Major Threats to Marine Ecosystem- A Global Issue

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OPEN ACCESS

Keywords

Climate Change, Overexploitation, Pollution

How to cite this article:

Janshi, T., Pinak, B. and Kishan, S. 2023. Major Threats to Marine Ecosystem- A Global Issue. *Vigyan Varta* 4(9):110-113.

ABSTRACT

Due to human activities exerting more pressure on the ocean environment, it poses a significant danger to the long-term survival of marine species and ecosystems, resulting in a decline in marine biodiversity. The world's marine ecosystems face numerous significant threats that jeopardize their health and stability. Among these threats, climate change, overfishing, and pollution emerge as primary concerns. Climate change contributes to rising sea temperatures, ocean acidification, and sea-level rise, leading to detrimental impacts on marine habitats and biodiversity. Overfishing disrupts the delicate balance of marine food chains, depleting fish stocks and undermining the overall health of aquatic ecosystems. Pollution, specifically plastic pollution, carbon pollution, and oil spills, further exacerbate the degradation of marine environments, causing harm to marine organisms and their habitats. This article provides an overview of these major threats and highlights the urgent need for collective action to conserve and protect our marine ecosystems for future generations.

INTRODUCTION

None of the Earth's surface is land—it's all oceans. We need healthy oceans for a healthy planet. But they're in danger. Human activities and climate change are causing problems for marine ecosystems. Water bodies worldwide have suffered irreversible damage due to continuously increasing pollution levels. Studies show that 80% of marine pollution comes from different forms of pollutants that originate on land,

mainly because of various human activities. Yet, they face threats.

These are the challenges confronting our marine ecosystem.

1. **Pollution**

Oil Spills: The main source of maritime pollution, oil spills, must be mentioned in any discussion of the marine environment. The primary cause of oil toxicity lies in aromatic hydrocarbons, specifically polycyclic aromatic hydrocarbons (PAHs). These compounds have a strong affinity for DNA and protein, low solubility in water, a preference for lipids, and significant persistence. Even at low concentrations, exposure to marine organisms can lead to carcinogenic effects and long-term chronic consequences. The potential impact on marine life could be catastrophic since mangroves serve as the juvenile habitat of the marine ecosystem. Mangrove ecosystems are highly vulnerable to harm caused by significant oil spills. When oil is discharged into coastal waters and subsequently reaches the shore, it settles on sediments that envelop the delicate and crucial fine-feeding roots of mangrove trees. Once deposited, the oil firmly binds to the oleophilic surfaces of plants and rarely dislocates. It envelops the respiratory surfaces of mangrove roots, stems, seedlings, and the adjacent sediment, as well as the fauna residing in burrows and root hollows. When smothered by oil, smaller plants and animals typically perish within a few days. In contrast, taller mature trees and vegetation, which are only affected by their exposed roots and surrounding sediments, may persist for approximately six months or longer before succumbing to the damage. Mangrove forests, along with organisms that filter-feed like corals and various crustaceans and mollusks, require special attention. Crabs are primarily impacted by oil toxicity when it coats their surfaces, suffocates them, and when they consume sediments contaminated with oil. These conditions result in the entanglement and blockage of their gills, as well as reduced feeding. Excessive oil coating on a crab's body has adverse effects, including impaired physiological functions and behaviors, disruption of their ecological roles, and the potential transfer of toxins to crab predators. Extensive studies have documented high mortality rates among oil-exposed crabs, with surviving individuals experiencing compromised movement and digging abilities. Among mollusks, mussels and other bivalves accumulate oil over extended periods through their filter feeding via the gills. Prolonged oil accumulation leads to developmental setbacks and DNA damage within 48 hours of exposure, with a significant increase in such impairment observed by the 72-hour mark. The cellular immunity of mussels is also disrupted by these oil-induced effects.(Seveso et al., 2021)

Carbon Pollution: Carbon pollution is the most detrimental pollutant to the ocean. Nearly 30 percent of the carbon dioxide released by industrial activity during the past ten years has been absorbed by the ocean. The ocean life it supports, from small snails that feed salmon to coral reefs that attract tourists, is affected when carbon dioxide is absorbed by seawater. The quantity of black carbon released by ships may significantly affect the climate. The pollutant, a mixture of varying size of particles and oil droplets, is the second-largest contributor to global warming, behind carbon dioxide. Diesel engines, such as those in ships, account for around one-fifth of the world's black-carbon emissions, according to a study published in 2013. (Bond, T. C. et al., 2013)

Black-carbon particles grab other pollutants, such sulfuric acid and heavy metals, as they move through the atmosphere, making the pollution harmful to breathe in. One area of special concern is the rapidly melting Arctic. The region's shipping traffic is projected to increase in the coming decades, as sea ice

recedes a thaw that could be exacerbated by particles of black carbon, which quickly melting when they land on snow and ice.

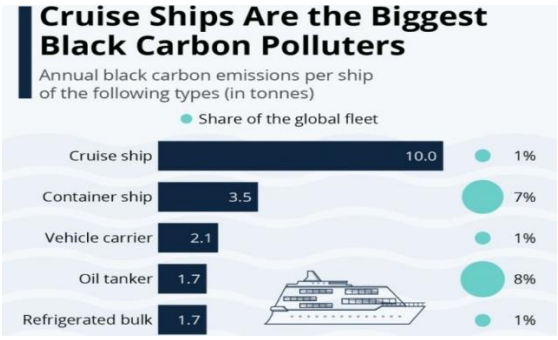
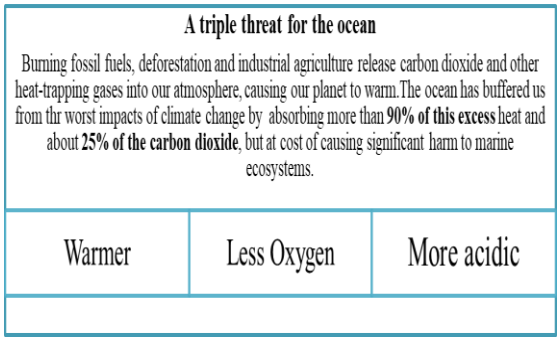


Figure 1 Source: Comer et al. (2017) via European Maritime Transport Environmental Report 2021

Plastic Pollution: Human populations worldwide are utilizing the oceans as their personal dumping grounds, and one of the detrimental elements they introduce is microplastics. These microplastics, which are particles smaller than 5 mm in size, not only contaminate coastlines but also bodies of freshwater on a global scale. Essentially, microplastics are minuscule plastic granules employed in various applications such as cosmetics, hand cleansers, and air-blasting. These contaminants pervade virtually every marine environment today. The inherent durability of plastics renders them highly resistant to degradation, enabling their entry into the aquatic ecosystem through unregulated disposals. This issue has garnered increasing scientific concern due to the ease with which these tiny particles can be accessed by a wide variety of aquatic organisms, subsequently making their way through the food chain. Accumulation of microplastics in the cells and tissues of marine organisms leads to chronic biological effects. Furthermore, ingesting microplastics presents potential hazards to human health, as it can result in chromosomal alterations leading to infertility, obesity, and cancer. Given the recent threat microplastics pose to marine life and human well-being, it is crucial to curtail the excessive usage of plastic additives and implement legislation and policies to regulate the sources of plastic waste. Adopting diverse plastic recycling processes and launching awareness initiatives through various social and informative media platforms will enable us to restore cleanliness to our marine dumping grounds in the future.

Climate Change



***Source: IPCC, 2019: Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC)**

Climate change can have adverse effects on marine ecosystems by causing ocean warming, altered thermal stratification, reduced upwelling, sea-level rise, increased wave height and frequency, diminished sea ice, heightened risk of diseases in marine organisms, and decreased pH and carbonate ion concentration in surface oceans. The acidification of seawater expected in the coming century could potentially influence the speciation of nutrients. The decline in upwelling, deep-water formation, and increased stratification of the upper ocean will decrease the supply of vital nutrients to sunlit regions, leading to reduced productivity. In coastal areas and margins, increased thermal stratification may result in oxygen depletion, habitat loss, biodiversity decline, species distribution alterations, and overall ecosystem impact. Changes in rainfall and nutrient runoff from land could exacerbate these occurrences of oxygen deficiency. The impacts of climate change on the oceans are now widely acknowledged, and polar bears are among the species most vulnerable to the reduction of sea ice. Due to habitat loss and declining habitat

quality, the polar bear population is estimated to decrease by approximately 30%.

2. Overexploitation

Excessive fishing frequently causes significant disruptions to ecosystems and has been identified as a catalyst for shifts in ecosystem patterns. In terms of exerting pressure, overfishing has adverse implications for various indicators of oceanic well-being, encompassing biodiversity, food security, and the prosperity of coastal communities and economies. The direct consequences of overfishing involve the depletion of fish biomass, which affects biodiversity and the viability of fisheries, while also exacerbating the detrimental effects of destructive fishing equipment on marine ecosystems (such as bottom trawls). Moreover, when overfishing is a result of illegal, unreported, or unregulated fishing, these fishing operations often employ highly damaging gears, like bottom trawls, which have a negative impact on the benthic substrate.

Current estimates suggest that approximately 40% to 70% of fish populations in European waters are presently in an unsustainable state, with either overfishing occurring or reaching their minimal biomass thresholds (Gras et al., 2023). By way of contrast, certain fish populations in the northern European region are experiencing more favourable conditions. For instance, fish stocks in the Norwegian Sea and Barents Sea are faring well. These waters have a history of effective fisheries management, resulting in some fish populations reaching the maximum sustainable yield (MSY) (Gullestad et al., 2014).

CONCLUSION

The major threats to marine ecosystems, including climate change, overfishing, and pollution (specifically plastic pollution, carbon pollution, and oil spills), pose significant risks to the health and sustainability of our oceans. limate change contributes to adverse effects such as rising temperatures, ocean acidification, and sea-level rise, which disrupt marine habitats and biodiversity. Overfishing disrupts marine food chains, leading to the depletion of fish populations and a decline in overall ecosystem health. Pollution, including plastic pollution, carbon pollution, and oil spills, further exacerbates the degradation of marine environments, causing harm to marine organisms and their habitats. pose significant risks to the health and sustainability of our oceans. Urgent and collective action is necessary to mitigate these threats and preserve our marine ecosystems for future

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