Ayantika Banerjee et al., Hydrol Current Res 2014, 5:4
http://dx.doi.org/10.4172/2157-7587.S1.014

OMICS Group Conferences
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3rd International Conference on
Hydrology & Meteorology
September 15-16, 2014 Hyderabad International Convention Centre, India

Ecological, physiological and biochemical effects of climate change and ocean acidification on coral reefs in tropics

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Over the last twenty years, human-induced climate change and global warming have become areas of growing concern for scientists, environmentalists, and public policy makers. It is becoming increasingly clear that coral reefs are among those environments most threatened by climate change. These "tropical rain forests of the ocean", are estimated to provide benefits worth approximately US$ 30 billion in goods and services on an annual basis, including income from and resources for tourism, fishing, building materials and coastal protection. Although reefs cover only 0.2 per cent of the world's ocean, they contain about 25 per cent of marine species and are renowned for their biological diversity and high productivity. Almost 50% of all the anthropogenic CO_2 emitted over the last 250 years has been taken up by the world's oceans. Increasing concentrations of CO_2 lower the pH of seawater (ocean acidification) with a coincident decrease in the concentration of carbonate ions. This reduces the capacity of corals and other calcifying organisms to make calcium carbonate skeletons. Ocean acidification also may increase the susceptibility of corals to bleaching during thermal stress. Bleaching and mortality become progressively worse as thermal anomalies intensify and lengthen. Calcification of coral reefs appears to be highly sensitive to the concentration of carbonate ions. Doubling the partial pressure of CO_2 above seawater leads to decrease in calcification of 9–59% for reef-building corals. Water temperatures over the past century have risen on coral reefs in all global regions. The largest increases have been in the Indian Ocean, symbolized by the massive coral bleaching there in 1998. Bleaching is the loss of algal symbionts and a reduction in the coral's energy producing systems; severe stress often results in coral mortality or reduces reproduction and their ability to stave off infectious disease. Three general types of high temperature bleaching are defined: Physiological bleaching, algal stress bleaching and animal stress bleaching. Increased ocean temperature will also affect the physiological performance and behaviour of coral reef fishes, especially during their early life history. Climate change will impact coral-reef fishes through effects on individual performance, trophic linkages, recruitment dynamics, population connectivity and other ecosystem processes. An immediate global response to reduce anthropogenic drivers of climate change is imperative to ensure the survival of these invaluable and diverse ecosystems.

Biography

Ayantika Banerjee has completed her BSc (Hons.) in Environmental science from University of Kalyani. Currently, she is a final year MSc student in Department of Environmental Science, Asutosh College, Kolkata, India. She has research interest in ecotoxicology, environmental chemistry and water pollution.

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