Committee: United Nations Environment Commission

Issue: Devising ways to counteract the increasing acidification of the ocean

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Introduction

Ocean acidification is a process that occurs when carbon dioxide (CO2) from the atmosphere dissolves in seawater, leading to a decrease in pH levels. Deforestation, human activity, is the primary cause of this phenomenon, releasing large amounts of CO2 into the atmosphere.

Ocean acidification has several significant impacts on marine ecosystems and organisms. The most notable effect is the reduced availability of carbonate ions, which are essential building blocks for the formation of calcium carbonate, a key component of the shells and skeletons of many marine organisms, such as corals, molluscs, and some plankton species. Acidic conditions make it more difficult for these organisms to produce and maintain their shells, making them more vulnerable to predation, disease, and other stressors. To mitigate ocean acidification, reducing carbon emissions is essential. Additionally, efforts to protect and restore coastal ecosystems, such as seagrass beds and mangroves, can help absorb CO2 from the atmosphere and buffer the impacts of acidification on nearby marine environments.

Therefore, UNEP found out that there must be a specific solution in order to prevent ocean acidification and reduce environmental harm. It is crucial to improve international awareness of possible ocean protection and foster the ability to solve them.

Definition of Key Terms

Ocean acidification

Ocean acidification defines the phenomenon of decreasing in the ocean pH level due to the absorption of carbon dioxide (CO2) from the atmosphere. When CO2 dissolves in seawater, concentration of hydrogen ions (H+) increases and reduces the ocean pH, making it more acidic. It undergoes a series of chemical reactions, the equation itself is CO2 + H2O -> (H+) + (HCO3-). Since the industrial revolution, CO2 emissions are increasing, and ocean pH is decreasing at the same time. But this has a range of potentially harmful effects for marine organisms.

History

Minimizing and addressing ocean acidification

It discussed the growing concern surrounding the acidification of Earth's oceans, which is primarily caused by increased levels of carbon dioxide (CO2) in the atmosphere. The document suggested the strategies and approaches to minimize and address these environmental issues such as air pollution.

Ocean acidification: a hidden risk for sustainable development

This document was published in December 2009, it discussed the concept of ocean acidification as a hidden risk to sustainable development. It highlights the potential negative impacts of ocean acidification on marine ecosystems and emphasizes the need for global action to mitigate this hazard.

Our Ocean, Our Future, Our Responsibility: resolution / adopted by the General Assembly

This resolution, adopted by the United Nations General Assembly in July 2022. The title is "Our Ocean, Our Future, Our Responsibility." It suggests a commitment to addressing ocean-related issues.

Draft resolution on results of the review by the Commission on Sustainable Development of the sectoral theme of "oceans and seas"

This resolution, dated November 24, 1999, concerns the results of a review conducted by the Commission on Sustainable Development regarding the sectoral theme of "oceans and seas." It discusses findings and recommendations related to the sustainable use and management of oceans and seas.

Key Issues

The Industrial Revolution marked a transition to societies to ones driven by industrial production. It was characterized by the mechanization of production processes, the rise of factories, the development of transportation infrastructure, and the widespread use of fossil fuels such as coal, oil, and natural gas. Fossil fuels became the primary energy source during the Industrial Revolution, fueling the growth of industries such as manufacturing, transportation, and electricity generation. As a result, there was a dramatic increase in the combustion of fossil fuels, leading to the release of large amounts of carbon dioxide (CO2) into the atmosphere. The problem is that the ocean is absorbing all the CO2.

When CO2 dissolves in seawater, it undergoes chemical reactions that lead to the production of carbonic acid. This process increases the concentration of hydrogen ions (H+), thereby reducing the pH of the ocean and making it more acidic. This phenomenon is known as ocean acidification. Ocean acidification has accelerated since the Industrial Revolution due to the increased burning of fossil fuels and the resulting rise in atmospheric CO2 concentrations. The Intergovernmental Panel on Climate Change (IPCC) reported in “Ocean and coastal ecosystems and their services” that estimates that about

one-third of the CO2 emissions from human activities have been absorbed by the oceans, leading to a decline in ocean pH. The decrease in ocean pH and the resulting acidification pose significant risks to marine ecosystems. Many marine organisms, including coral reefs, shellfish, and some plankton species, rely on carbonate ions in seawater to build their shells, skeletons, and other structures. The increased acidity hampers their ability to form and maintain these vital structures, making them more vulnerable to damage and affecting their overall health and survival.

The primary cause of climate change is increasing CO2 emissions. If the CO2 emissions increase, more and more CO2 will dissolve in seawater. The acidity of the ocean has increased by about 26% since the industrial revolution. At this point, some people might think that if the CO2 dissolves in seawater, it's going to be better for the environment. However, if the CO2 dissolves in seawater, concentration of hydrogen ions in the ocean increases and reduces the pH of the ocean. This phenomenon is called ocean acidification which has accelerated since the industrial revolution caused by fossil fuel. According to the Intergovernmental Panel on Climate Change (IPCC), about one-third of the CO2 emissions from human activities have been absorbed by the oceans, leading to a decline in ocean pH. Ocean acidification can lead to serious harms towards marine ecosystems. For example, The acidified sea is pointed out as a factor that hinders the growth of coral composed of calcium carbonate and causes damage to coral reefs. So far, research has shown that marine acidification adversely affects the reef ecosystem. Also, Ocean acidification restrains the growth of marine organisms that could be exposed by dangerous predators.

Governments and the United Nations have recognized the seriousness of ocean acidification and tried to resolve the problem and find a possible solution. The UN's 2030 Agenda for Sustainable Development includes a comprehensive framework for addressing various global challenges, including ocean acidification. It highlights the need to minimize and address the impacts of ocean acidification, among other threats to marine ecosystems. UNEP (United Nations Environment Programme) has always been seeking the ultimate solution to prevent the harms of the marine ecosystem due to ocean acidification. Recently, UNEP has revealed the report 'Impacts of Ocean Acidification on Marine Biodiversity' and this report informs that increasing ocean acidification reduces the availability of carbonate minerals in seawater, important development factors for marine plants and animals.

The government is enacting laws to reduce CO2 emission and increasing the educational awareness about ocean acidification especially in schools. Because research said that ocean acidification has been increasing by 30% every year. And it supports research, capacity-building initiatives, and partnerships to address this issue. However, it's difficult to solve ocean acidification, because to stop ocean acidification, human beings must stop using fossil fuels so that CO2 emissions can decrease. By raising awareness,

fostering scientific research, and acting international cooperation, the UN and government is taking actions and adjusting policies to mitigate the impacts of ocean acidification and protect marine ecosystems for future generations.

Major Parties Involved and Their Views

Japan

Japan ranks as the most vulnerable nation to the impacts of ocean acidification out of 187 nations, due to the consumption of a high number of fish. In Japan, academics and nonprofit organizations are properly working together to comprehensively monitor its impact, and share research information. According to a professor of environmental sciences at Hokkaido University, awareness of ocean acidification has been slower to develop because people cannot experience it. The ocean acidification process poses a threat to the future of the fishery and aquaculture industries. Many institutes in Japan are doing research on ocean acidification for a better solution.

Australia

The pH and aragonite saturation state of surface sea waters around Australia are influenced by the large-scale circulation, and superimposed on this are the effects of seasonal changes due largely to biological activity and temperature change. According to data released by British scholars on the same day, oysters in New South Wales (NSW), southeastern Australia, are getting smaller due to coastal acidification, and their population is also decreasing. The government of Australia represented the program about coral reef conservation and management in 2018. Environment Minister Josh Frydenberg has announced AUD 500 million ($379 million) in support for marine ecosystems that have been devastatingly damaged over the past few years by warming caused by climate change. He said by helping vital ecosystems and world treasures.

Korea

The Korean government (National Institute of Fisheries Science) revealed that ocean acidification is progressing at a level similar to that of the world’s oceans in Korea's oceans. According to a research institution, as a result of the eight-year survey, it was confirmed that the trend of ocean acidification in Korea’s waters was similar to the rate of ocean acidification in the global ocean and neighboring countries, and the seasonal variability of acidification factors in our waters was large. This is because the recent high temperature in summer and low water temperature in winter are due to the physical effects of abnormal climate in our waters.

NOAA (national oceanic and atmospheric administration)

The National Oceanic and Atmospheric Administration (NOAA) is an agency of the United States government that was formed in 1970 within the Department of Commerce. NOAA was the result of a merger of three governmental organizations that were formed in the 19th century. These three organizations included the United States Coast and Geodetic Survey (now known as the National Geodetic Survey), the United States Commission of Fish and Fisheries (today succeeded by the NOAA Marine Fisheries Service), and the United States Weather Bureau (now known as the National Weather Service). The work and legacy of these historic organizations continue today under their more recently created parent organization. The research laboratories of the agency help scientists understand Earth's ocean, inland bodies of water, and atmosphere. Through the National Weather Service, NOAA tracks and records climate and weather data and provides weather models and forecasts for meteorologists. NOAA also controls satellites that help track weather systems throughout the world.

Timeline of Relevant Resolutions, Treaties and Events

Date	Description of event
2003	In 2003, a landmark study published in the journal Nature by Dr. Ken Caldeira and Dr. Michael Wickett provided one of the first comprehensive assessments of the potential impacts of ocean acidification. This report highlighted the threat posed to marine organisms and ecosystems due to the absorption of excess carbon dioxide by the oceans.
Early 2000s	The Intergovernmental Panel on Climate Change (IPCC) included a dedicated section on ocean acidification in its Fourth Assessment Report published in 2007. This report raised global awareness of the issue by emphasizing the significant impacts of rising CO2 levels on marine ecosystems.
2008	In 2008, the European Project on Ocean Acidification (EPOCA) was launched, bringing together over 100 scientists from 27 research institutes. This initiative aimed to enhance understanding of the causes and consequences of ocean acidification through international collaboration.
2010	The first dedicated international conferences on ocean acidification were organized, including the inaugural Symposium on the Ocean in a High-CO2 World held in Paris, France, in May 2004. Subsequent conferences, such as the Second Symposium on the Ocean in a High-CO2 World in Monaco in October 2008,

	provided platforms for scientists, policymakers, and stakeholders to discuss the latest research findings and exchange knowledge.
present	Ocean acidification continues to be a topic of ongoing research, awareness-raising, and policy actions. Events such as the International Day of the Reef (celebrated annually on June 1) and World Oceans Day (observed on June 8) raise public awareness about the importance of ocean health and the impacts of acidification. Ongoing

Evaluation of Previous Attempts to Resolve the Issue

I. Restoration and Protection of Coastal Habitats:

Coastal habitats, such as seagrass meadows and salt marshes, play a crucial role in absorbing CO2 and buffering the effects of ocean acidification. Restoration and protection of these habitats are being pursued as nature-based solutions to mitigate acidification. Restoration projects focus on enhancing the resilience of coastal ecosystems, which can provide multiple benefits, including carbon sequestration and enhanced biodiversity.

II. Carbon Capture and Storage (CCS):

CCS technologies aim to capture CO2 emissions from industrial sources and store them permanently underground. Although primarily focused on reducing atmospheric CO2 levels, these technologies can indirectly help mitigate ocean acidification by reducing the amount of CO2 that enters the atmosphere and subsequently dissolves in seawater.

III. International Cooperation and Collaboration:

Addressing ocean acidification requires global cooperation and knowledge sharing. International organizations, such as the Global Ocean Acidification Observing Network (GOA-ON) and the International Atomic Energy Agency (IAEA), facilitate data exchange, coordinate research efforts, and promote collaboration among scientists, policymakers, and stakeholders. These collaborations foster the development of effective strategies to mitigate and adapt to ocean acidification on a global scale.

IV. Ocean Acidification Research Programs:

Governments and scientific organizations have invested in research programs to enhance our understanding of ocean acidification. For instance, the United States established the Ocean

Acidification Program in 2008 to support research, monitoring, and modeling efforts. These initiatives provide crucial insights into the processes, impacts, and potential solutions related to ocean acidification

Possible Solutions

1. ***Mitigating Climate Change***:

The international society should prioritize efforts to mitigate climate change, as the primary driver of ocean acidification is the increasing concentration of atmospheric carbon dioxide (CO2) resulting from human activities. Countries can implement a range of measures to reduce greenhouse gas emissions and limit global warming. This includes transitioning to renewable energy sources such as solar and wind power, promoting energy efficiency in industries and transportation, and adopting sustainable land-use practices. For instance, nations can invest in renewable energy infrastructure, implement carbon pricing mechanisms, and enforce stricter emissions regulations to significantly reduce CO2 emissions.

2. ***Promoting Blue Carbon Ecosystems:***

Blue carbon ecosystems, which include mangroves, seagrass meadows, and salt marshes, have high carbon sequestration potential. Protecting and restoring these coastal habitats can contribute to mitigating ocean acidification. The international society can support initiatives that conserve and restore these ecosystems by establishing marine protected areas, implementing sustainable land-use practices, and integrating blue carbon considerations into national climate and conservation strategies. For example, countries can provide financial incentives for the conservation and restoration of these ecosystems and develop monitoring programs to assess their carbon sequestration potential.

3. ***Sustainable Fisheries and Aquaculture Practices***:

Sustainable management of fisheries and responsible aquaculture practices are crucial for maintaining the resilience of marine ecosystems and mitigating the impacts of ocean acidification. International cooperation can focus on implementing science-based fisheries management plans, reducing overfishing, and adopting ecosystem-based approaches. Additionally, promoting sustainable aquaculture practices, such as optimizing feed composition, improving water quality management, and developing acidification-resilient species, can minimize the vulnerability of

farmed species to acidified waters. Collaboration among countries can involve sharing best practices, supporting capacity building programs, and establishing certification schemes for sustainable fisheries and aquaculture operations.

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