Research report

COMMITTEE: UN Oceans
ISSUE: How to protect marine ecosystems and their populations from human activities ?
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How to protect marine ecosystems and their populations from human activities?

INTRODUCTION

Hello everyone! My name is Timothée Poulard, I am 15 years old, and I will be the president of the Ocean committee, together with Camille Lévêque. I am in the Spanish Section at the Lycée International de Ferney-Voltaire, a French town near Geneva. In my free time, I like to listen to music of all kinds. I play the violin, and I also like sports in general, especially tennis and climbing. This is my second conference because at, FerMUN 2022, I was a delegate for Greenpeace in the UNEP committee. This gave me a first insight into the major environmental issues we are facing and which are becoming more and more urgent. In this committee, we will discuss the impact of our actions on marine ecosystems. We will try to find ways of curbing the problems that arise from these often devastating actions as we will be able to observe them. I look forward to meeting you at this FerMUN 2023 conference and hope that together we can have a constructive debate that will lead to successful solutions to preserve the marine environment.

KEYWORDS

Biodiversity: All living beings (animals, plants, microorganisms) present in various living environments, particularly aquatic environments. It is divided into three levels: biodiversity linked to ecosystems, specific biodiversity linked to species and genetic biodiversity linked to the variability of individuals of the same species.

Ecosystem: A dynamic complex of all the species that live and interact in the same environment with specific physical, chemical and geographical conditions.

Eutrophication: Enrichment of water with nutrients (phosphates, nitrates, etc.), often linked to anthropogenic pollution, causing a disruption of the biological balance of the water by deoxygenation of the deep waters.

Pollution of marine ecosystems: The direct or indirect introduction by man of substances or energy into the marine environment where it has, or may have, harmful effects such as damage to living resources, marine life and the quality of seawater.

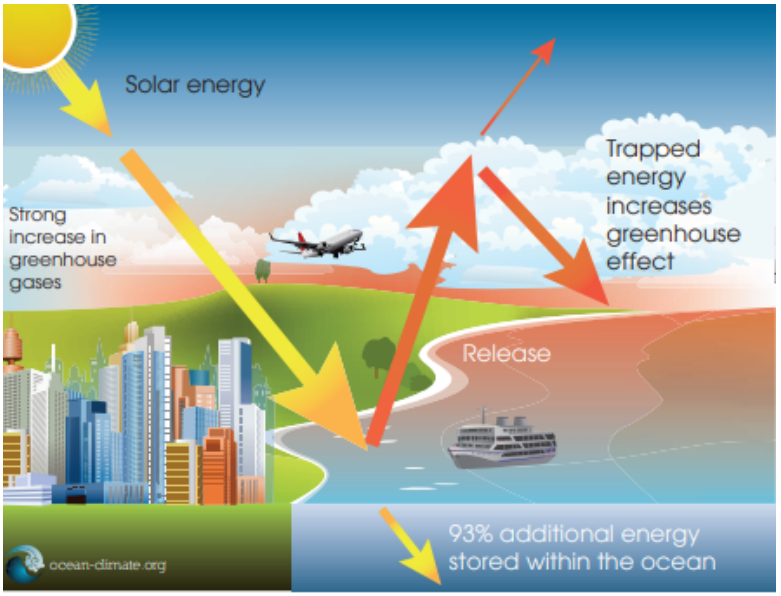
Protected area: Any geographically defined area that is designated, or regulated, and managed to achieve specific biodiversity conservation objectives.

OVERVIEW

1. Human activities, disruptors of the ocean

First of all, it is important to understand that there are many different marine ecosystems: seas, oceans, salt marshes, coral reefs, shallow coastal waters, estuaries, coastal saltwater lagoons, rocky shores and coastal areas. We will focus on the oceans because they are the largest, most endangered, most polluted and most biologically rich marine ecosystem. Covering 72% of the Earth's surface, or 361 million square kilometres, the oceans are home to some 230,000 species, although scientists estimate that between 500,000 and 700,000 remain to be discovered ! Human activities are at the origin of two main types of disruption that have a lasting effect on the oceans: disruption caused by greenhouse gas emissions and climate change, and disruption caused by pollution.

The greenhouse effect is a natural phenomenon that keeps the sun's rays (heat) in the atmosphere for a certain period, thus maintaining an average temperature of 15°C on Earth and not -18°C if this phenomenon did not exist. However, since the Industrial Revolution, mankind has been emitting excess greenhouse gases, causing infrared radiation to be reflected back into the troposphere, thereby increasing the heat on Earth. This impacts the entire planet, including the oceans: acidification, warming and deoxygenation.



Increase of the greenhouse effect

Diagram of the greenhouse effect from the "Ocean & Climate Platform

Pollution arriving in the ocean is mainly of terrestrial origin: it is industrial pollution (hydrocarbons, heavy metals, chemical substances, etc.) or agricultural pollution (fertilisers, nutrients, pesticides, etc.). These two types of pollution introduce harmful contaminants that are then ingested by marine microorganisms, thus entering the food chain and threatening the survival of marine organisms through bioconcentration.

In addition, industrial pollution contributes to the acidification of the oceans. According to UNESCO, each year between 300 billion and 500 billion kilos of heavy metals, toxic sludge, solvents and other dangerous waste are dumped into the seas by industrialists around the world. This represents an average of 12,700 kilos of pollutants every second that infect the waters.

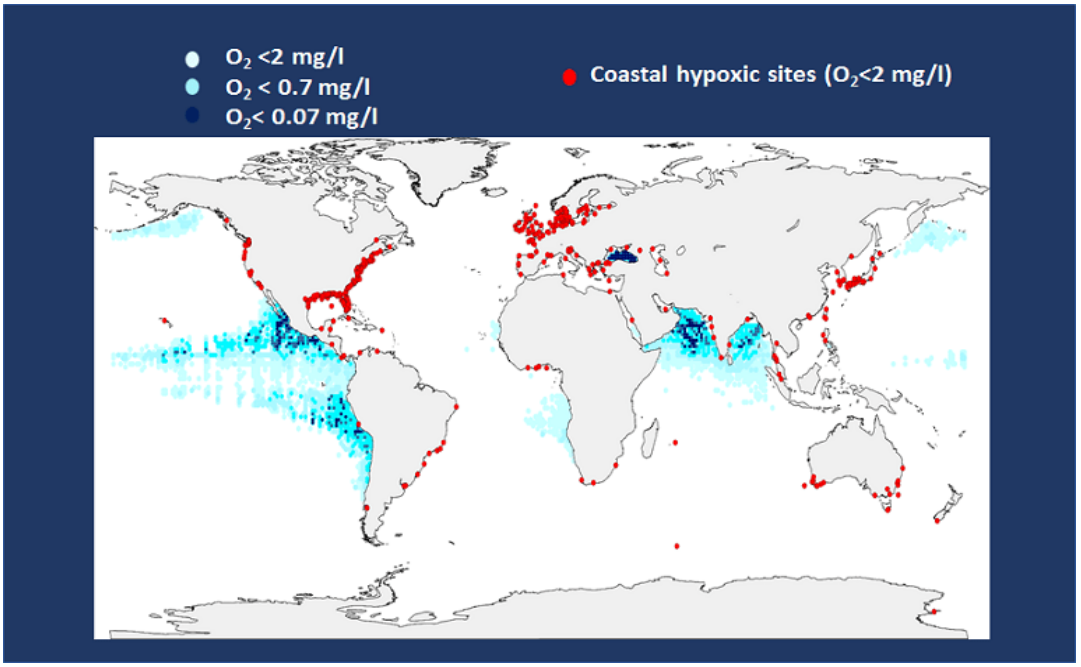
2. The destabilisation of the ocean

a. Warming

Warming is a phenomenon caused by the absorption of solar energy by the ocean, which has a heat capacity about 1000 times that of the atmosphere and can therefore cool or warm very slowly. The excess heat generated by human activities through the greenhouse effect is absorbed 93% by the ocean, which mitigates the temperature rise in the atmosphere. This heat is now reaching the deep sea and polar regions, endangering hundreds of species that are not adapted to higher temperatures. It also impacts the thermohaline circulation of ocean currents.

b. Deoxygenation

Deoxygenation is a phenomenon caused by the increase in water temperature (warm waters contain less oxygen than cold waters) and the eutrophication of coastal areas (the appearance of invasive algal blooms, a chemical phenomenon that denatures organic matter to produce salts and other harmful substances that can become gaseous. In addition, these algal blooms require a high oxygen supply). The result is an increase in oxygen-free ocean areas (4 times more than in 1960) and a possible loss of 3 to 4% of the oxygen in the oceans by 2100.

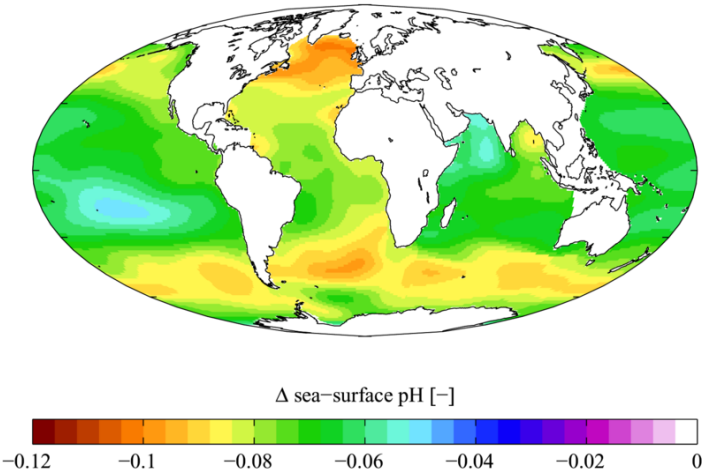


Map of hypoxic or dead zones (containing less than 2 milligrams of oxygen per litre) from a study by the "Smithtonian Environmental Research Center" and published in the journal "Science"
At less than 2 mg/L, fish have serious respiratory difficulties and, below 0.2 mg/L, it is anoxia (death of marine beings except for some microorganisms).

The consequences of oxygen depletion in the oceans include a loss of biodiversity (hypoxia of marine life), changes in species distribution, displacement or reduction of fisheries resources and expansion of algal blooms.

c. Acidification

Acidification is a phenomenon due to the absorption by the ocean of 30% of the CO_2 generated by human activities. It is then transformed into carbonic acid, resulting in an increase in hydronium and hydroxide ions, which are responsible for acidification, and a decrease in hydrogen carbonate ions, which are essential elements for marine plants and animals to build their skeletons and other calcareous structures.

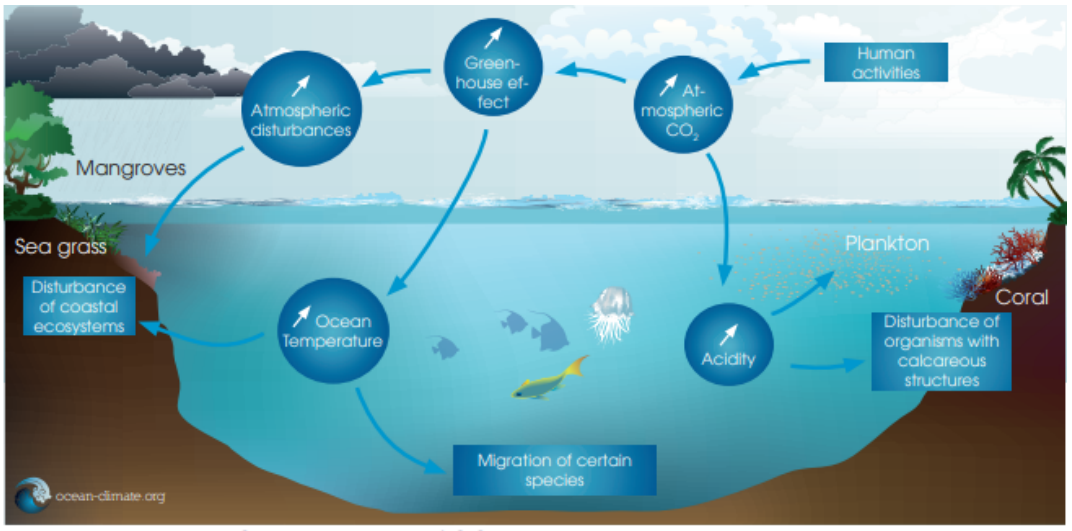


Map of pH variations from the pre-industrial era (1700s) to the 1990s. In general, the pH of the oceans has decreased, which corresponds to an acidification of the sea water.
Map from the "Global Ocean Data Analysis Project"

3. Marine ecosystems in distress

These ocean changes cause a multitude of changes for marine organisms.

➔ Rising temperatures induce variable behaviour in different species: some adapt to temperature changes, and others migrate towards the poles or to new areas. Others disappear, such as certain corals that can bleach and die quickly due to a breakdown in the symbiosis with the single-celled algae they harbour and which contribute to their food.



Consequences of CO_2 increase on the ecosystems

Diagram of the impact of human activities on marine biodiversity from the "Ocean & Climate Platform"

- ➔ Ocean acidification has a direct impact on marine organisms with a calcareous skeleton or shell: phytoplankton, crustaceans, molluscs, etc. These have difficulty structuring and regenerating their calcareous skeleton or shell, which makes them more vulnerable.
- ➔ Exceptional climatic events impoverish natural environments through erosion and flooding, for example. They alter the conditions for marine life in coastal areas, particularly in certain coastal habitats such as mangroves and seagrass beds, which are not only conducive to the reproduction of species but also the capture of CO_2. This contributes to deoxygenation, hypoxia of certain areas, eutrophication of the water and invasive algal blooms.

Industrial pollution causes intoxication to marine organisms that ingest toxic substances. Indeed, heavy metals such as cadmium, mercury, lead or chromium are found in the tissues and skeletons of fish. This can cause problems for human health when fish is eaten, as was the case with Minamata disease in Japan (seafood contaminated with mercury). Hydrocarbons, during degassing and deballasting, mean the emptying of oil tanks and the discharge of this water into the oceans, which is also a cause of fish contamination.

Agricultural pollution releases substances full of nutrients (phosphates, nitrates, etc.) which contribute to the pollution of fresh or salt water and accentuate the eutrophication of the coast.

The addition of these various sources of pollution constitutes a destabilising factor for the ocean, modifying its main parameters: temperature, acidity and oxygen levels. This, therefore, impacts the organisms that live there: marine ecosystems are forced to adapt or disappear, causing the extinction of hundreds of species.

RELEVANT UN TREATIES AND EVENTS

1975

London Convention (here) for the prevention of marine pollution by dumping of wastes
→ Important articles: 1-2-4 (regulations concerning the dumping of waste)

1982

United Nations Convention on the Law of the Sea (here), which, among other things, provides for the delimitation of the world's waters into different maritime zones.
→ Important articles: Part XII (Protection and Preservation of the Marine Environment), including articles 192-193-194 (general obligations) and articles 207-212 (international regulations and domestic law against pollution).

2015

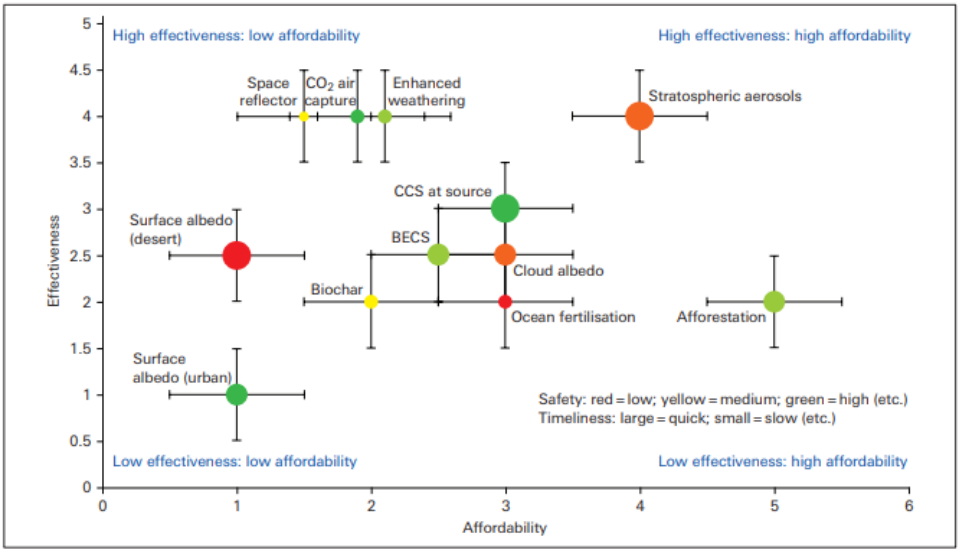
Sustainable Development Goals (SDGs) – 14 (here), UN goals to be achieved by 2030, including Goal 14 to conserve and sustainably use the oceans and seas.

2021

The Decade of the Ocean (2021-2030) – 1&2 (here), bringing together a series of goals to preserve ocean resources and develop ocean science.

POSSIBLE SOLUTIONS

➻ Combating greenhouse gas emissions to combat ocean acidification, warming and deoxygenation using geoengineering techniques presented in this table. However, only carbon capture and storage (CCS) could affect the levels of CO_2 in the atmosphere and thus the changes in the ocean.



Options represented by green dots are safer than options indicated by red dots. The size of the dot is proportional to the response time (large size means the option is quickly feasible and effective, small size means it is not). The black bars indicate the degree of uncertainty regarding cost (x-axis) and effectiveness (y-axis). Diagram taken from the article "Geoengineering the Climate" in "The Royal Society"

➻ Raise awareness of the problems caused by the environmental crisis as early as possible and, more generally, continue to promote the use of renewable energies and make every effort to reduce the global production of greenhouse gases.

➻ Create protected areas free of human activities (except shipping) in International Waters to preserve marine biodiversity.

➻ Regulate waste and pollution by country by introducing maximum quotas on heavy metals, hydrocarbons, chemical substances, etc. to move towards the total elimination of their use.

➻ Set up laboratories and groups of experts in ocean sciences in each country bordering a marine area to measure and observe the variations of the different water parameters (salinity, acidity, temperature...).

➻ Use the NGO Mercator's Digital Ocean Twin, which is a digital copy of the ocean on which we can test the effects of climate and disaster scenarios on the ocean system, as well as the

effectiveness of mitigation and adaptation plans. It would also allow us to monitor and preserve marine and coastal habitats.

Questions to consider:

1. Does my country have a strong agricultural/industrial sector responsible for a significant amount of greenhouse gas emissions and/or waste?
2. Does my country have a large Exclusive Economic Zone with a wide variety of marine ecosystems to protect?
3. Does my company/NGO work to preserve marine ecosystems despite its activities, economic or otherwise?
4. Does my country work in cooperation with specialised scientists on environmental projects to best protect marine ecosystems?

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1. Definitions

➔ Marine pollution - Wikipedia (wikipedia.org) (definition marine pollution)

➔ Ocean acidification - Ocean & Climate Platform (ocean-climate.org) (definition of ocean acidification)

➔ Marine ecosystems | National Geographic Society (definition of marine ecosystems)

➔ Biodiversity in the ocean | World Ocean Observatory) (definition and explanation of biodiversity)

➔ Oceans and the Law of the Sea | United Nations (general explanation of ocean issues and the law of the sea)

2. Conventions, reports and objectives

➔ World Ocean Science Report (unesco.org) (UNESCO report)

➔ Convention on Biological Diversity (un.org)

➔ Goal 14 Sustainable Development (un.org) (one of the United Nations Sustainable Development Goals)

➔ London Convention on the Prevention of Marine Pollution by Dumping of Wastes (admin.ch)(un.org)

➔ Convention on the Law of the Sea (un.org)

➔ Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (imo.org) (International Maritime Organisation convention)

- ➔ Ocean report | CMEMS (copernicus.eu) (annual ocean report of the European Copernicus organisation)

- ➔ The Decade of the Ocean: Challenges for Collective Impact (oceandecade.org) (objectives of the Ocean Decade 2021-2030)

- ➔ Oceans and Law of the Sea (un.org) (United Nations site on the sea and law of the sea with links to several conventions)

- ➔ Chapter 5: Changing Ocean, Marine Ecosystems, and Dependent Communities (ipcc.ch) (IPCC Special Report on the Ocean)

3. Additional references

- ➔ Resources - Ocean & Climate Platform (ocean-climate.org) (educational and scientific fact sheets addressing several ocean issues including acidification, deoxygenation...)

- ➔ Marine pollution explained | National Geographic

- ➔ IOC-UNESCO | IOC UNESCO (site of the UNESCO Oceanographic Commission)

- ➔ IUCN Global Ecosystem Typology 2.0 (iucn.org) (annual report of the International Union for Conservation of Nature with a detailed description of all marine ecosystems → pages 131-170)

- ➔ Biodiversity and oceans - Foundation for research on biodiversity (fondationbiodiversite.fr) (environmental issues between biodiversity and oceans)

- ➔ Addressing Land-Based Pollution | UNEP - UN Environment Programme (UNEP article on land-based pollution discharged into the sea)

- ➔ Marine Biodiversity and Ecosystems Underpin a Healthy Planet and Social Well-Being | United Nations (UN article showing the importance of marine biodiversity in several aspects)

Videos :

- One Planet, One Ocean: Mobilizing Science to #SaveOurOcean
- Ocean Decade Challenge 1: Understand and beat marine pollution
- Ocean Decade Challenge 2: Protect and restore ecosystems and biodiversity
- The Ocean & Climate Platform's recommendations for the Ocean during climate negoti...