4,000 crores Tk/yr comes from the country's fish export sectors. These export fishes have mainly come from the marine fisheries. The marine waters of Bangladesh are home to about 475 fish species, 36 shrimp species. About 336 species of molluscs, 3 lobsters and 7 species of turtles and tortoises, 168 species of seaweeds, 3 species of sponges, 16 species of crabs, 3 species of lobsters, 10 species of frogs, 3 species of crocodiles, 24 species of snakes, 3 species of otters, 1 species of porcupines, 9 species of dolphins and 3 species of whale found in the territorial water of Bangladesh. Among the marine and migratory animals, 4 species of fishes, 5 species of reptiles, 6 species of birds, and 3 species of mammals are threatened (SPARRSO, ICEAB10, Japan, 2010). A species can become endangered due to various stressors, including climate change, which has severe consequences for marine ecosystems that are high in productivity and support significant fisheries, particularly in developing nations like Bangladesh. Sea surface temperatures (SST) have increased by 0.2-0.3°C along the Indian coast of the Bay of Bengal for the 45 years from 1960 to 2005 (Vivekanandan et al. 2009). They have predicted an increase of 2.0-3.5°C by the end of the century. Sea level rise is mainly caused by thermal expansion, and researchers have noted an accelerating rate of increase at 12-13 mm/decade in the northern Indian Ocean (Unnikrishnan and Shankar, 2007).

Mariners once feared the Bay of Bengal because of its man-eating sharks and other tops of the food chain predators like grouper, croaker and rays. Catches now consist mainly of species like sardine, herrings, anchovy, mackerel, whiting, sprat, hilsa ete which are at the bottom of the food chain. The balance from top to bottom of the food chain has been disrupted and many species have been lost. Experts believe that these types of consequences mainly occur due to the extreme direct impact of climate change.



The coral reef is also under serious threat. A heated ocean causes thermal stress that contributes to coral bleaching and pathogenic infections. The heated ocean creates cyclones and other storms frequently and that disrupts the coral habitat. Besides, ocean acidification decreases coral growth and structural integrity, Due to ocean acidification, shellfish and other sea creatures are at high risk of using calcium carbonate minerals to form their shells. More acidic water can store less calcium, making it unavailable to calcifying animals like oysters, clams, sea urchins, shallow water corals, deep-sea corals, and calcareous plankton.

It is essential to balance the diversity depending on their functional activities rather than the species or genetic diversity within a community or ecosystem. An example of functional diversity is the number of planktonic feeders compared to the number of predators. Functional diversity is thought to be one of the main factors determining the long term stability of an ecosystem and its ability to recover from significant disturbance. Climate change destroys the balance of ecosystem components through biodiversity loss.

Climate change is a global problem and requires a global solution. Climate adaptation resilience is one of the topmost options to avoid its reaction to marine life for every victim. To avoid the loss of marine biodiversity and adopt climate change vulnerabilities, the following measures may play a vital role:

> Enhanced ecosystem resilience

> Secure breeding and nursing ground

> Brood collection of endangered species for artificial breeding

> Enhance genetic diversity

> Reduce megafauna catch

> Chain MPA declaration and proper management technique development

> Slowing down fishing pressure and regional pollution rate

> Avoid destructive fishing gear

> Proper implementation of the fishing ban period

> Effective implementation of existing fishing rules and regulations

Sea is an open water body. Single-handed management may bring immediate results, but it will never sustain. A regional approach is needed for possible adaptation.

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