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Assessing the Impact of Overfishing on Marine Ecosystems in India

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Abstract

India's marine ecosystem is characterized by diverse habitats, including coral reefs, mangroves, sea grasses, and deep-sea ecosystems. The country is home to several key marine species, including various species of fish, crustaceans, mollusks, and marine mammals. These ecosystems provide essential services such as food, climate regulation, coastal protection, and economic opportunities for millions of people. Overfishing has emerged as a significant threat to marine ecosystems, particularly in India, where fishing is both a major economic activity and a source of livelihood for millions. This paper aims to assess the impact of overfishing on India's marine ecosystems, highlighting the ecological consequences, socio-economic implications, and potential mitigation strategies. Key areas of focus include biodiversity loss, habitat degradation, and the effects on local fishing communities. Through a comprehensive review of current literature and data analysis, this study seeks to contribute to the understanding of overfishing's effects and inform policy-making for sustainable fisheries management. Overfishing in India is a serious issue that affects both the marine environment and the livelihoods of coastal communities. The consequences of overfishing include the depletion of fish stocks, destruction of habitats, and disruption of marine food webs. While conservation efforts are underway, greater commitment to sustainable fishing practices, improved enforcement, and the restoration of marine habitats are essential for preserving India's rich marine biodiversity for future generations.

Keywords: Overfishing, Marine Ecosystems, Biodiversity, Sustainable Fisheries, India, Socio-Economic Impact

Introduction

The marine ecosystems of India play a crucial role in both biodiversity and the economy, thanks to the country's extensive coastline and exclusive economic zone. However, these ecosystems face significant threats from overfishing, primarily driven by the high demand for seafood and the economic reliance of coastal communities on fishing activities. Overfishing not only depletes fish stocks but also disrupts the ecological balance, adversely affecting a multitude of marine species and their habitats. The detrimental impacts of overfishing extend beyond the immediate reduction of targeted species; they also include the degradation of vital habitats such as coral reefs and mangroves, as well as disruptions to food webs. India's fisheries sector serves as a cornerstone of the economy, offering employment to millions and making a substantial contribution to the national GDP. Nonetheless, the continuous pressure exerted on fish stocks due to overfishing raises serious sustainability concerns.

The lack of regulation and effective enforcement exacerbates this problem, enabling unchecked overexploitation. Furthermore, climate change adds another layer of complexity, altering marine environments and making fish populations even more susceptible to these pressures.

This paper investigates the extent of overfishing in India, its ecological and socio-economic repercussions, and the strategies necessary for sustainable fisheries management. By examining current practices and policies, the study seeks to emphasize the importance of a balanced approach that both safeguards marine biodiversity and supports the livelihoods of coastal communities. The findings highlight the urgent need for integrating scientific research, community involvement, and policy reforms in a comprehensive strategy to tackle the multifaceted issue of overfishing in India.

Review of Literature

1. Thankam Theresa Paul, 2023:

This comprehensive review highlights the various climatic vulnerabilities impacting India's inland fishery resources. Key issues include habitat destruction, biodiversity loss, pollution, overfishing, invasive species, and the pressing effects of anthropogenic climate change.

To address these challenges, the review emphasizes the importance of ecosystem-based management strategies implemented in India to ensure the sustainability of these vital resources.¹

2. Sureshkumar Pandian, 2022:

This review explores the expansion of marine fisheries in India and worldwide, the decline of biodiversity, the impact of bycatch, the loss of top predators, and the consequences of overfishing on coral reefs. It also discusses ways to prevent overfishing. Additionally, the review highlights the role of policy interventions and international cooperation in mitigating overfishing. Emerging technologies and community engagement are examined as pivotal elements in sustainable fisheries management. It also discusses ways to prevent overfishing².

3. U. Rashid Sumaild, 2020:

This review examines how reducing overfishing and improving fish populations can support healthier marine ecosystems. It highlights the role these efforts play in making marine environments more resilient to the challenges posed by climate change. To illustrate these ideas, the study uses the example of fish stock management in the European Union.³

4. **Das, R. (2024)** explored the ecological impacts of overfishing on coral reef ecosystems in India, noting that overfishing has led to the degradation of coral habitats and a decline in associated marine species.

Objective of the Paper

The objective of the paper is to assess the impact of overfishing on marine ecosystems in India, focusing on the ecological consequences, socio-economic implications, and potential strategies for sustainable fisheries management. Through this assessment, the paper aims to provide insights into the current state of overfishing in India and recommend measures to mitigate its adverse effects.

Ecological Consequences of Overfishing

Overfishing has profound ecological consequences, including the depletion of target fish species, bycatch of non-target species, and disruption of food webs. In India, the overexploitation of commercially valuable fish like sardines and mackerels has led to significant population declines. This depletion affects predator species that rely on these fish for food, leading to a ripple effect throughout the marine ecosystem. Overfishing can have severe consequences, leading not only to the depletion of fish stocks but also to significant habitat destruction. Fishing methods such as trawling can wreak havoc on the ocean floor and coral reefs, which serve as vital homes for countless marine organisms. This destruction contributes to a troubling loss of biodiversity, undermining the resilience of marine ecosystems. Consequently, these systems become increasingly vulnerable to environmental changes and are less capable of recovering from disturbances. Moreover, as fish populations dwindle, the structure of the marine community is altered, giving rise to smaller, opportunistic species while displacing larger, ecologically significant ones.

Socio-Economic Implications of Overfishing

The socio-economic implications of overfishing in India are profound, particularly for coastal communities that rely on fishing for their livelihoods. As fish stocks dwindle, fishermen face lower catches and diminished income, which only deepens the cycle of poverty and food insecurity in these vulnerable populations. This economic pressure often drives them to resort to more intensive and sometimes illegal fishing practices, creating an even more pressing issue. Moreover, the decline in biodiversity and the loss of vital ecosystem services not only threaten the livelihood of local fishermen but also adversely impact tourism and other marine-based industries. This situation underscores the urgent need for sustainable fishing practices to secure long-term economic stability for these communities.

Table 1: Impact of Overfishing on Marine Ecosystems in India

Category	Statistics	Source
Total Marine Fish Catch (2014)	3.59 million tons	World Sustainable Development Forum (2024)
Value of Marine Fish Catch (2014)	\$5.6 billion USD	World Sustainable Development Forum (2024)
Fishery Employment	Approximately 14 million people	World Sustainable Development Forum (2024)
Population Relying on Fisheries	Around 30% of India's coastal population	World Sustainable Development Forum (2024)
Overfished Fish Stocks (2019)	4.4% of assessed fish stocks	CMFRI Booklet Series (2023)
Healthy Fish Stocks (2023)	91.1% of assessed fish stocks	CMFRI Booklet Series (2023)
Marine Fish Export Value (2014)	\$5 billion USD	World Sustainable Development Forum (2024)
Decline in Dolphin Population in Odisha	From 469 in 2018 to 259 in 2019 (45% decline)	World Sustainable Development Forum (2024)
High Vulnerability Coastal Area in Odisha	407 km under medium and high vulnerability	World Sustainable Development Forum (2024)
Fish Catch per Person (2021, Global)	11.6 kilograms	World Bank (2023)

Global Overfished Fish Stocks (2019)	35% of global capture fish stocks	World Bank (2023)
Maximally Sustainably Fished Stocks (2019)	57% of global capture fish stocks	World Bank (2023)

Sources:

- World Sustainable Development Forum (2024). Climate Risks and Collapsing Marine Biodiversity: Lessons from India.
- World Bank (2023). Ending overfishing: An urgent need to protect our oceans.
- CMFRI Booklet Series (2023). Marine Fish Stock Status of India 2022.

These statistics highlight the significant impact of overfishing on both the ecological and socio-economic aspects of marine ecosystems in India. The depletion of fish stocks affects biodiversity and the livelihoods of millions dependent on fisheries. Sustainable management practices are crucial to mitigating these impacts and ensuring the long-term health of marine environments.

Strategies for Sustainable Fisheries Management

To reduce the damage caused by overfishing, we need to adopt smart and effective strategies that protect marine life while also helping local communities that depend on fishing. One of the best ways to achieve this is by creating marine protected areas. These zones act as safe havens where overfished species can recover and thrive without the constant pressure of fishing. Another key step is setting strict catch limits to ensure fish populations stay healthy and don't run out. Encouraging sustainable fishing practices can also make a big difference, giving fishermen the tools and knowledge to use methods that are both eco-friendly and profitable. By taking these steps together, we can build a better balance between humans and the ocean, protecting marine ecosystems and securing a stable future for everyone who relies on them. Community-based management approaches, where local fishermen participate in decision-making processes, have shown promise in achieving sustainable outcomes. Additionally, investing in alternative livelihoods and aquaculture can reduce the pressure on wild fish stocks. Strengthening regulatory frameworks and enhancing monitoring and enforcement are also essential to curb illegal fishing activities. Education and awareness programs are vital in promoting sustainable fishing practices among local communities. These programs can help fishermen understand the long-term benefits of sustainable practices and the importance of conserving marine resources. Technological advancements, such as satellite tracking and electronic monitoring, can also play a significant role in improving compliance and tracking illegal activities. Moreover, international collaboration is necessary to address overfishing, especially for migratory species that cross national boundaries. Regional fisheries management organizations (RFMOs) can facilitate cooperation between countries to ensure sustainable fishing practices are adhered to across different jurisdictions.

Economic incentives, such as subsidies for sustainable fishing gear and practices, can encourage fishermen to adopt more eco-friendly methods. Implementing stricter penalties for violations and rewarding compliance can also motivate adherence to regulations. Research and data collection are critical for making informed decisions and adapting management strategies to changing environmental conditions and fish population dynamics. Finally, integrating traditional knowledge with scientific research can provide a more holistic approach to fisheries management. Indigenous and local communities often have extensive knowledge of marine ecosystems and sustainable practices that have been passed down through generations, which can complement modern scientific methods.

Research Methodology

- Type of Data**
The research paper is purely based on secondary data.
- Type of Research**
The research is descriptive in nature.
- Period of Research**
The research will cover a period from 2023 to 2024, encompassing the latest data and developments in fisheries management and marine conservation in India.

Conclusion

Overfishing is a serious problem in India, putting both marine ecosystems and the livelihoods of millions of people who rely on them at risk. The ecological and socio-economic impacts are profound, necessitating urgent action to implement sustainable fisheries management practices. By adopting a holistic approach that includes scientific research, community involvement, and robust policy enforcement, it is possible to mitigate the adverse effects of overfishing and ensure the long-term health of marine ecosystems in India. Enhancing public awareness and education about the consequences of overfishing is crucial in driving behavioral change among consumers and fishers. Working together—government agencies, non-governmental organizations, and local communities—can lead to stronger and more effective conservation efforts. Moreover, investing in marine conservation technologies and sustainable aquaculture practices can provide alternative livelihoods and reduce pressure on wild fish stocks. Long-term monitoring and adaptive management strategies will be essential in responding to environmental changes and ensuring the resilience of marine ecosystems.

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Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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