

Forum: Special Conference
Issue: Mitigating the effects of ocean acidification on marine ecosystems
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Introduction

For years, the world's oceans have been able to maintain a stable level of acidity. Nevertheless, research reveals that recently this balance has been at great risk. The pH levels of oceans are constantly declining; in other words, marine ecosystems all around the world are suffering from ocean acidification, which affects marine ecosystems in ways such as but not limited to: disrupting food webs, damaging calcifying organisms, and overall changing the structure and composition of these ecosystems. These changes in marine ecosystems ultimately harm humans too, as ocean acidification affects the goods and services provided to the society. There are several known causes for ocean acidification, the main one being the uptake of carbon dioxide. When carbon dioxide dissolves in seawater, the pH level of water decreases, resulting in more acidic oceans. Since detecting the causes of ocean acidification is uncomplicated, coming up with measures to prevent this issue is also unchallenging. However, the challenging part of solving this issue is to ensure a globally collaborative action in order to make a substantial change.

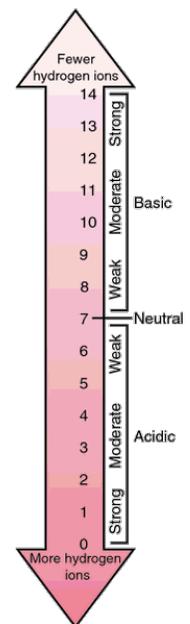
Definition of Key Terms

Ocean Acidification: As oceans absorb carbon dioxide (CO_2) from the atmosphere, their pH levels decrease. This reduction in the oceans' pH levels is called "ocean acidification".

pH: A measure that determines whether a solution is acidic or basic. A pH level less than 7 indicates that the solution is acidic, and a pH level more than 7 indicates that the solution is basic. A pH level of 7 indicates neutrality.

Acid: Acids are substances that can give up hydrogen ions (H^+). They have pH levels less than 7. As acids' pH levels get closer to 0, they become stronger.

Calcification: A process of hardening a tissue in the body by depositing calcium salts. Many marine organisms calcify using calcite in order to produce shells and repair them.



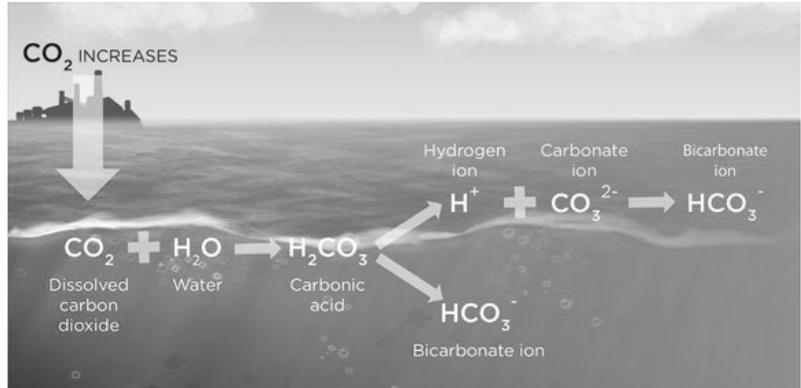
Picture 1: pH scale

General Overview

Causes of Ocean Acidification

Ocean acidification is known to be equally detrimental to climate change. However many people are not aware of this issue, since it mostly affects marine ecosystems rather than people directly. Since the beginning of the industrial revolution, as people started to burn more fossil fuels, the emission of carbon

dioxide (CO_2) into the Earth's atmosphere has increased significantly. Over time, oceans absorbed the carbon dioxide (CO_2) in the atmosphere. As the carbon dioxide (CO_2) in the atmosphere dissolves in seawater, it reacts with water (H_2O) and form carbonic acid (H_2CO_3). Being a weak acid, carbonic acid then easily breaks down into bicarbonate (HCO_3^-) and hydrogen ions (H^+). The increase in the number of hydrogen ions causes the water to become more acidic and carbonate ions to be relatively scarce. Up till now, the pH level of oceans has dropped from 8.2 to 8.1 since the industrial revolution, and is expected to continue to fall in the future.

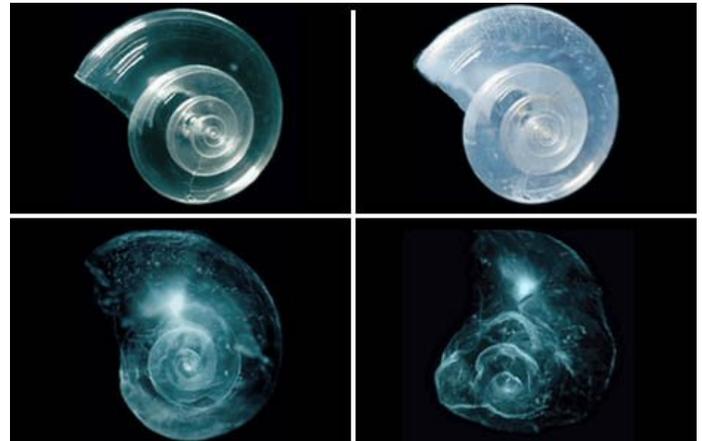


Picture 2: The chemistry of ocean acidification

Effects of Ocean Acidification

1) Calcifying Organisms

Calcifying organisms initially have to make calcium carbonate (CaCO_3) in order to build their shells. To make calcium carbonate, these organisms combine calcium ions (Ca^{+2}) with carbonate ions (CO_3^{-2}) in the ocean. Nonetheless, with increasing numbers of hydrogen ions in water, the oceans are lacking carbonate ions. Thus, calcifying organisms such as corals, clams, mussels, barnacles and planktons are dependent to the normal pH levels of the oceans, in order to obtain the amount of



Picture 3: A sea butterfly shell dissolution in water over 45 days

carbonate ions that they need for building their shells and protecting them. As a result of the changes in ocean chemistry, calcifying organisms have to spend more energy on building shells or skeletons. Organisms have a limited supply of energy, hence when they spend most of their energy on building their shells, they have relatively less energy to spend on other vital activities such as reproducing or finding food. Ocean acidification may also affect calcifying organisms indirectly by changing the organisms' respiratory rates or metabolism, which would also alter the organisms' ability of calcifying (creating shells).

2) Food Webs

One of the major impacts of ocean acidification is evident on marine food webs. Organisms existing in marine ecosystems interact with each other in complex food webs that contain numerous species. These food webs are undoubtedly damaged by ocean acidification, because of losses in key species. Calcifying organisms play a huge role in the food web, being an important source of prey for many marine animals. Yet, calcifying organisms are threatened by ocean acidification, since they have trouble finding carbonate ions in acidified water to form their shells. This means that a decline in the population of calcifying organisms may cause the marine food webs to collapse.

3) Socioeconomic Effects

Ocean acidification is not only a problem for marine animals, but also for humans themselves. It is rather ironic that humans are especially influenced by ocean acidification, when it is in fact an anthropogenic problem. Humans benefit from healthy ocean ecosystems in many ways. For instance, coral reefs are a big source of tourism for many countries. Coral reef tourism provides approximately 15% of the Caribbean Island of Tobago's Gross Domestic Product (GDP). Marine populations form the key foundation of many islands' cultures. Furthermore, ocean acidification affects the seafood industry more than anything. Ocean acidification is exceptionally damaging to island nations, where seafood is a major protein source. Even though some species will learn to cope with the new acidity levels of oceans, many will suffer and eventually go extinct. Countries that are dependent on fishery might need to make new adjustments. This issue, overall, may cause more people to suffer from hunger.

Major Parties Involved and Their Views

Japan: Japan is amongst the countries that are the most vulnerable to the effects of ocean acidification, since it is one of the largest consumers of fish and has a vast percentage of coral reef area. If the population of corals in Japan decrease as a result of ocean acidification, this would have a considerable impact on Japan's fishery and tourism sectors (Harrould 4).

France: France is another country that consumes a great deal of fish, which makes the it highly vulnerable to ocean acidification (Harrould 4).

China: China is the world's largest carbon dioxide emitter. Considering that carbon dioxide is the main reason of ocean acidification, China plays a great role in this issue (Harrould 4).

United States: Being rather vulnerable to ocean acidification itself, the United States is, in fact, the world's second largest carbon dioxide emitter (Harrould 4).

Timeline of Events

1800s	The Industrial Revolution began, which caused an increase in the amount of carbon dioxide emissions.
1960	The Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO) was established.
5 June 1972	The United Nations Environment Programme (UNEP) was established.
10 December 1982	The United Nations Convention on the Law of the Sea (UNCLOS) was signed.
25 September 2015	The Sustainable Development Goals were adopted by UNDP.

UN Involvement

The Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO): IOC is a body within UNESCO (The United Nations Educational, Scientific and Cultural Organization) that promotes cooperation and coordinates programs in order to protect oceans and marine environments. UNESCO-IOC finances the International Ocean Carbon Coordination Project (IOCCP), which is a project that concentrates on the increasing carbon dioxide (CO₂) levels and the effects of ocean acidification on calcifying organisms. UNESCO-IOC is also one of the founders of the Ocean Acidification Network. ("Intergovernmental Oceanographic Commission")

The United Nations Environment Programme (UNEP): UNEP is an agency of the United Nations that works with governments in order to ensure ecosystem management, to meet both the ecological and humanitarian needs. ("About Ecosystems | Ecosystem Management")

United Nations Development Programme (UNDP): UNDP is a non-governmental organization that works in almost 170 countries towards sustainable development. UNDP has adapted a series of goals called the "Sustainable Development Goals" in the year 2015, in order to pursue the "Millennium Development Goals", which were set in 2000. The fourteenth Sustainable Development Goal is to "conserve and sustainably use the oceans, seas and marine resources for sustainable development". ("Overview")

Relevant UN Documents

There are not any resolutions that directly tackle the issue of ocean acidification, however there are some that recognize the issue, such as:

- 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/RES/70/226)
- Modalities for the 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, 9 September 2016 (A/RES/70/303)

There are also several reports of the Secretary General of the United Nations such as:

- Oceans and the law of the sea, 25 November 2009 (A/64/66/Add.1)
- Oceans and the law of the sea, 19 October 2009 (A/64/66/Add.2)
- Oceans and the law of the sea, 29 August 2008 (A/63/63/Add.1)

Treaties and Events

Currently, ocean acidification is not regulated by any explicit treaties. However, the United Nations has had three Conferences on the Law of the Sea (UNCLOS I, UNCLOS II and UNCLOS III).

The United Nations Convention on the Law of the Sea (UNCLOS): UNCLOS is an international agreement that was signed in 10 December 1982, as a result of the third United Nations Conference on the Law of the Sea that took place between 1973 and 1982. Even though this convention is not solely about ocean acidification, it is one of the few international conventions that notes the issue. UNCLOS has been ratified by 168 parties, including all 164 United Nations member states. A list of the parties that have ratified this convention can be found in the following link:

http://www.un.org/Depts/los/reference_files/chronological_lists_of_ratifications.htm

Sustainable Development Goals (SDGs): SDGs are a set of goals adopted by the United Nations Development Programme (UNDP). SDGs recognizes ocean acidification, as the fourteenth Sustainable Development Goal is to “conserve and sustainably use the oceans, seas and marine resources for sustainable development”.

Evaluation of Previous Attempts to Resolve the Issue

Even though there haven't been any direct measures taken to tackle this issue yet, there has been close attempts. One of the main efforts was the Sustainable Development Goals adopted by the United Nations Development Programme in 2015. The fourteenth Sustainable Development Goals is to “conserve and sustainably use the oceans, seas and marine resources for sustainable development”. This goal recognizes ocean acidification as a vital problem, and calls for action. Other than this, the United Nations has held three conferences (UNCLOS I, UNCLOS II and UNCLOS III), as previously stated before. It cannot be said that these conventions were unsuccessful, but they do not tackle the issue directly either.

Since ocean acidification is a problem that calls for an immediate action, there should be more direct measures taken against it.

Possible Solutions

There are many actions that can be taken in order to combat this issue, some being individual, some being on a global level. The main cause of ocean acidification is rather evident: carbon dioxide emissions as a result of burning fossil fuels. Therefore, the most important action to be taken in order to solve this issue is to reduce carbon dioxide emission into the atmosphere. In order to tackle this issue at hand, people, businesses and states should try to prefer “greener” (more environmentally friendly) options. Governments should encourage corporations to pollute the atmosphere less, in ways such as taxing pollutants or offering tradable permits. Governments should also penalize polluters when necessary. Moreover, the role of the Non-Governmental Organizations should also be considered while addressing the issue. Collaboration and communication between Member States and the relevant NGOs should be ensured.

Notes from the Chair

In the link down below, there is a video that explains ocean acidification thoroughly, which will help the delegates grasp the issue better.

<https://www.youtube.com/watch?v=Wo-bHt1bOsw&feature=youtu.be>

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