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The question of the impacts of climate change on coral reefs and the marine environment



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Introduction

Climate change affects ocean temperatures, ocean chemistry and food chains, and has already done irreversible damage to the marine environment. For example, ocean acidification will be irreversible in this century. The ocean hosts more than 75 per cent of all known species and is the most productive habitat. Coral reefs, which make up approximately 0.5 per cent of the ocean floor, are complicated 3D structures constructed over thousands of years as a result of the deposition of the calcium carbonate skeletons of reef-building coral species. Coral reefs are often termed "rainforest of the sea". In actual fact, coral reefs have greater biodiversity than rainforests. They play an important role in circulating nutrients through the intricate food web and provide food at all levels of the food chain. The sea is of great economic importance, providing fisheries, tourism and raw materials. It is therefore of paramount importance that the impacts of climate change that are particularly harmful to this unique marine environment are limited.

Definition of Key Terms

Climate change

A change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.

Global warming

A gradual increase in the overall temperature of the earth's atmosphere generally attributed to the greenhouse effect caused by increased levels of carbon dioxide and other pollutants.

Coral bleaching

Coral bleaching is the whitening of corals, due to stress-induced expulsion or death of their symbiotic protozoa, zooxanthellae, or the loss of pigmentation within the protozoa

Ocean acidification



Ocean Acidification (OA) is a term used to describe significant changes to the chemistry of the ocean. It occurs when carbon dioxide gas (or CO₂) is absorbed by the ocean and reacts with seawater to produce acid

Marine-protected areas (MPAs)

Marine protected areas (MPA) are protected areas of seas, oceans or large lakes. MPAs restrict human activity for a conservation purpose, typically to protect natural or cultural resources

Ocean dead zones

Dead zones are hypoxic (low-oxygen) areas in the world's oceans and large lakes formed when the depletion of the oxygen required to support most marine life in bottom and near-bottom water occurs

General Overview

Temperature

The Intergovernmental Panel on Climate Change (IPCC) predicts that the sea surface temperature will rise by 1 to 3 degrees Celsius by 2100. Temperature change will result in altered lifestyles and locations of marine species. Marine plants will gradually decrease in quantity in warmer waters, reducing the amount of nutrients further up the food chain. Marine organisms will migrate depending on their tolerance of higher temperatures, leading to the extinction of species unable to migrate. In addition, for many species, temperature is a cue for reproduction, so changing temperatures will affect breeding, worsening this problem. Coral reefs will be worst affected by increases in sea surface temperature, resulting in coral bleaching, leading to the death of corals that are unable to recover. Coral mortality has reached 70% in some regions. It is now estimated that one third of coral species are facing extinction, with the most serious decline being in the Caribbean. Temperature change will also result in decreased vertical mixing in some areas. This disturbs the transportation of nutrients from deep to shallow waters, and surface water rich in oxygen into deeper waters. This can result in a reduction of oxygen levels at depth, creating ocean dead zones.

Sea-level rise

The IPCC further predicts that sea level will rise by 0.18 to 0.79 metres by 2100. Rising sea levels will reduce the amount of light reaching offshore plants and algae reducing the rate of photosynthesis, upsetting entire food chains. Coastal habitats will also be flooded, damaging fragile aquatic ecosystems. Rapid sea level rise will be most damaging to mangrove ecosystems whose long-term survival depends on stable sea level.

Ocean acidification

The increase in carbon dioxide in the atmosphere due to human activities results in increased carbon dioxide absorption of the oceans, reducing their pH over time. Since pre-industrial times, the pH of the oceans has dropped from an average of 8.2 to 8.1 today. Projections of climate change estimate that by the year 2100, this will drop to around 7.8. Ocean acidification will decrease calcification, having a detrimental impact on corals, shellfish, crabs and lobsters who will find it more difficult to build their calcium carbonate



shells (which may even start to dissolve in some areas). It will further make it more difficult for organisms to extract oxygen as the water becomes more acidic, affecting fish, squid and other gilled marine animals. It will make changes to the amount of phytoplankton, upsetting food chains. The fragile ecosystems of the polar regions, including the Arctic Ocean and the Arctic Ice Cap, are particularly affected by the projected adverse effects of ocean acidification.

Storm Events

Climate change will also result in an increase in the frequency and severity of storm events, such as cyclones. Stormy weather will do huge damage to coral and coastal ecosystems. For example, the Hurricane Hugo (1989) and Hurricane Marilyn (1995) did huge damage to coral ecosystems in the US Virgin Islands National park.

Major Parties Involved and Their Views

Intergovernmental Panel on Climate Change (IPCC)

The leading international body for the assessment of climate change. It was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) in 1988 to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socioeconomic impacts. □

UN Framework Convention on Climate Change (UNFCCC)

Main intergovernmental negotiation forum of the States Parties to the FCCC and its Kyoto Protocol (international agreement linked to the United Nations Framework Convention on Climate Change, which commits its Parties by setting internationally binding emission reduction targets). The Conference of States Parties (COP) meets once a year to determine international climate policy under the FCCC and the Kyoto Protocol, as well as a successor agreement to the Kyoto Protocol. □

Green Climate Fund

An entity within the financial mechanism of the UN Framework Convention on Climate Change. Its purpose is to catalyse and channel financial resources to developing countries to enable the implementation of climate change mitigation and adaptation measures. □

United Nations Environment Programme (UNEP)

The voice for the environment within the United Nations system, established on 1972. UNEP acts as a catalyst, advocate, educator and facilitator to promote the wise use and sustainable development of the global environment. □

The Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA)

This is the only global intergovernmental mechanism directly addressing the connectivity between terrestrial, freshwater, coastal and marine ecosystems

The Coral Reef Unit (CRU)



CRU was established by the UNEP Executive Director in 2000 to coordinate UNEP's work on coral reefs

Indonesia and the Philippines

Indonesia and the Philippines hold 77% of Southeast Asia's coral reefs and nearly 80% of threatened reefs, and are therefore strongly affected by this issue.

Australia

The Great Barrier Reef is the world's largest collection of coral reefs. It's absence from the World Heritage in Danger List is evidence of Australia's continued commitment to its protection. Australia will have to continue making a big effort to give the Great Barrier Reef its best chance of adapting to and recovering from the threats ahead, including the impacts of a changing climate

Belize

The Belize Barrier Reef Reserve System is the second largest reef system in the world and is currently on the United Nations Educational, Scientific and Cultural Organisation's (UNESCO) World Heritage in Danger List. Belize has been taking action to protect the value of its coral reefs.

Small Island Developing States (SIDs)

These are uniquely vulnerable to the effects of climate change on coral reefs and marine environments, as communities depend on coral reef ecosystems for a range of services.

Timeline of Events

Date	Description of event
1972	UNESCO World Heritage Convention
1979	The first World Climate Conference takes place
1988	The Intergovernmental Panel on Climate Change (IPCC) is set up
1994	The UN Framework Convention on Climate Change (UNFCCC) enters into force
1997	The Kyoto Protocol is formally adopted in December at COP3. The Protocol legally binds developed countries to emission reduction targets.
2002	World Summit on Sustainable Development
2007	The IPCC's Fourth Assessment Report is released. Climate science entered into popular consciousness.
2012	Rio+20 Earth Summit
2014	Resolution 69/220 - Protection of global climate for present and future generations of humankind
2015	UN Climate Change conference in Paris (COP21)



Resolution 70/235 – Oceans and the Law of the Sea

Resolution 70/472 - United Nations Conference to Support the Implementation of Sustainable Development Goal 14: Conserve and Sustainably Use the Oceans, Seas and Marine Resources for Sustainable Development

UN Involvement, Relevant Resolutions, Treaties and Events

- Oceans and the Law of the Sea, 23 December 2015 (**A/RES/70/235**)
- Protection of global climate for present and future generations of humankind, 19 December 2014 (**A/RES/69/220**)
- United Nations Conference to Support the Implementation of Sustainable Development Goal 14: Conserve and Sustainably Use the Oceans, Seas and Marine Resources for Sustainable Development, 22 December 2015 (**A/70/472/Add.8**)
- Rio+20 Earth Summit 2012 - “The Future We Want”, the outcome document of the United Nations Conference on Sustainable Development (UNCSD) held in Rio de Janeiro, 2012
- The Johannesburg Declaration adopted at the World Summit on Sustainable Development (WSSD) held in Johannesburg, South Africa, 2002
- Adoption of “Agenda 21” by the United Nations Conference on Environment and Development (UNCED), Earth Summit 1992
- UNESCO World Heritage Convention, 16 November 1972

Evaluation of Previous Attempts to Resolve the Issue

The General Assembly of the United Nations has recognised that “adaptation to climate change represents an immediate and urgent global priority”. The General Assembly has further recognised the impact of climate change on coral reefs specifically, noting that “climate change continues to increase the severity and incidence of coral bleaching throughout tropical seas and weakens the ability of reefs to withstand ocean acidification, which could have serious and irreversible negative effects on marine organisms, particularly corals, as well as to withstand other pressures, including overfishing and pollution”.

It has committed itself to considering “further opportunities to actively involve Governments, civil society, the private sector, the United Nations system and other actors in



driving progress and supporting the implementation of Sustainable Development Goal 14” to conserve and sustainably use the oceans, seas and marine sources. These targets include responding to the impact of climate change on our seas and oceans, for example, through targets that aim to “minimise and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels” and to “sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans”. The General Assembly has further called for support for “initiatives that address ocean acidification and the impacts of climate change on marine and coastal ecosystems and resources” and has therefore strongly encouraged collective work to prevent further ocean acidification, increase the resilience of marine environments and especially supported “marine scientific research, monitoring and observation of ocean acidification and particularly vulnerable ecosystems, including through enhanced international cooperation in this regard”.

The international community has made efforts to mitigate climate change on a global scale. Most recently, at the Paris climate conference (COP21) in December 2015, 195 countries adopted the first-ever universal, legally binding global climate deal. The agreement sets out a global action plan to put the world on track to avoid dangerous climate change by limiting global warming to well below 2°C. This will go into force in 2020. The importance of raising awareness of the impact of climate change on the marine environment, marine biodiversity and sea level was recognised.

Recognition of the gravity of the issue has been met with calls for international collaboration and scientific research to move forward with climate change adaptation and mitigation, as well as more specific action to combat the detrimental impact of climate change on the marine environment, for example, through ocean acidification.

Possible Solutions

An important step in tackling the problem is collaboration. In order for marine scientists to transfer their research into practical solutions, governments, organisations, impacted communities and scientists must collaborate on a wider scale so that policies can be implemented to tackle the issue that take into account scientific knowledge and the needs of local communities. Research conducted by the scientific community has provided innovative ways to protect coral reefs and the marine environment. For example, research has indicated that algae have been outcompeting corals for space. Maintaining a healthy population of parrotfish could help prevent this from occurring.

A key solution for the negative impacts of climate change on coral reefs and the marine environment is adaption. This includes activities such as reef restoration and the establishment of marine protected areas (MPAs). MPAs are particularly useful as they provide a safe zone for marine organisms to grow and replenish the surrounding marine environment. Similarly, some remote oceanic reefs have been declared World Heritage Sites such as Australia’s Great Barrier Reef. This ensures that they are treated as matters of national environmental significance so that governments adopt and enforce national legislation which implements their obligations set by the World Heritage Convention.

Another solution to limit the impact of climate change on the marine environment is to reduce other stressors. Addressing land-based pollution and overfishing will enhance the ability of marine ecosystems to adapt to climate change. This is because with reduced



anthropogenic stressors, the marine environment will likely become more resilient to the impacts of climate change.

When searching for solutions to this issue, it is important that delegates are mindful of the priorities of developing countries with limited financial means, such as Small Island Developing States (SIDs), where adaptation strategies must be integrated into broader development efforts.

Delegates should be guided by the United Nations Sustainable Development Goals 13 and 14.

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<http://www.un.org/sustainabledevelopment/oceans/>

Appendix or Appendices

Links to particularly useful UN resolutions:

<https://documents-dds-ny.un.org/doc/UNDOC/GEN/N15/456/94/PDF/N1545694.pdf?OpenElement>

http://www.un.org/ga/search/view_doc.asp?symbol=A/70/472/Add.9

http://www.un.org/en/ga/search/view_doc.asp?symbol=A/RES/69/220



