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Critical Analysis on Marine Pollution and Depletion of Marine Resources

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ABSTRACT

Marine pollution and depletion of marine resources are two major environmental challenges that threaten the health and sustainability of the ocean and its ecosystems. Marine pollution refers to the introduction of harmful substances or energy into the marine environment by human activities, such as plastics, chemicals, nutrients, sediments, noise, and heat. Marine resource depletion refers to the overexploitation or degradation of living and non-living marine resources, such as fish, coral reefs, minerals, oil, and gas. These two issues are interrelated and have negative impacts on marine biodiversity, productivity, ecosystem services, human health, and socio-economic development. This Paper aims to critically analyze the causes, consequences, and solutions of marine pollution and depletion of marine resources from a multidisciplinary perspective. Firstly, this Paper Discusses about the marine pollution and depletion of marine resources, and explains why they are important and relevant issues to study. Secondly, this Paper provides a critical analysis of the causes and consequences of marine pollution and depletion of marine resources. Thirdly, this Paper evaluates the effectiveness and challenges of existing policies and measures to address marine pollution and depletion of marine resources. Fourthly, about the Marine ecosystem services like aquaculture, cultural identity, fishing, shoreline protection, and Tourism and subsistence harvest. Fifthly, this Paper discusses about blue economy in the Indian Ocean, sustainable management of marine resources. Lastly, this paper Concludes by summarizing the main findings and implications of the paper. It emphasizes that marine pollution and depletion of marine resources are serious and urgent problems that require a holistic and collaborative effort from all stakeholders. This Paper provides some recommendations and directions for future research and action on these issues.

Keywords: *Blue Economy, Marine Ecology, Tourism, Marine Resources*

I. INTRODUCTION

When substances such as chemicals, particles, garbage from industry, agriculture, and residences, noise, or the introduction of invasive species have a detrimental or potentially

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hazardous effect on the ocean, that is when water pollution occurs. The majority of pollution in the ocean comes from land. A lot of pollution comes from non-point sources, like dust, wind-blown debris, and agricultural runoff. The ocean can be directly contaminated. Sewage, rivers, and drainages all directly discharge pollutants or hazardous materials into the ocean. This is a common way that minerals and other substances from mining camps wind up in the water.

Additional chemical fertilizers released into the ocean's ecosystem result in decreased oxygen levels, declining plant life, and drastically reduced sea water quality. All aquatic life strata, including plants and animals, suffer serious damage as a result. The deepest ocean tunnels have been penetrated by plastic debris produced by modern human civilization, and large regions of it have gathered on the ocean's surface. It is estimated that there are 5.5 trillion pieces of plastic trash in the world's oceans[2]. There are several sources of plastic litter, but the vast majority comes from land because we regularly use plastics and dispose of our trash improperly. Natural forces, marine species, and bird migration all have an impact on how plastic waste moves and accumulates throughout the complex marine environment, including the food chain and the Plastisphere, after it enters the ocean. The gyres, which are substantial marine current circulation zones, are where much of the plastic debris is concentrated. To learn more about the types of plastic trash in the ocean, ORP has conducted numerous research expeditions in the Atlantic, Pacific, and Arctic Oceans. 2013 saw the conclusion of ORP's first study expedition on marine debris. During this voyage of 70 days at sea, the crew mapped out the eastern half of the North Atlantic garbage patch and collected samples of plastic waste from the ocean. The following year, ORP carried out a second mission to look into micro plastic pollution in the Pacific Ocean. From San Francisco to Yokohama, Japan, ORP's crew sailed nonstop for nearly 6,800 kilometers while gathering micro plastics samples. A number of upcoming expeditions to conduct important satellite validation work are being discussed by ORP with scientists in order to strengthen monitoring of the coverage and abundance of micro plastics in the subtropical gyres. By collaborating across industries, satellite models will be better able to identify high concentration areas that could be the focus of cleanup operations and assess whether land-based material waste management improvements are necessary. Once the resources and gear for these outings are in place, ORP will be able to step up its work in this area and offer a new level of insight into this crucial issue.

[2] Marine Pollution, SCIENCEDIRECT, https://www.sciencedirect.com/topics/earth-and-planetary-sciences/marine-pollution

II. MARINE POLLUTION AND DEPLETION OF MARINE RESOURCES

When dangerous compounds or contaminants are introduced into the marine environment, it is referred to as marine pollution. This has a negative impact on aquatic life and the health of the ecosystem. Industrial waste, sewage, oil spills, plastic waste, agricultural runoff, and atmospheric deposition are a few common causes. The unsustainable exploitation of fish stocks, which causes decreases in their populations and ecosystems, is referred to as depletion of marine resources. Both marine pollution and the depletion of marine resources are serious environmental problems with repercussions for both the environment and human society.

Why they are important and relevant issues to study?

- **Ecosystem Health:** Marine ecosystems, including oceans, seas, and coastal areas, are home to a vast array of species and play a crucial role in maintaining the Earth's overall ecological balance. Pollution and resource depletion can disrupt these ecosystems, leading to habitat degradation, biodiversity loss, and even the collapse of certain species and ecosystems. Healthy marine ecosystems are essential for a thriving planet[3].
- **Food Security:** A substantial portion of the global population relies on seafood as a primary source of protein. Overfishing and resource depletion can lead to the decline of fish populations, which, in turn, threatens food security for millions of people. Sustainable management of marine resources is crucial to ensure a stable food supply for current and future generations.
- **Human Health:** Marine pollution can have direct and indirect health consequences for humans. Contaminated seafood can lead to foodborne illnesses, while toxins released into the marine environment can contaminate drinking water sources and recreational areas, posing health risks to coastal communities.
- **Ocean Aesthetic and Cultural Value:** Oceans and coastal areas have cultural and aesthetic significance for many societies. They provide recreational opportunities, inspire art and literature, and hold spiritual importance for various cultures worldwide. The degradation of marine environments diminishes these values and cultural connections.
- **Global Interconnectedness:** Oceans cover over 70% of the Earth's surface and are interconnected; meaning that pollution and resource depletion in one part of the ocean

[3] James R Karr, Ecological Health, NATIONALACADEMICS, https://nap.nationalacademies.org/read/4919/chapter/8

can have far-reaching consequences, affecting marine life across vast distances. These issues require international cooperation and global solutions.

III. CAUSES OF MARINE POLLUTION

- **Intentional discharge:**

In many parts of the world, manufacturing facilities discharge toxic waste into the ocean, including mercury. Despite being prohibited in the US, sewage nevertheless pollutes the ocean. A particularly difficult problem is plastic garbage, which, according to the Ocean Conservancy, enters our waters in the amount of eight million metric tons annually[4].

- **Oil spills:**

Ships have a significant role in maritime pollution, particularly when there are crude oil spills. Crude oil is challenging to remove from the ocean after it has been there for years.

- **Littering:**

Littering is a common cause of atmospheric pollution, a sort of ocean pollution in which items is blown by the wind to the ocean. It consists of single-use plastics and Styrofoam containers, whose biodegradation can take hundreds of years. Worldwide, an estimated 1 trillion plastic bags are used each year.

- **Ocean Mining:**

Deep-sea ocean mining pollutes and disturbs the ecology at the ocean's lowest depths. Deep beneath the ocean's surface, drilling for minerals including cobalt, zinc, silver, gold, and copper causes poisonous sulphide deposits.

IV. EFFECTS OF MARINE POLLUTION

- **Threat to marine life:**

Ocean pollution frequently kills marine life. For instance, oil spills can trap and drown marine life by seeping through their gills. Seabirds that have oil in their feathers may be unable to fly or feed their young. Animals not killed by crude oil may get cancer, have behavioral abnormalities, or lose the ability to reproduce. As well as becoming entangled in or strangled by plastic bags and abandoned fishing nets, marine creatures also mistake small pieces of plastic garbage for food. Dolphins, fish, sharks, turtles, seagulls, and crabs are among the

[4]Ocean pollution, TEXAS DISPOSAL SYSTEMShttps://www.texasdisposal.com/blog/ocean-pollution-causes-effects-and-prevention/

animals most at risk from marine plastic trash impact[5].

- **Loss of oxygen in seawater:**

There is less oxygen in the water as more trash slowly breaks down over many years, using oxygen in the process. Sharks, penguins, dolphins, and other marine species perish due to low oxygen levels in the water. Oxygen depletion in seawater is also brought on by excess nitrogen and phosphate. A dead zone is an area of the water where very little marine life may survive when there is a significant amount of oxygen deficiency there.

- **Danger to human health:**

Ocean pollution finds its way back to humans. Toxin-eating small organisms are consumed by larger predators, many of which are seafood that humans subsequently consume. Birth abnormalities, cancer, and long-term health concerns can result from the poisons in contaminated animals being deposited in human tissue.

V. INTERNATIONAL CONVENTIONS ON MARINE POLLUTION

- **London Convention on Marine Pollution:**

The London Convention, also known as LC-72, is a non-binding agreement that seeks to end the practice of dumping trash and other garbage from platforms, aircraft, and ships at sea. However, as long as such disposal does not conflict with the objectives of the Convention, it excludes discharges from land-based sources such pipes and outfalls, wastes produced inadvertently during regular vessel operation, and placement of materials for purposes other than simple disposal[6].

- **International Convention for the Regulation of Whaling:**

The International Convention for the Regulation of Whaling is a global environmental agreement that regulates the commercial, scholarly, and subsistence whaling activities of its 59 member nations. It was signed in 1946. This convention created the International Whaling Commission (IWC) to "ensure the correct conservation of whale stocks and, as a result, the orderly development of the whaling industry."

- **ACCOBAMS:**

ACCOBAMS stands for "Agreement on Cetacean Conservation in the Black Sea,

[5]Ocean pollution, TEXAS DISPOSAL SYSTEMS, https://www.texasdisposal.com/blog/ocean-pollution-causes-effects-and-prevention/

[6]Various conventions on marine pollution, GK TODAYhttps://www.gktoday.in/topic/various-conventions-on-marine-pollution/

Mediterranean Sea, and Contiguous Atlantic Area." As a result, there is cooperation to protect cetaceans in the Mediterranean and Black Seas. On the fringes of the Convention for the Conservation of Migratory Species of Wild Animals, it was signed in 1996, and it went into force in 2001. There are now 21 signatories to this treaty from the Black Sea, Mediterranean Sea, and adjacent Atlantic region.

- **MARPOL 73/78:**

MARPOL stands for Marine Pollution. The MARPOL 73/78 acronym stands for the 1973 International Convention for the Prevention of Pollution from Ships as revised by the 1978 Protocol. It has 169 signatories and was signed on October 2, 1983. It is one of the most significant environmental conventions on reducing pollution from sewage, waste, air pollution, hazardous liquids transported in bulk, and oil spills on ships. Reduced dumping, oil spills, and exhaust pollution are the main areas of focus. 150 nations have ratified this treaty.

VI. NATIONAL LEGISLATIONS ON MARINE POLLUTION

The coastal population of India is dependent on the resources that are provided by this marine eco-system due to its extensive marine ecology and biodiversity, which supports a huge number of species. Since sustaining this ecosystem is so important, Coastal States are required under UNCLOS 1982 to take responsibility for safeguarding the maritime environment and its associated resources. The 1976 Indian Maritime Zones Act gives the government the authority to take measures to protect the marine environment. According to the Coast Guard Act of 1978, the Indian Coast Guard is in charge of maintaining and protecting the marine environment as well as controlling marine pollution. Interagency coordination is necessary for any response to an oil disaster[7]. The required preparedness national level contingency plan has been prepared, which incorporates all of the pertinent information and functional responsibilities of multiple agencies, in order to address measures as a group. The National Oil-spill Disaster Contingency Plan (NOSDCP), adopted by the Indian government in 1993, assigned various ministries and departments functional responsibility for oil-spill response in India's maritime zones.

What are the Measures Available to Control Marine Pollution and depletion of Marine Resources?

- **Adopt regulations to reduce litter and outlaw single-use plastics:**

In addition to enhanced drainage system maintenance, beach and harbor cleanup services, and

[7]Marine Environment, INDIAN COAST GUARD, https://www.indiancoastguard.gov.in/content/246_3_MarineEnvironmentProtection.aspx

community-led clean-up initiatives, other methods of preventing littering include the utilization of natural drainage systems and urban planning to minimize direct littering into drainage systems and waterways. Along with stepping up efforts to assure compliance and enforcement, it is crucial in this effort to enhance national and regional rules and regulations.

- **Save money by recycling plastic:**

Import and use of common trash, such as single-use plastic bottles, straws, plastic bags, and single-use Styrofoam food containers, are subject to fees, voluntary initiatives, and bans. This should also include initiatives to reduce the manufacturing and consumption of plastic in non-recoverable items, such as microbeads in cosmetics and personal care products. Encourage the reuse of plastic items while reducing the usage of non-biodegradable products or packaging.

- **Reduce toxicity and industrial pollutants:**

Identify chemical pollution hotspots, regulate chemical usage and release in artisanal mining, encourage used oil recycling in urban areas, and encourage the manufacturing of long-lasting goods that take less energy to make and produce less trash. Join forces with businesses to put better procedures for handling and storing pollutants and spills from industrial sites into place.

- **Adopt preventative and control measures as part of national policy:**

Pollution control is important for the growth of tourism, agriculture, shipping, and industry in addition to coastal and marine resources. As a result, it ought to be considered in both integrated water management and economic planning for land use.

- **Make people more aware:**

Public education through local television, radio, social media, and websites can enhance awareness, and school instruction on the importance of the environment to the region's well-being is also vital. In order for future generations of students to grow up understanding the issue, this would require involving ministries of education in the introduction of new information into school curriculum.

VII. MARINE ECOSYSTEM SERVICES

- **Aquaculture:**

Aquaculture is the technique of breeding, producing, and harvesting fish, shellfish, algae, and other organisms in various aquatic settings. As the demand for seafood has increased, technology has made it possible to grow food in both Open Ocean and coastal marine environments. Aquaculture is a method for producing food and other commercial goods, as

well as for regenerating threatened and endangered animal populations, replacing wild supplies, and restoring habitat[8].

- **Fishing:**

Fishing is the act of attempting to catch fish. Fishing techniques include hand collection, spearing, and netting, angling, and trapping. Taking aquatic animals such as mollusks, cephalopods, crustaceans, and echinoderms—species other than fish—is referred to as "fishing."

- **Shoreline Protection:**

Shoreline protection is the technical term for an effort to lessen or stop coastal erosion. As sea levels rise and we decide to develop coastal areas, shoreline erosion has turned into a frequent and critical worry for many municipalities.

- **Tourism:**

Tourism in Marine Environments, an interdisciplinary journal published by the International Coastal and Marine Tourism Society (ICMTS), addresses a variety of coastal and marine management challenges. It is a scholarly publication that taps the expertise of researchers and professionals in a wide range of subjects that are pertinent to the marine environment, including tourism, marine science, geography, the social sciences, psychology, environmental studies, economics, and many more.

- **Subsistent Harvest:**

To meet their needs for food, fuel, clothes, and a means of sustenance, individuals, households, and communities engage in subsistence harvesting through hunting, fishing, and resource collection. The social ties that exist between communities are closely related to the trade of necessities. Sales, bartering, gifts, and reciprocal exchanges are a few examples.

VIII. MARINE RESOURCE MANAGEMENT

Marine resource management is a politically and culturally driven process that influences human lives and attitudes. These factors have a significant impact on policies and decision-making. In a brand-new branch of geography, geographic challenges related to the management of maritime resources are thoroughly investigated.

To explicitly define this topic and explain the contributions of spatial approaches and lenses to comprehending marine resource management processes, however, relatively little study has

[8]CurrentBiologyMagazine, CELL https://www.cell.com/current-biology/pdf/S0960-9822(17)30289-0.pdf

been done. One of the earliest collections of geographic studies on the socio-cultural and sociospatial aspects of managing marine resources can be found in this special issue, which also focuses on research that has been or can be applied to management and policy challenges. The various ways in which marine spaces and places are conceptualized by marine resource users and managers, emerging spatial approaches to marine resource management, human dimensions of marine protected areas, mapping and GIS roles, quantitative and qualitative data integration, and these are all significant themes[9].

How Can Marine Resource Management be improved to achieve Sustainable development and Conservation Goals?

Firstly, it is essential to recognize the centrality of oceans for all three pillars of sustainable development: environmental, economic, and social. The oceans provide a range of ecosystem services and benefits that support human well-being and livelihoods, such as climate regulation, food security, trade, tourism, recreation, and cultural heritage. Therefore, marine resource management should aim to maintain or enhance these services and benefits, while minimizing the negative impacts of human activities on the marine environment. Secondly, it is important to adopt a participatory and equitable approach to marine resource management that involves all relevant stakeholders, such as governments, local communities, indigenous peoples, civil society, private sector, and scientific institutions. Such an approach can help to ensure that the costs and benefits of marine resource use are fairly shared, that the rights and interests of different groups are respected, and that the knowledge and values of different cultures are incorporated. Thirdly, it is necessary to apply the principles of ecosystem-based management and integrated coastal zone management to marine resource management. These principles imply that marine resources should be managed in a holistic way that considers the interactions and interdependencies among different components of the marine ecosystem, as well as the linkages between land and sea. This can help to address the cumulative and synergistic effects of multiple stressors on the marine environment, such as overfishing, pollution, habitat degradation, invasive species, and climate change.

IX. BLUE ECONOMY

The Blue Economy sees oceans and seas as "Development Spaces" where marine transportation, oil and mineral exploration, bio-prospecting, conservation, and sustainable use of living resources are all integrated into spatial planning. A long-term strategy called a "blue

[9] Marine Resource Management, IBPES, https://www.ipbes.net/policy-support/tools-instruments/marine-resource-management

economy" aims to advance sustainable economic growth through ocean-related industries and endeavors while enhancing social justice, environmental protection, and human well-being. The Indian Ocean region's maritime commercial operations are to be encouraged through the Blue Economy to grow in a way that is intelligent, sustainable, and inclusive while also creating jobs. The Blue Economy is dedicated to launching appropriate programs for, among other things, sustainable management of ocean resources, research and development, development of pertinent oceanography sectors, stock assessment of marine resources, marine aquaculture, deep sea/long line fishing, biotechnology, as well as the development of human resource[10].

ISSUES DISCUSSED:

- The sources, pathways, and impacts of different types of pollutants in the marine environment, such as metals, pesticides, pharmaceuticals, micro plastics, sediments, temperature, and invasive species.
- The challenges and opportunities for enhancing stakeholder participation and empowerment in marine resource management, such as involving governments.

X. SUSTAINABLE MANAGEMENT OF MARINE RESOURCES

The alliance seeks to increase island country’s capacity to sustainably manage maritime and coastal resources for growth and development. The European Union, which has funded a great number of regional programs for the development of the IOC's island members, is the most significant technical and financial partner of the Indian Ocean Commission (IOC). These initiatives seek to strengthen island states' capacity for managing coastal zones, managing fisheries, and managing coastal, marine, and island-specific biodiversity. In order to eliminate IUU fishing, the CBD will concentrate on the Nagoya Protocol, UNCLOS, and fisheries control. The programs will aid in filling in the gaps in the institutional, administrative, and legal framework, which will improve regulatory enforcement and adherence to regional and global agreements like the Nairobi Convention and its protocol.

XI. CASE LAWS:

- **Moses v MV Sea Chase:** This case was about the damage to a reef and the spillage of petroleum products caused by a vessel that ran aground on the reef. The court dismissed the claims of the plaintiffs who sought compensation for the damage to the reef system and the penalty under the Environmental Protection Act, as well as the claims against the

[10]Blue Economy, THE COMMONWEALTH, https://thecommonwealth.org/blue-economy

vessel's insurer[11].

- **People of Rull ex rel Ruepong v MV Kyowa Violet:** This case was about the damage to a reef and the oil spillage caused by a vessel that struck a reef while navigating a canal into the lagoon. The court awarded compensation to the plaintiffs who represented the people of the coastal municipalities for the physical damage to the reef structure and resources, and for the effects of the oil spill on the use of the inner lagoon.

XII. CONCLUSION

The problem of marine pollution and resource depletion is a complicated and serious issue that has an impact on both human health and the ecosystem. The key takeaway from this subject is that there is a need for more efficient and comprehensive management of marine resources and their usage, as well as for increased prevention and mitigation of marine pollution and its effects. The following are some crucial arguments in favor of this conclusion:Marine pollution and depletion of marine resources are caused by various human activities, such as overfishing, aquaculture, shipping, tourism, mining, agriculture, industry, and waste disposal.Marine pollution and depletion of marine resources have negative consequences for the biodiversity and ecosystem services of the marine environment, such as coral reefs, mangroves, seagrasses, fish stocks, and marine mammals.

Marine pollution and depletion of marine resources also have negative consequences for the economic and social aspects of human well-being and livelihoods, such as food security, trade, tourism, recreation, health, and cultural heritage. Marine pollution and depletion of marine resources can also be addressed by adopting a participatory and equitable approach to marine resource management that involves all relevant stakeholders, such as governments, local communities, indigenous peoples, civil society, private sector, and scientific institutions.

Marine pollution and depletion of marine resources can further be addressed by employing novel techniques and technologies for monitoring and assessing the status and trends of marine resources and their use, such as remote sensing, satellite imagery, geographic information systems (GIS), biotechnology, citizen science, and artificial intelligence.

Marine pollution and depletion of marine resources can finally be addressed by strengthening the legal and policy frameworks for marine resource management at the national and international levels, which are consistent with international conventions and agreements on marine issues, such as the United Nations Convention on the Law of the Sea (UNCLOS), the

[11]Moses v MV Sea Chase, FSMLAW, http://www.fsmlaw.org/fsm/decisions/vol10/10fsm045_053.htm

Convention on Biological Diversity (CBD),.These are some of the possible ways to improve marine resource management to achieve sustainable development and conservation goals.

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