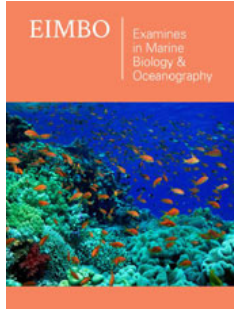




Impacts of Climate Change on Oceans and Marine Species

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Abstract

There are different effects of climate conditions on oceans and marine environment, most effects are negative, while there are some positive effects of these changes. Climate changes affect the oceans and marine species due to rising CO₂ levels, increased water temperatures, and low oxygen levels. The most negative effects are changes in water acidity, increased frequency and severity of marine events, and changes in the timing of seasonal events like reproduction and transition to the permanent habitat. Climate change poses significant risks to commercial fisheries, decreases the size and distribution of marine species, and affects life cycle events. Therefore, an effective strategy is required to protect oceans and the marine environment and reduce the negative impacts of climate change on fisheries and oceans.

Keywords: Fisheries; Marine environment; Oxygen levels; Rising CO₂ levels; Water temperatures

Background

Increasing human activities in the marine environment and rising carbon dioxide emissions, cause negative impacts on marine life and oceans. Climate change is a complex problem, and it affects benthic communities in the oceans, which play an important role in preserving the marine environment. Therefore, it is necessary to understand how they respond and the extent of their adaptation to climate change. Climate change affects the ocean in different ways, it could modify the ocean ecosystems, which leads to severe extreme marine events, and affect various marine organisms. The increase in carbon dioxide and rising temperatures are the most common climate change factors that affect the ocean's benthic and marine environment [1].

These factors directly affect the biotic and abiotic components and change the distribution and abundance of benthic species in response to water temperature change, e.g., in the Atlantic Ocean. Furthermore, climate changes increase storm severity and loss of habitats for various marine organisms. It causes hazards for the reproduction output and the availability of food for larvae, the plankton availability, and thus the number of marine species [2]. Rising CO₂ emissions affect the ocean and marine fauna in different ways, such as warming, low oxygen rates, and increased acidification [3]. Due to the ongoing climate changes, its effects on the oceans and marine environment must be noted under changing climatic conditions. Our review focuses on the impacts of climate change on ocean cycles and their impact on the sustainability of various marine organisms.

Main Effects in Oceans and Marine Environment

Climate change causes different negative impacts on the oceans and marine biological processes that include:

- a) **Warming:** The increase in greenhouse gases in the atmosphere leads to the trapping of more solar energy, and due to the expansion of the ocean's water surface, it absorbs

much of this energy, causing the water temperature to rise, which in turn contributes to a rise in sea level [4].

b) **Acidification:** As a result of increased carbon emissions, the oceans absorb larger amounts of carbon dioxide from the atmosphere, which leads to an increase in the acidity of the water due to changes in the pH of the oceans, which negatively affects the activity of various marine organisms [5].

c) **Low oxygen level:** It is known that high water temperatures reduce the oxygen levels, thus affecting the ability of fish to grow and reproduce [6].

Disorders of climate change

Furthermore, there are other disorders of climate change on the oceans and marine organisms, particularly:

- a. Changing ecosystems in the oceans
- b. Acceleration of hazardous marine events
- c. Impact on habitats and fisheries

Ocean acidification effects

The oceans are considered the main sink for fixing atmospheric carbon dioxide, as they absorb the majority of emission of carbon dioxide, consequently, the increasing emission of carbon dioxide causes increasing acidification of ocean waters [7]. Ocean acidification indicates a decrease in pH value due to increasing the concentration of hydrogen ions released during the dissolution of carbon dioxide in ocean water, which leads to an increase in the acidity of the water. Therefore, the continuous different human activities and increasing carbon dioxide in the atmosphere, negatively affect Oceans and the marine environment [8].

Impacts on Marine Fisheries

Climate change poses significant risks to commercial fisheries and affects the size and distribution of marine species. Furthermore, it has changed the habitats of some species to new proper climatic conditions, such as pollock and cod which move northern to colder waters when local ocean temperatures rise [9]. The movement of marine species to new areas leads to disturbances in the biological balance and the deterioration of ecosystems. It also leads to the relocation of fishing areas, which increases fuel consumption and emitted carbon emissions, as well as increased fishing costs and rising prices for marine products. However, there is a positive impact of climate change, as it provides new opportunities in some cases to increase the diversity in new habitats, which provides new fishing opportunities and economic growth for new areas, for instance, in the case of the Bering Sea, where increased water temperature prompted marine species to migrate north, consequently improve biological diversity and growth the fishing sector in this region [10]. Rising water temperatures, acidification, and low oxygen levels contribute, along with ocean cycles, to the formation of extreme marine events that harm marine ecosystems, leading to the appearance of dead zones and coral bleaching, which are expected to become more common and severe [11]. For instance, a severe heatwave collapsed crab fisheries and starved

young sea lions on the Northwestern coast of the Pacific Ocean [12].

Life Cycle Events and Climate Change

Climate conditions affect the life cycle events of species that are greatly dependent on climate-related factors such as temperature, e.g., life cycle events include main steps, reproductive output, recruitment and post recruitment development, larval transport and settlement in the habitat. Therefore, there is a vital role for the life cycle events in preserving diversity and benthic community structure. Previous studies reported that marine plankton is highly sensitive to rising sea temperatures and directly affects the life cycle of various benthic species, particularly during the early stages of their life cycle [13]. The life cycle of marine species correlates greatly with climate factors, especially temperature, therefore changing temperatures may significantly limit reproduction. Various biotic and abiotic factors affect the steps of the life cycle, either directly, such as physiological responses, or indirectly (such as changes in nutritional interactions).

Strategy to Dealing with Climate Change

Reducing the negative impacts of climate change on oceans and the marine environment strongly requires a proper strategy to protect oceans and fisheries. this strategy includes numerous steps as follows:

- a) Changing dangerous fishing policies and practices to avoid overfishing and sustaining the marine environment to adapt fisheries. Government agents and fishermen's organizations must protect the marine environment, sustain fisheries, and encourage using sustainable management techniques and practices.
- b) **Diversification of fisheries:** By establishing an aquaculture system for fish and other marine organisms to diversify fishing sources, protect natural habitats, and improve the ability of marine fauna to face climate change.
- c) **Rationalizing energy use:** This contributes to reducing carbon emissions, which reduces the rise in ocean temperature and controlling water acidity.
- d) Avoid excessive use of skincare products, such as moisturizers and sunscreen, which contain chemicals that harm marine ecosystems.
- e) Protecting coral reefs, by reducing damage during diving and snorkelling, caring during anchors use to avoid destroying coral reefs and the seabed, and using fishing methods that do not harm coral reefs and seagrass beds.
- f) Rationalization of consumption, sustainably consumed seafood and fish, contribute to the marine ecosystems preservation and changing the policy of fishing and eating of marine organisms.
- g) Marine biologists predict that by 2040, some sensitive marine ecosystems such as coral reefs will be threatened with extinction or may have been lost, with other unforeseen consequences [14].

Conclusion

Climate change over recent decades, as a result of increased gaseous emissions, has led to rising temperatures, increased ocean acidity, rising sea levels, and increased ocean acidity, which has negatively affected the marine environment and ocean cycles. Reducing the negative impacts of climate change on oceans and the marine environment strongly requires a proper strategy to protect oceans and fisheries. Therefore, wise steps are urgently required to protect oceans and marine life from the adverse effects of climate change, including, changing dangerous fishing policies and practices to avoid overfishing, diversity of fisheries, rationalizing energy use, avoiding excessive use of skincare products, protecting coral reefs, and rationalization of consumption of marine species.

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