



Impacts of Climate Change on Marine Biodiversity: Challenges and Conservation Strategies

Graciela Husser*

Department of Biotechnology, Hanoi National University of Education, Vietnam

*Corresponding author: Graciela Husser, Department of Biotechnology, Hanoi National University of Education, Vietnam, E-mail: gracielahuss@hnu.vn

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Abstract

Climate change is one of the most significant threats to marine biodiversity, causing shifts in species distribution, habitat loss, and altered ecosystem functioning. Rising sea surface temperatures, ocean acidification, and deoxygenation are driving unprecedented changes in marine environments. This article examines the key impacts of climate change on marine biodiversity, focusing on coral reefs, fisheries, and marine mammals. It further discusses conservation strategies such as marine protected areas (MPAs), habitat restoration, and climate-resilient fisheries management to mitigate biodiversity loss and maintain ecosystem services.

Keywords: Climate change; Marine biodiversity; Ocean acidification; Coral reefs; Conservation strategies

Introduction

Marine ecosystems are critical for global biodiversity, supporting millions of species and providing vital services, including food, climate regulation, and livelihoods. However, climate change has emerged as a major driver of biodiversity loss in the oceans. Key stressors such as increased sea temperatures, rising sea levels, ocean acidification, and reduced oxygen levels are altering marine habitats and species distributions. Understanding the extent of these impacts is essential for developing strategies to protect and restore marine biodiversity [1].

Description

Climate change has far-reaching implications for marine biodiversity:

Rising sea temperatures: Elevated ocean temperatures cause coral bleaching, disrupt fish migration patterns, and alter breeding cycles in many marine organisms. Coral reefs, home to nearly a quarter of all marine species, are particularly vulnerable.

Ocean acidification: Increased carbon dioxide (CO₂) absorption

by oceans reduces pH levels, impairing the ability of calcifying organisms, such as corals, mollusks, and certain plankton, to build their skeletons and shells [2].

Sea level rise: Coastal habitats, including mangroves, salt marshes, and seagrass meadows, are being submerged or eroded, leading to habitat loss for species that depend on these areas for breeding and feeding.

Deoxygenation: Warming waters hold less oxygen, creating hypoxic zones that can lead to massive marine die-offs and reduced biodiversity.

Food web disruption: Changes in plankton communities affect the entire marine food chain, from small fish to apex predators, influencing productivity and resilience [3].

Results

Studies indicate that approximately 60% of coral reefs worldwide are under threat due to climate change and related stressors. Ocean acidification is projected to increase by 100–150% by the end of the 21st century, significantly affecting marine calcifiers. Climate-induced shifts in fish distribution have already impacted global fisheries, with tropical nations experiencing reduced catches. The Arctic, warming at twice the global average, has seen a notable decline in ice-dependent species such as polar bears and walrus [4].

Discussion

Climate change affects marine biodiversity at multiple levels, from genes to ecosystems. Mitigation strategies must address both global and local drivers of change. The establishment of Marine Protected Areas (MPAs) has shown promise in enhancing resilience by reducing additional human pressures such as overfishing and habitat destruction. Restoration projects, such as coral gardening and mangrove planting, are effective in rehabilitating degraded habitats. Furthermore, adopting climate-resilient fisheries management can ensure sustainable harvests in changing conditions. Collaboration between nations is essential, given the transboundary nature of marine ecosystems. Integrating climate change considerations into marine policy frameworks can strengthen conservation outcomes. Public awareness campaigns and citizen science initiatives can also contribute to monitoring and protecting marine biodiversity [5].

Conclusion

Climate change poses a severe threat to marine biodiversity, necessitating urgent global action. Mitigation measures must focus on reducing greenhouse gas emissions, protecting vulnerable habitats, and promoting adaptive management strategies. With comprehensive conservation efforts, it is possible to enhance the resilience of marine ecosystems and safeguard the biodiversity that sustains human well-being.

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