

**Committee: Environmental Committee**

**Issue: Measures to prevent ocean acidification and melting of polar ice**

**Student Officer: Nikolas Athanassiadis**

**Position: Co-Chair**

## Introduction

With carbon dioxide (CO<sub>2</sub>) emissions constantly increasing, the issue of ocean acidification and melting of polar ice has become more crucial than ever. To start with, the acidification of our oceans is one of the many negative effects (such as climate change), CO<sub>2</sub>-emissions have on our planet. The increase in levels of CO<sub>2</sub> has been contributing to an increasing acidification of the world's oceans. This human-caused chemical process has consequences for ocean marine life, especially in the Arctic Ocean, which is particularly susceptible to acidification. This means that the top layer of Arctic waters is

more likely to mix with greenhouse gases found in the atmosphere directly above it. Through this mix, the aforementioned gases are dissolved in the ocean, causing a series of chemical reactions. Having said that, one can come to the conclusion that as the amount of CO<sub>2</sub> in the atmosphere has been increasing, so has a big amount of CO<sub>2</sub> dissolved in the oceans. Meanwhile, the enormous amounts of CO<sub>2</sub> emissions have contributed to the rise of global average

temperatures and thus the increased melting of polar ice. As one may understand, this has negative effects on the environment. One of them is indirectly related to the issue discussed above.

In concrete terms, polar ice prevents Pacific Ocean water (which is already high in CO<sub>2</sub> and is

thus acidic) to flow into the Arctic Ocean. Moreover, with polar ice constantly melting, more acidic water flows into the Arctic and eventually spreads the acidity. As already mentioned before, the described process has devastating impacts on marine organisms as the increase of CO<sub>2</sub> dissolved in the oceans contributes to the decrease of ocean water pH. While mostly shellfish and corals are seriously threatened by this kind of pollution in every ocean around the globe, the impacts of acidification are, as mentioned above, more pronounced on Arctic marine ecosystems. Fortunately, not all hope is lost. International organizations and laboratories like the “International Alliance to



### *1. Healthy/Dead Coral Aftermath of Ocean Acidification*

Combat Ocean Acidification” or the “Center for Ocean Solutions”, who bring together jurisdictions across the globe to change ocean conditions and conduct studies on how to take action against ocean acidification, help in the protection of coastal economies as well as ocean ecosystems. Furthermore, although the effort of such organizations, laboratories and alliances is helpful, it is still not enough. Thus, with millions of tons of invisible greenhouse gases being absorbed by our oceans and raising the earth’s global temperature every day, the crucial issue of the melting polar ice and eventually the issue of ocean acidification still remain unsolved.

## Definition of Key-Terms

### Greenhouse gases

Greenhouse gases are gases like carbon dioxide or chlorofluorocarbons, which are responsible for the so-called “greenhouse effect”. After being emitted by means of transport, through electricity production, fossil fuels etc., they absorb radiation and radiate heat in all directions.

### Carbon dioxide

Also known as CO<sub>2</sub>, carbon dioxide makes up the largest share of greenhouse gases, which disturbs the earth’s radiative balance. This is leading to an increase of the earth’s temperature and to effects like climate change, sea level rise and more.

- “Carbon Dioxide (Co2) Emissions.” *Wikiprogress*,  
[wikiprogress.org/articles/environment/co2-emissions/](http://wikiprogress.org/articles/environment/co2-emissions/)

### Climate change

Scientists refer to climate change as an increase in global average temperatures and the worldwide shift of (extreme) weather phenomena, caused by the constantly increasing greenhouse gas emissions.

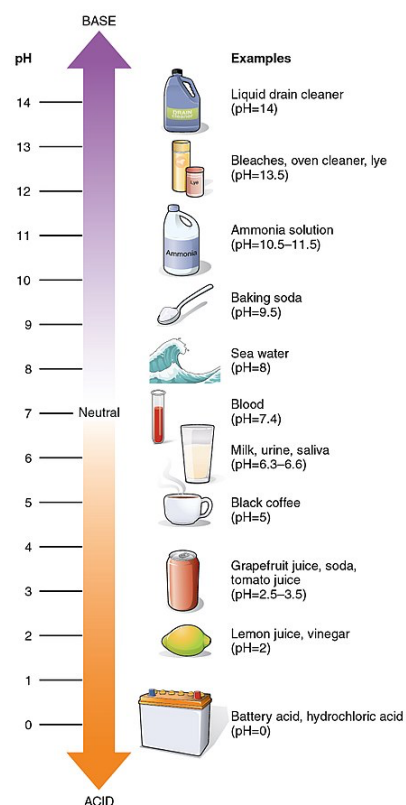
### Marine life

Marine life is composed of every creature (plant, animal, organism) living in the sea.

### (Ocean water) pH

pH is a logarithmic scale, which indicates the acidity of a fluid solution.

While ocean water pH used to lie at 8.00 pH, it now has fallen to 7.9 pH.



## 2. The pH scale

## Ecosystem

An ecosystem is constituted by all living creatures (plants, animals, organisms) living in a certain area together and the relationship that exists between them and their environment.

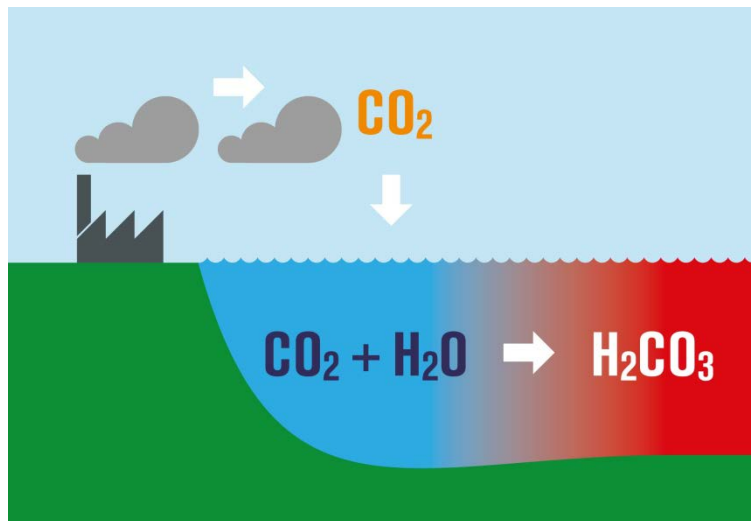
## Pacific winter water

Pacific Ocean water, already high in carbon dioxide, which flows from the Pacific into the Arctic during winter and builds up there.

## Background Information

### The acidification process

The acidification process of the oceans is a series of chemical reactions. It all starts with the top layer of the ocean mixing with the gases found in the atmosphere. Those gases mostly consist of carbon dioxide ( $\text{CO}_2$ ) and other greenhouse gases. As this mixing takes place, the toxic gases mentioned above react with water ( $\text{H}_2\text{O}$ ) and eventually are dissolved in the water. Furthermore, the dissolved carbon dioxide forms carbonic acid ( $\text{H}_2\text{CO}_3$ ), as soon as it reacts with (ocean) water. As you may understand from the name of the substance, it increases the ocean's acidity. In fact, the acidity of the world's oceans has increased by 30% since the beginning of the industrial era. Evidently, this is to blame on the increasingly extreme amounts of  $\text{CO}_2$  emissions. As mentioned, the higher the amount of emitted carbon dioxide, the higher the acidity in our oceans.



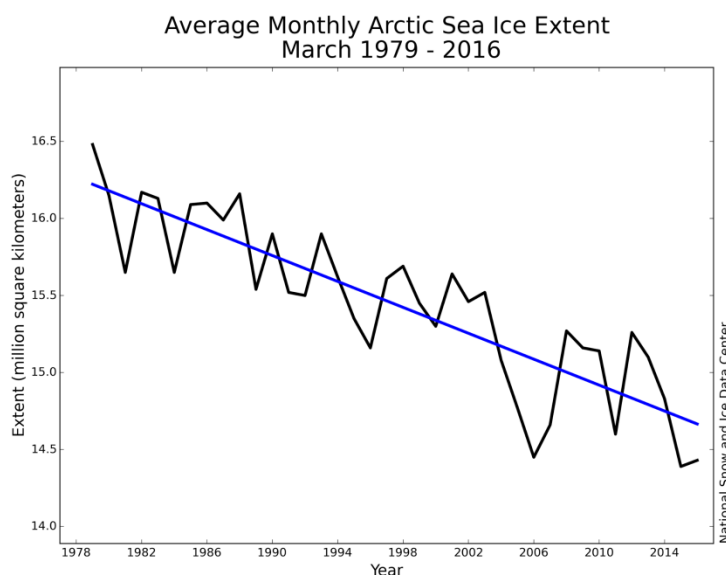
### *3. The process of acidification quickly explained*

### How the melting of polar ice is linked to ocean acidification

The Arctic Ocean is the first ocean where such a rapid and large-scale increase in acidification has been seen. Scientists observe the dangerous process taking place at least twice faster in the Arctic than in any other ocean. In particular,

#### **4. Average Monthly Arctic Ice Extent, Graph**

scientists blame the so-called Pacific winter water for the rapid acidification in the Arctic. As polar ice has been increasingly melting in the past years, due to the temperature rise caused by the greenhouse effect, ocean acidification has been intensified as well. This is due to the fact that one of the many functions of polar ice is to prevent the already acidic waters of the Pacific Ocean to flow into the Arctic and build up there. Today however, with millions of tons of polar ice having already melted down, the Arctic ice cannot longer prevent the flow of Pacific winter water in the



Arctic Ocean as efficiently as in the years, where climate change did not have such a serious impact on the environment. Thus, the Arctic Ocean is day by day becoming more acidic as polar ice continues to melt rapidly (**see picture 4**). Having said the above, one can conclude by realizing that the more polar ice melts down, the more acidic the Arctic Ocean and eventually all oceans become.

### Effects on animal and human life

The decrease of the ocean waters' pH affects many marine organisms and animals, as only not polluted seawater supports life. More specifically, sea animals, such as various types of fish, mammals like whales, sharks and many further, are suffering from the increasingly acidic oceans, due to the fact that certain abilities of maritime species, like the ability to detect predators, get decreased in more acidic waters. Furthermore, as the absorbed CO<sub>2</sub> results (through a series of chemical reactions) in an increased concentration of hydrogen ions, which cause the decrease in the amount of carbonate ions, organisms like oysters, clams, sea urchins, corals, etc., are struggling to build and maintain their shells (and other CaCO<sub>3</sub> structures), as they need carbonate ions to produce calcium carbonate shells and skeletons. Thus, if maritime life suffers and various sea animals die, humans who depend on them in order to survive are hit by the issue as well.

Moreover, the higher acidity of the world's oceans results in an increase in soil acidity, which makes the cultivation of specific crops almost impossible and eventually leads to a lower production of goods. This may pose a serious threat to humanity in the long term, and it could slowly lead to the starvation of humankind. Apart from that, by eating fish which have lived in acidic waters and thus having lived in a dangerous situation, the human health gets negatively

affected. As a matter of fact, many fatal diseases, like various cancer-types, often get transmitted to humans who consume fish that lived in acidic waters.

### CO2- the main factor of ocean acidification

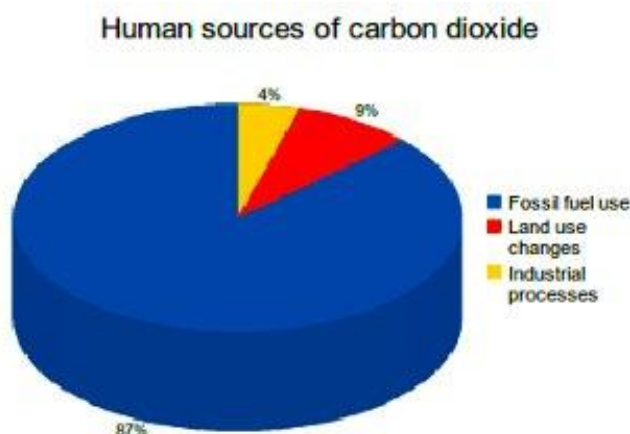
As previously mentioned, carbon dioxide emissions are directly linked to the issue of ocean acidification and the constant melting of polar ice. Thus, in order to take measures to prevent ocean acidification, one needs to track down the reasons why 40 billion tons of carbon dioxide are emitted into the air annually (by humans). Thirty percent of the above-mentioned amount get absorbed by the world's oceans and increase their acidity. In addition, the tremendous amount of CO2 emissions contributes to the increase of global average temperatures, causes the rapid melting of Arctic ice, and thus indirectly acidifies the Arctic Ocean.

To start with, human activities such as the burning of fossil fuels (oil, coal and natural gas), together with the massive deforestation

are the primary cause of the increased carbon dioxide concentrations in the atmosphere. While 9% of all human-produced carbon dioxide emissions are the result of deforestation programmes, 87% are emissions coming from the burning of the already mentioned fossil fuels. This is due to the fact that the entire world's electricity and heat sector heavily relies on coal and the combustion of fossil fuels in general.

As one may deduce from **picture 6**, with an exception of Canada and France, all other G8 Nations are severely dependent on fossil fuel combustion as a means of electrical energy production. In particular, all industrialized countries get the majority of their electricity from the combustion of fossil fuels and thus contribute to global warming, ocean acidification and much more.

Moreover, the transportation sector is the second largest source of anthropogenic CO2 emissions. The transportation of goods and people around the globe produces a huge amount of carbon dioxide. In year 2010, the transportation sector produced 22% of fossil fuel related CO2 emissions. In addition, the aforementioned sector is rapidly growing and thus posing a bigger threat to the environment year by year.



5. Sources of human-produced CO2 , diagram (2013)

Electrical Energy Produced By Fossil Fuel Combustion			
(Billion Kilowatthours)			
G8 Nation	Fossil Fuel Combustion	Total	%
Canada	136.31	622.98	21.9%
France	44.65	532.57	8.4%
Germany	340.38	567.33	60.0%
Italy	286.35	201.7	70.4%
Japan	759.93	1031.22	73.7%
Russia	668.26	996.82	67.0%
United Kingdom	244.5	342.48	71.4%
United States	2,788.87	4,100.14	68.0%

6. International Energy Statistics Database (2011), Energy Information Administration

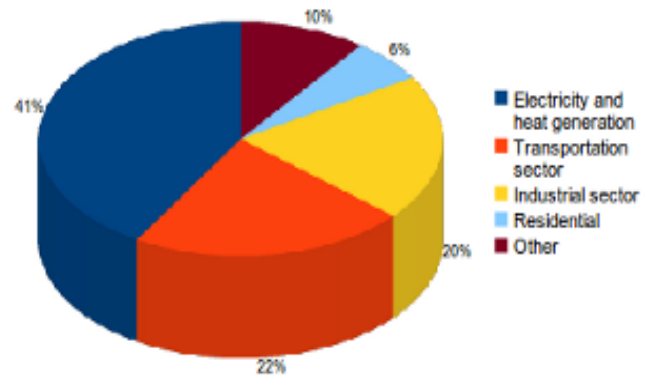
The industrial sector follows as the third largest source of man-made carbon dioxide emissions. The specified sector produced 20% of fossil fuel related carbon dioxide emissions in 2010. The sector



consists of manufacturing, construction, mining and agriculture. As many manufacturing facilities directly use fossil fuels for the creation of heat and steam needed at various stages of production, the manufacturing and industrial processes produce large amounts of carbon dioxide.

Although the above-mentioned human sources of carbon dioxide are just few examples, they are the **three main sources of anthropogenic CO<sub>2</sub>**. Thus, in order to tackle both the issue of ocean acidification and the problem of the melting polar ice, one needs to concentrate on the ways to combat the rising threat the aforementioned sources of human-produced carbon dioxide pose to our planet first.

Carbon dioxide emissions from fossil fuel combustion



7. CO<sub>2</sub> Emissions from Fuel Combustion (2012), International Energy Agency

## Major Countries and Organizations involved

### China

China is the planet's biggest emitter of greenhouse gases from fossil fuels and industry. While the United States had been the biggest polluter, China's emissions leapt after their start in the 1990s and overtook the US by 2007. The reason for it is the country's galloping industrial growth, fueled by coal. China's economic "takeoff" has been propelled by intensively polluting factories, power plants, etc. However, China pledged under the agreement made in Paris, by stating that it would cut its carbon intensity by 60-65% by 2030.

### United States of America

USA comes second (after China) in respect to carbon dioxide emissions. In fact, it has contributed more than any other country to the emissions of atmospheric carbon dioxide that is scorching our planet. Although the United States emit hundreds of tons of carbon dioxide daily, the country's President, Donald Trump, announced that the US will pull out of the Paris Agreement, and thus withdrew his strongly pollutant country from the 2015 deal to curb carbon emissions, invest in green technology, and generally take other steps to combat the existential threat the climate change poses to earth.



8. People wearing masks on a polluted day in Beijing

### **United Nations Framework Convention on Climate Change**

The UNFCCC is an international treaty adopted in 1992. Its objective is to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the world's ecosystems. Thus, it aims at controlling greenhouse gas emissions to a tolerable amount, by outlining specific international treaties ("Protocols" or "Agreements") to urge for further action towards the objective of the framework.

### **International Alliance to Combat Ocean Acidification**

The IACOA is a non-governmental organization that involves itself both in increasing global attention to actions that address the causes of ocean acidification and in changing ocean conditions as well as reducing future impacts to the world's coastal communities.

### **Timeline of Events**

Date	Description of Event
9 May 1992	UNFCCC treaty was adopted. Its adoption set a groundwork for further UN action on climate matters caused by anthropogenic interference.
11 December 1997	Kyoto Protocol was adopted. It was the first treaty to contain concrete mandatory aims for the countries that have signed it.
2007	China becomes the biggest emitter as a result of the country's booming economy. Although it was a surprising and unexpected fact for many people, several studies had predicted it.
12 December 2015	Paris Climate Change Agreement was adopted with 195 nations agreeing to invest towards a low-carbon future.
6-17 November 2017	UN Climate Change Conference, Bonn with the aim of actuating nations to the next level of ambition needed to tackle global warming.

### **Relevant UN Treaties, Resolutions and Events**

#### **Adoption of the UNFCCC treaty**

The United Nations Framework Convention on Climate Change is an international environmental treaty run by the United Nations, which was adopted in May 1992. Entering into force in March 1994, the aforementioned UN treaty set an “infrastructure” for further climate actions to be taken. Since 1995, countries, which ratified the treaty, meet annually in order to ensure progress in dealing with climate change. Further important treaties like the Kyoto Protocol or the Paris Agreement were initialized by the UNFCCC.

### **Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC)**

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. It binds its parties by setting internationally binding emission reduction targets. The protocol was adopted in December 1997 and entered into force in February 2005. Currently, there are 192 parties to the Kyoto Protocol.

### **Paris Agreement**

The Paris Agreement is a treaty within the UNFCCC aiming at the long-term goal of keeping the increase in global average temperature below 2°C. It was adopted in December 2015. Moreover, 195 members of the UNFCCC have signed the agreement, and 178 have ratified it. The agreement sets a framework for all countries around the world to take action against the changing climate starting in 2020.

### **UN Climate Change Conference**

The UN Climate Change Conference took place in Bonn, Germany in 2017. Leaders from national governments, cities, states, businesses, NGOs and civil society gathered to speed up climate action to meet the goals of the Paris Climate Change Agreement.

### **Resolutions**

1. General Assembly resolution 44/228 of 22 December 1989
2. General Assembly resolution 44/207 of 22 December 1989

## Previous attempts to solve the Issue

As already mentioned, the adoption of several treaties has helped the issue of ocean acidification and melting of polar ice, by proposing a decrease in carbon emissions globally. Extreme anthropogenic CO<sub>2</sub> emissions are, as already explained, very harmful to the environment for various reasons.



Starting with the adoption of the UNFCCC in 1992, the issue of climate change got primarily recognized as a threat by the international community. After the creation of the Intergovernmental Panel on Climate Change (IPCC), a scientific body aimed at providing the world with an objective, scientific view of the changing climate, the first historical milestone of the framework was achieved with the adoption of the Kyoto Protocol in 1997. This protocol made history, as it is the world's first greenhouse gas emissions reduction treaty. On Hundred Ninety Five parties have signed and ratified the treaty proposing various means to tackle the issue of climate change through monitoring the actual emissions of each country. Moreover, the UNFCCC has generally discussed measures to limit greenhouse gas emissions by simultaneously taking big steps towards assisting developing countries.

Furthermore, the second historic milestone of the UNFCCC was reached with 195 nations agreeing to combat climate change and to unleash actions and investment towards a low-carbon future. More specifically, limiting a global average temperature increase in this century to 2 degrees Celsius as well as strengthening the ability of developing countries to cope with the impacts of global warming and aiming to peak greenhouse gas emissions as soon as possible are the largest goals included in the Paris Climate Change Agreement, met in 2015. As one may be able to assume, the implementation of the above-mentioned treaty is certainly going to improve the situation of ocean acidification and the melting of Arctic ice, as it mainly focuses on widely reducing greenhouse gas emissions.



**9. Picture from the Paris Climate Change Agreement in 2015**

Apart from that, the 17 adopted Sustainable Development Goals of the 2030 Agenda for Sustainable Development, one of which is to tackle climate change, came into force in 2016.

Lastly, many NGOs have started taking action against the issue discussed, in the past years. Organizations like the International Alliance to Combat Ocean Acidification or NRDC and the National Oceanic and Atmospheric Administration aim at protecting maritime species from the devastating impacts, ocean acidification has on them, and at raising funds in order to increase public awareness on the topic and to generally save wildlife and wild places.

## Possible Solutions

As one already may have figured out, the main way to tackle the issue being discussed here is to limit greenhouse gas—and mainly carbon dioxide—emissions. However, as the act of decreasing the amount of human-produced CO<sub>2</sub> is not as easy as it may sound, our world's oceans are constantly becoming more acidic. Although reducing greenhouse gas emissions is hard to do, it is still achievable. In any case, we can do many things as a public community.

To start with, one should focus on the many power plants around the world, which are still allowed to dump unlimited amounts of carbon dioxide in the atmosphere. Until now, no regulations for

limiting their emissions of CO<sub>2</sub> are in effect. Thus, new rules and standards, which will reduce carbon emissions from power plants, need to be set. The EPA Clean Power Plan, which was set by the Obama administration in the United States of America, is a bright example of what still needs to be done in many other countries, which produce huge amounts of carbon dioxide.

Furthermore, the investment in further renewable energy sources is vital for the achievement of the optimistic Sustainable Development Goals of the UN. At present, renewable energy sources account for 24% of global power production. However, the International Renewable Energy Agency claims that renewables should represent 80% of global power generation, in order to achieve a bearable amount of decarbonization. By investing in wind turbines, solar panels and other means that help us profit from renewable energy, less carbon emissions are going to be produced, while the world will be one step closer to tackling the issue of the extreme amounts of CO<sub>2</sub> in the atmosphere and thus the issue of ocean acidification.

Equally important is to establish climate policies in order to control emissions in every country. A good example is the Emission Rights Policy, which is currently implemented in Europe. More specifically, the aforementioned market-based approach, which is controlled by a central authority (a governmental body), is intended to ensure pollution reduction in the European Union primarily setting a limit on the amount of greenhouse gases that certain industries and installations emit annually. This “cap” is reduced over time so as to achieve a major decrease in total emissions. Each industry gets its own emission allowances according to its size and power. However, companies can afterwards trade their emission allowances for money. Thus, if a certain company does not intend to emit as much CO<sub>2</sub> as planned, it can sell its allowances to other companies, wanting to produce more greenhouse gases. Apart from that, if certain companies do not follow the described policy, heavy fines are imposed on them.

All in all, as the amount of greenhouse gases, which companies are allowed to produce, gets reduced over time, the Emission Rights Policy is efficiently decarbonizing Europe.

Lastly, governments and NGOs should contribute to further educating young as well as old people on the causes and effects of ocean acidification, while teaching them how to detect and consume the right, healthy fish. By organizing training school days and other instructive campaigns civil society could efficiently get sensitized on the risks posed by climate change and ocean acidification. Equally important is to ensure that the chances of dangerous diseases being transmitted to humans by fish via consumption are reduced, by checking the health of the fish, which are to be offered on the market and thus sorting the unhealthy ones out.

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