Climate Change Impact

Coral reefs under threat

CORAL reefs are the largest structures created by any group of animals in the world. They have existed on earth for over 240 million years. Reefs are ecologically important ecosystems and have a high biodiversity. They are a source of food and medicine, and they protect the coast from wave erosion. Coral reefs are home to over 25 percent of all marine life and are among the world's most fragile and endangered ecosystems. Coral reef is a mound-like structure built by tiny animal corals, mainly composed of calcium carbonate. There are two types of coral, hard and soft. The actual architects of coral reef are hard corals, which are referred to as reef-building corals. Corals are sessile animals, meaning they are not mobile but stay fixed to one place. Soft corals do not build reef.

Hard corals are colonial organisms composed of hundreds of thousands of individuals. An individual coral animal is known as polyp or coral polyp. A polyp generally ranges in size from tiny (no bigger than a pinhead) up to a foot in diameter. Growth of these reef structures varies greatly, depending on the species of coral and environmental conditions -- growing on average a half inch (1.3 centimeters) a year. It is estimated that 800 different hard coral species are involved in building reefs. Corals can form a reef in a wide range of shapes that can stretch for tens or even hundreds of miles.

Reef-building coral lives a symbiotic life. Inside the sac of each coral polyp lives microscopic one-celled algae called zooxanthellae. Through photosynthesis the algae gives off oxygen and other nutrients that the coral polyp needs to live and in return the polyp gives the algae carbon dioxide and other substances that algae needs. Another byproduct of the symbiotic relationship with zooxanthellae is colour. Generally, their brilliant colour comes from the zooxanthellae living inside their tissue. Although hard corals have a wide distribution in the world's oceans, the varieties that form reefs are typically restricted to relatively shallow, warm tropical waters between latitudes 30o north and 30o south. Reefs grow best in warm(optimum water temperature

Worldwide, about 500 million people have some level of dependence upon coral reefs. Besides, coral reefs support millions of species and are the sources of food, rich genetic resources, medicine and many more. Healthy coral reefs mean a healthy world.

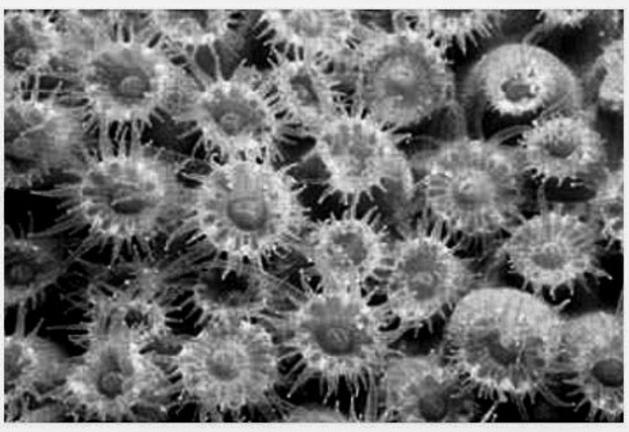
25°C-29°C), shallow (maximum depth of about 70 meters.), clear, sunny, and agitated waters. The best salinity is between 34 and 37 parts per 1000. The coral cannot grow in polluted water.

Based on current estimates, shallow water coral reefs occupy approximately 284,430 square kilometers (110,000 square miles), and are found in the waters of 109 countries. Based upon geographic distribution, 60% of the world's reefs are found in the Indian Ocean and Red Sea, 25% are located in the Pacific Ocean, and 15% in the Caribbean.

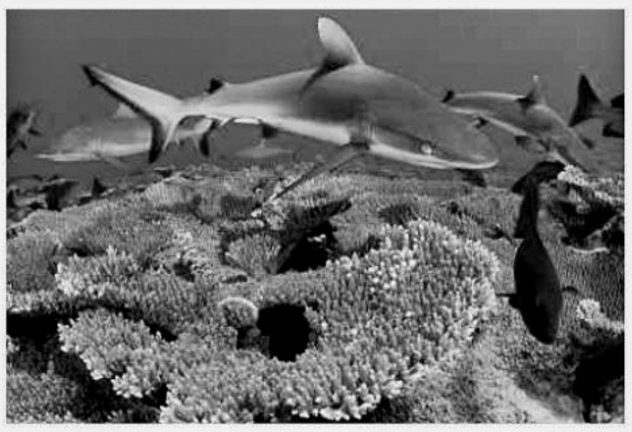
The geological record indicates that ancestors of modern coral reef ecosystems were formed at least 240 million years ago. The coral reefs existing today began growing as early as 50 million years before. A coral reef is like a metropolis under the sea. The Great Barrier Reef off the north-east coast of Australia is the largest coral reef and is considered to be one of the seven Natural Wonders of the world. It is over 2000 km long and 150 km wide. The Great Barrier Reef is not in fact one single reef, but a system of about 3000 individual coral reefs.

Coral Triangle region known for its biodiversity, evidenced by the multitude of organisms in this small section of House Reef in the Philippines. PHOTO: DAVE BURDICK

In 2007, Acropora corals in the Tumon Bay Marine Preserve in Guam bleached due to higher water temperatures caused by global climate change. PHOTO: DAVE BURDICK



Coral polyps form a living mat over a calcium carbonate skeleton. PHOTO: SCHMAHL/FGBNMS



Coral reef habitat. PHOTO: BRIAN J. SKERRY

Importance of coral

Coral reefs play an important role in terms of biodiversity, coastal protection, fisheries, medicine, tourism and recreation etc.

Biodiversity: Coral reefs act as homes and nurseries for 25% of marine life. Although reefs cover only 0.2 per cent of the world's ocean floor, these provide habitat for 250,000 known species, including more than 4,000 fish and about 800 species of hard coral. Over 25 percent of the world's fish biodiversity and between 9 and 12 percent of the world's total fisheries are associated with coral reefs. Many species have yet to be discovered. Scientists believe that one to nine million species are associated with coral reefs.

Coastal protection: Coral reefs buffer shorelines from currents, waves, and storms, helping to prevent loss of life, property damage, and erosion. In Florida, the absence of coral reefs would cause parts of the state to be submerged.

Fisheries: Fisheries related to coral ecosystems range from subsistence fishing, commercial fisheries, aquaculture, food industry, recreational fishing, the aquarium/marine ornamental trade, and the curio and fashion industries. The fish that grow and live on coral reefs are a significant food source for over a billion people worldwide.

Medicine: Coral reefs and creatures found in coral ecosystems are important sources of medicines. Coral reefs have been used in the treatment of cancer, HIV, cardiovascular diseases, ulcers. Coral's porous limestone skeletons have been used for human bone grafts. The medicines and other potentially useful compounds identified to date have led to coral ecosystems being referred to as the medicine cabinets of the 21st century by some, and the list of approved and potential new drugs is ever growing.

Tourism and recreation: Healthy coral ecosystems support local businesses and economies, as well as provide jobs through tourism and recreation. Coral reef attracts millions of tourists, scuba divers and snorkelers every year. Local economies receive billions of dollars from these visitors through diving tours, recreational fishing trips, hotels, restaurants, and other businesses based near reef ecosystems.

According to the WMO/CBD, coral reefs, referred to as the 'tropical rainforests of the ocean' are facing unprecedented threats because of climate change, including damage from increasingly severe tropical cyclones, bleaching events and ocean acidification. About 20 percent of the original area of coral reefs has been lost, with a further 25 percent threatened in the next century.

Climate change threats

Climate change impacts have been identified as one of the greatest global threats to coral reef ecosystems. Increasing concentrations of carbon dioxide (CO_2) leads to "double trouble" for coral reefs. First, the trapping of heat in the atmosphere leads to ocean warming, which can cause extensive coral bleaching events and mass mortalities. A slight rise in maximum water temperatures -- only 1 to 2 degrees -- can stress the corals. The global devastation of coral reefs from record warming of the sea surface in 1997/98 was the first example of what is likely to occur in the future under a warming climate.

Second, high CO_2 levels lead to ocean acidification. Ocean acidification refers to the reduction in ocean pH as CO_2 is taken up by the ocean surface. An even more critical factor, however, is that a drop in pH leads to a loss of carbonate ions, which are required for corals, to build their skeletons.

The warmer water associated with more nutrients (human or animal wastes and fertilizers that runoff into the ocean can increase nitrogen levels) also encourage the growth of harmful algae on top of the coral, which kills it, because it blocks out the sun. Without the sun, the zooxanthellae cannot perform photosynthesis and so they die. Without the zooxanthellae, the coral polyps cannot survive.

With temperature rise, mass bleaching, and infectious disease outbreaks are likely to become more frequent. The frequency of coral diseases appears to have increased significantly over the last 10 years, causing widespread mortality among reef-building corals. Many scientists believe the increase is related to deteriorating water quality associated with anthropogenic pollutants and increased sea surface temperatures.

A report's lead author Professor Ove Hoegh-Guldberg, an expert on coral bleaching at Sydney University, states that coral reefs could be eliminated from most areas of the world by 2100; even the world's largest, the Great Barrier Reef, could be dead within 30 years unless measures are taken now to slow climate change.

Moreover, anthropogenic activities are also major threats to coral reefs. Pollution, over-fishing, destructive fishing practices using dynamite or cyanide, collecting live corals for the aquarium market, coastal development, tourism and mining coral for building materials or jewelry, oil spill are some of the many ways that people damage reefs all around the world every day. Researches say that, taking into consideration the present condition, if the rate of destruction continues, almost 70% of the world's coral reef will be destroyed by the year 2050.

Worldwide, about 500 million people have some level of dependence upon coral reefs. Besides, coral reefs support millions of species and are the sources of food, rich genetic resources, medicine and many more.

Healthy coral reefs mean a healthy world. The Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) says that "An immediate global response to reduce anthropogenic drivers of climate change is imperative to ensure the survival of these invaluable and diverse ecosystems,"

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Arsenic -- a silent killer

AHAMMADUL KABIR (PH. D.) AND FARHANA RAHMAN

ARSENIC in ground water was detected in Bangladesh more than a decade ago when the country had just achieved more than 95% coverage in supplying safe drinking water in the rural areas and making available irrigation water for the high yielding variety crops. More or less that was a win-win situation for drinking and irrigation water in the rural areas. But this achievement was outshined after the detection of arsenic in the ground water. Basically arsenic is a natural water contaminant originated from naturally occurring sulfide ores. It has a geological origin. The main source are the arsenic containing rocks from the Himalayas which were taken out by torrents of water and washed down by the rivers to the low lying areas of Bangladesh and West Bengal. These had been getting deposited together with sand, silt and clay for thousands of years forming a part of aquifers that have been releasing the poison today. Arsenic is a hazardous material and recent studies showed that it is a carcinogen, reportedly responsible for lung and skin cancers.

Considering the adverse impact of arsenic an human health, the government in late 90s conducted a nationwide tube well screening and patient identification programme. It was found from the study that around 29% of the tube wells in 271 upazilas had high level of arsenic contamination (over the Bangladesh standard 0.05 mg/l). The DG Health mentioned in 2008 that there were around 24389 patients in the country which increased to 38320 in 2009 indicating that the number of patients was increasing. Potential threat of arsenic contamination of food grains was also observed in recent days. High level of arsenic was found in rice by many researches when irrigated with arsenic contaminated water. Still now the country is failing to decide a standard of arsenic in food crops.

There are two important notations in the MDG about the drinking water supply all over the world namely "safe water" and "coverage". The countrywide situation of safe water and coverage is frustrating. The surface and ground water source is chemically and microbiologically contaminated. Availability of underground and surface water has decreased abruptly especially in dry season due to inadequate recharge of the aquifers and un-fashioned rainfall in rainy season due to climatic impact. Water, the most important determinant of health and socioeconomic development, should be safe wholesome and the provision of safe drinking water is one of the prior conditions for overall social development of any country. But now presence of arsenic in the groundwater has appeared to be a serious public health problem in rural Bangladesh. NGO Forum being an apex service delivery networking organization has undertaken some measures to combat the problem by establishing an independent working set-up, Arsenic Cell. Recently it initiated an arsenic mitigation program named as "Integrated Community Based Arsenic Mitigation Project, Bangladesh" with the financial assistance from European Union and MISEREOR to address the problem for 2010-2012 with a number of activities like community mobilization, sensitization and collaboration,

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capacity building, health campaign and patient management, interest free loan to poor arsenicosis patient, alternative safe water options, research studies, advocacy activities, etc. The project has been working in 133 most affected villages under 61 unions of 35 upazilas of 22 districts targeting 95,000 direct beneficiaries.

A baseline survey was conducted under the project by considering a total number of 2111 respondents and 1818 tube wells. The survey findings indicated that present level of tube well contamination is 68% irrespective of new, old or time of instillation but respective of the depth of the tube well. The reason behind that is, almost 51% of the tube wells in the survey villages were installed after the last nation wide tube well screening program. The survey findings also indicated, in these 133 emergency villages 18.6% of households have arsenicosis patients. This result necessitates a further nationwide tube well screening for arsenic and patient identification. The qualitative analysis (FGDs) indicated a common discrimination that the regular income has been reducing among the arsenicosis patients day by day and unemployment rate has been increasing. The survey findings also indicated that 74.5% respondents had been using the water from shallow tube well followed by 19.8% from deep tube well, for drinking and cooking purposes. But it is very interesting that among these respondents 18% have been still using the arsenic contaminated water for drinking and cooking purposes. Among those who were drinking arsenic contaminated water 56% was doing that because they have no alternative sources of arsenic free water and 25.30% was doing that because the safe water option is far from their houses more interesting is that 15.80% people have been drinking arsenic contaminated water, because they were not facing any problems which is an indication of lack of awareness.

Constructive criticisms, sustainable activities and integrated programmes are needed to strengthen the arsenic mitigation policy and implementation plans. Basically arsenic mitigation requires a sequence of practical steps involving enquiry and associated action and considering the findings of the baseline some short time and long time interventions are suggested for future intervention. The suggested long-term interventions are institutional development for water quality testing and arsenicosis patient management, installation of arsenic free safe water source including village pipeline water supply system to address large community of people, strengthening the public private partnership for sustainability of different interventions and institutional development for ensuring arsenic free safe food side by side the drinking water. The short-term interventions will include a nationwide survey for status of overall situation of arsenic contamination and patient number and status in the country, strong political commitment for comprehensive arsenic mitigation programme, dissemination of actual appropriate information to the community people in the arsenic contaminated area for avoiding disharmony within the societies, advocacy activities for addressing the problem and more social, applied and scientific research to mitigate this problem.

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Affected hands.

Affected foot.

A restricted tubewell in affected area.