Reducing Ocean Acidification and Mitigating its Effects

Intergovernmental Panel on Climate Change

I. Introduction

"The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change." IPPC was "created in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP)" with the objective of providing "governments at all levels with scientific information that they can use to develop climate policies." For this cause, the panel goes through "regular assessments of the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigation", which are reports that are also "a key input into international climate change negotiations" ("About the IPCC").

The ocean naturally absorbs a significant amount of carbon dioxide emissions, but as the world's population continues to grow, more and more factors contribute to increasing the release of harmful gases in the atmosphere. As a consequence, this is also "changing the chemistry of the ocean at an unprecedented rate," as the acidity of the gas changes the pH balance of ocean water. To be exact, *The Ocean Foundation* argues: "About one-third of all emissions in the past 200 years have been absorbed by the ocean, causing an average pH decrease of ocean surface waters by about 0.1 unit - from 8.2 to 8.1. This change has already caused short-term, local impacts on ocean flora and fauna. The ultimate, long-term consequences of an increasingly acidic ocean may be unknown, but the potential risks are high" The organization also adds that "it is estimated that by the end of the century, there will be an additional drop of 0.2-0.3 units" ("Ocean Acidification").

Ocean acidification is controversially one of the most serious threats facing the oceans and living organisms in this modern world. Many claims that: "Ocean acidification is not a symptom of climate change; rather, it is a threat concurrent with climate change and caused by a common root problem: ongoing anthropogenic CO2 emissions. It is a serious global challenge of unprecedented scale and importance that requires immediate action" (Herr, and Harrould-Kolieb). Small changes in the pH scale lead to grave consequences in the natural environment, especially in aquatic life. In order to prevent further acidification of the oceans, the level of CO2 in the atmosphere has to be reduced and stabilized. This is most effectively done by reducing CO2 emissions.

II. History and Description of the Issue

Vocabulary

To understand the causes and effects of ocean acidification, some key concepts must be defined. Scientists have studied ocean pH for over 30 years, and it was up until 2003 when the alarming change got noticed. The term "ocean acidification" was first coined to describe this

complex process involving the whole carbon cycle of nature as a consequence of human actions. Two investigators state: "Ever since the Industrial Revolution, more than 1.6 trillion tonnes of CO2 have been emitted into the atmosphere. This huge influx of carbon dioxide is drastically changing the chemistry and pH of the oceans, making them more acidic. The average global oceanic pH has already fallen roughly 0.1 units, representing an approximate 30 percent increase in acidity since the 1750s" (Herr, and Harrould-Kolieb).

Origins and Causes

"For more than 200 years, or since the Industrial Revolution, the concentration of carbon dioxide (CO2) in the atmosphere has increased due to the burning of fossil fuels and land-use change. The ocean absorbs about 30 percent of the CO2 that is released in the atmosphere, and as levels of atmospheric CO2 increase, so do the levels in the ocean. When CO2 is absorbed by seawater, a series of chemical reactions occur resulting in the increased concentration of hydrogen ions. This increase causes seawater to become more acidic and causes carbonate ions to be relatively less abundant" (NOAA).

There are natural and human sources of carbon dioxide emissions. "Natural sources include decomposition, ocean release and respiration." On the other hand, "human sources come from activities like cement production, deforestation as well as the burning of fossil fuels like coal, oil and natural gas." As a result of human activities, the atmospheric concentration of CO2 has been increasing alarmingly ever since the Industrial Revolution and has now reached dangerous levels that were never present ever since the last three million years. Although smaller amounts of carbon dioxide are emitted through human sources than natural processes; the additional contribution has upset the natural balance that had been regulated for thousands of years by nature itself without the influence of humans. *What's Your Impact* claims: "The largest human source of carbon dioxide emissions is from the combustion of fossil fuels. This produces 87% of human carbon dioxide emissions. Burning these fuels releases energy which is most commonly turned into heat, electricity, or power for transportation. Some examples of where they are used are in power plants, cars, planes, and industrial facilities. In 2011, fossil fuel use created 33.2 billion tonnes of carbon dioxide emissions worldwide." CO2 emissions do not only contribute to global warming, but it also affects the pH regulation of ocean waters all around the globe ("Main Sources of Carbon Dioxide Emissions").

Impact

The marine ecosystem basically depends on carbonate ions, which are a crucial building block of structures such as seashells and coral skeletons. As carbonate ions decrease due to higher levels of acidification, it is harder for "calcifying organisms such as oysters, clams, sea urchins, shallow water corals, deep-sea corals, and calcareous plankton" to build and maintain healthy shells and other structures. Recent research published by NOAA also claims: "These changes in ocean chemistry can affect the behavior of non-calcifying organisms as well. Certain fish's ability to detect predators is decreased in more acidic waters. When these organisms are at risk, the entire food web may also be at risk. Ocean acidification is affecting the entire world's oceans, including coastal estuaries and waterways. Many economies are dependent on fish and shellfish and people worldwide rely on food from the ocean as their primary source of protein" (NOAA).

A new study by *Oceana* reveals that "six of the ten biggest CO2 polluters are likely to suffer most from the impacts of ocean acidification by 2050." Japan ranks first, followed by France, the United Kingdom, the Netherlands, and Australia. However, "China and the United States, the world's top-ranked carbon dioxide emitters, ranked 13th and 8th, in relative vulnerability to ocean acidification." The rankings are based on many factors that measure each nation's vulnerability such as "its dependence on coral reefs, the size of its fishery, and its fish and shellfish consumption patterns." In fact, nations at high latitudes of the globe are highly vulnerable as acidification tends to occur much faster in their waters. An important remark made by *Oceana* is that "among the most vulnerable are those with the highest GDP, including the United States, China, Japan, Canada, the United Kingdom and the Republic of Korea." If these nations do not get into immediate action to reduce CO2 emissions, studies predict that there will be a massive extinction of corals around the world by the end of this century. *Oceana* expresses its concerns: "As reefs disappear, many commercially important fish species that depend upon reef services will also be in danger. The world's fisheries are likely to be affected by acidification both directly, through biological and physiological changes, and indirectly, through habitat declines and food shortages. As acidification worsens, many countries will suffer economic and food insecurity, as well as a loss of coastal storm protection and tourism revenue" (Browning).

III. International Response and Bloc Analysis

The majority of the world's richest nations are vulnerable because of their ocean-dependent economies, which also affects the rest of the world. To prevent further damage to coral reefs and other marine life, "scientists suggest we need to stabilize atmospheric CO2 levels at 350 parts per million (ppm) or lower." The richest and most vulnerable nations need to reduce carbon emissions, and to achieve this, "top climate scientists on the Intergovernmental Panel on Climate Change recommend a reduction of global emissions by at least 85 percent below 2000 levels by the year 2050." In easier words, developed nations are responsible for reducing their emissions "from 25 to 40 percent below 1990 levels by 2020, and 80 to 95 percent below 1990 levels by 2050" (Browning).

Oceana provides an example: "the U.S. ranks 8th in vulnerability, and has consistently been ranked the 2nd highest emitter of greenhouse gases behind top emitter China. Both nations have recently signaled their intent to make specific commitments to reduce their own emissions. Many nations will closely observe these two nations' actions at the negotiating table in Copenhagen. This new study evaluated the relative vulnerability of many nations to acidification impacts based on four criteria: the nation's fish and shellfish catch; the nation's per capita seafood consumption; the importance of coral reefs within a nation's exclusive economic zone (EEZ), based on the percentage of EEZ that is coral reef; and the projected level of acidification in each nation's coastal waters by 2050, based on aragonite saturation states."

International and national processes and systems already exist that can be helpful to address the problem of ocean acidification. The United Nations Framework Convention on Climate Change (UNFCCC) is an environmental policy regime to deal with the mitigation of ocean

acidification through CO2 reductions. To be more specific, "it is a suitable forum for devising and providing funding for responses to ocean acidification that can be incorporated into national adaptation plans" (Herr, and Harrould-Kolieb). A lot of action has been taken to raise awareness and inform policy and decision-makers about this environmental issue and its consequences. However, no existing recommendations or policies have been made on how ocean acidification could be handled within the UNFCCC.

IV. Committee Mission

In accordance with the ongoing efforts made by international organizations to raise awareness of ocean acidification, it is the committee's mission to debate on possible and realistic ways to reduce carbon dioxide emissions. Each nation stands with different objectives and needs, however, it is the IPCC's goal to consolidate and unify those differences into one that will allow individuals around the globe to carry responsible actions for the environment.

The purpose of the IPCC is to provide information and encourage governments to make policies that enforce the duty of protecting the natural environment. In this case, delegations representing different nations have to get into an agreement in order to engage and partake in one final goal: reduce ocean acidification and mitigate its effects.

Questions for Further Consideration

1. Which countries are responsible for the highest carbon dioxide emission rates?
2. What causes nations to be economically and environmentally vulnerable due to ocean acidification?
    a. How does ocean acidification affect the economies of developed nations?
3. What are the different ways developed and developing countries can do to reduce their CO2 emissions?
4. What policies can nations agree on to reduce emissions?
5. How can the IPCC committee work with other organizations to deal with ocean acidification?
6. What can individual nations do in response to the damaged marine life?
7. What agreements can be made to mitigate the effects of ocean acidification?
8. What can be done to prevent further damages in relation to climate change and ocean acidification?

V. Annotated links for further research

a) General Country Research

UN Member States
This link provides an overview of each country in the United Nations.

The World Factbook
Provides information of all the nations of the world.

b) Committee Links

Intergovernmental Panel on Climate Change (IPCC)
This is the official website of the IPCC committee.

United Nations Framework Convention on Climate Change (UNFCCC)
This is the official website of the UNFCCC organization.

IPCC Data Distribution Centre
Stores data from IPCC regarding climate.

c) Topic Links

UNESCO - Ocean Acidification
UNESCO's perspective on ocean acidification.

UN - Ocean Acidification
UN'S perspective on ocean acidification and provides events of what international organizations are doing regarding the issue.

UNFCCC - Climate Action Is Needed to Protect World's Oceans
An article about climate change that introduces other problems like ocean acidification. A source that can be quickly read just to understand the basic idea.

Societal Causes of, and Responses to, Ocean Acidification
A paper that analyses how human actions contributed to ocean acidification and what are their responses regarding the effects.

Ocean Acidification and its Effects
Contains a simplified panorama regarding the general topic of ocean acidification.

VI. Works Cited

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