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An Examination of Evolving Concerns, Obstacles, and Prospects in Relation to Pollution in the Marine Environment

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ABSTRACT

This article looks at how current regulatory tools may be used to successfully limit and reduce marine pollution. The urgent problem of marine pollution and its destructive effects on marine ecosystems and marine animals needs our immediate attention. In light of these concerns, legislative frameworks at the national and international levels have been established to control or eliminate marine pollution. Despite this, marine pollution is a widespread problem that has a chilling effect on the maritime economy. It's important to emphasize that marine pollution is seldom addressed until it has disastrous consequences. To better understand how effective current frameworks are in reducing marine pollution, this article analyses how they operate. To prevent the appearance of the disastrous detrimental effects of hazardous substances, it thinks that preventative steps should be adopted to ensure compliance with these criteria. Importantly, the article underscores the tendency for attention to be directed towards marine pollution only when its consequences become catastrophic. To comprehensively assess the effectiveness of current regulatory frameworks in curbing marine pollution, this study meticulously analyzes their operational dynamics. It contends that a proactive approach, focused on preventive measures to ensure compliance with established criteria, is imperative to avert the disastrous effects of hazardous substances and promote a sustainable marine environment.

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1. Introduction

Marine pollution is undeniably a significant issue, with far-reaching and detrimental consequences for marine resources and ecosystems (Cater, Erlet, 2007). According to Larson (2009), the World Health Organization (WHO) defines marine pollution as the deliberate or careless introduction of substances or energy into the marine ecosystem. Damage to marine life and resources, human health concerns, marine activity disruption (including fishing and other legal uses of the ocean), and deterioration of seawater quality are just some of the known negative outcomes of such introductions. The prevailing consensus acknowledges that the human component significantly contributes to the contamination of marine ecosystems. Landrigan et al., (2020) provided a comprehensive analysis of marine pollution and its associated concerns, stating that the world's seas and estuaries serves as a key reservoir for a vast variety of pollutants discharged either deliberately or accidentally by humans. The majority of deleterious substances, such as toxic effluent and chemicals that contribute to the contamination of marine environments, are discharged into oceans and seas by various stakeholders, notably industrial entities and shipping corporations (Diez et al., 2004).

The origin of these effluents and harmful compounds often stems from many human activities that take place regularly, including mining, dumping, oil spills, and leakages (Akhtar at el., 2021). It is further argued that the coastal zone has the most immediate and severe repercussions from toxic discharges into marine habitats, particularly due to significant population increases in recent years. Construction of industrial facilities, upkeep of ports and waterways, local development of coastal communities, greater demand for tourism, and other human activities have all had a major impact on the land-sea interface as the economy has expanded. As a result, there is no denying that the risks associated with a variety of human influences are significantly magnified in coastal locations. Pollution, such as the introduction of dangerous chemicals, may enter the high seas by air travel, sedimentation, and shipping operations that go beyond the continental shelf. These factors may have detrimental effects on the water quality of the open ocean. Seawater, sediments, and marine life are only few of the marine ecosystem components that show signs of being impacted by aerial deposition. The aforementioned activities pose a significant danger to marine life due to several factors, including overexploitation and harvesting, waste deposition, pollution, the introduction of alien species, soil recovery issues, dredging, and the impacts of global climate change (Folami, 2017).

The first documented instance of marine pollution in Pakistan dates back to 1886, during which deleterious compounds were dumped into the sea, resulting in water contamination. The persistent occurrence of marine pollution persisted without restraint until governmental and regulatory entities took action by enacting legislation that forbids marine pollution (Nwafor, Tony, 2020). Just as gender discrimination and sexual harassment persist as pressing issues in Pakistan, reflecting societal disparities, marine pollution exacerbates environmental challenges, emphasizing the interconnected need for comprehensive reforms that address both social and environmental concerns in the country (Jamshed, 2021).

It is imperative to note that marine pollution is a significant issue of concern for the global society, and efforts to address this problem have been carried out (Wang et al., 2022). According to Wang et al., (2022), the worldwide "*Convention for the Prevention of Pollution of the Sea by Oil"* was the first significant effort by the worldwide community to address the escalating magnitude of marine pollution. Nevertheless, it is noteworthy that despite the implementation of the "*Convention for the Prevention of Pollution of the Sea by Oil"* by the international community, the containment and reduction of marine pollution caused by oil spillages have regrettably seen an alarming escalation. The aforementioned phenomenon can be ascribed to the fact that the contamination of the oceans with substances such as oil, chemicals, nuclear waste, and the discharge from urban industrial activities has persistently increased, resulting in increasingly severe harm to the marine ecosystem, living resources, and coastal regions of affected states. Fox et al. (2012) suggest that individuals in the fields of resource management and scientific research are

actively addressing the task of comprehending and mitigating the effects of human activities on marine ecosystems. Similarly, both companies and governmental entities express apprehension over the escalating influence and ramifications of marine pollution on marine resources and ecosystems. According to Da Costa et al. (2020), the management, mitigation, and eradication of marine pollution have emerged as significant concerns within the modern field of maritime law. This undertaking has proved to be intricate, necessitating the development of an expanding corpus of international legal principles. It is important to note that despite a prevailing global increase in environmental awareness, progress in safeguarding maritime habitats has been sluggish. Consequently, the persistent lack of accountability among polluters has led to the detrimental consequences of marine animal mortality and the degradation of marine ecosystems, which have yet to be effectively mitigated (Duarte, 2020).

Marine contaminants with potential hazards might manifest in either visible or unseen forms within oceanic and marine environments. Nevertheless, a prevalent attribute of these incidents is their capacity to inflict irreversible harm upon marine resources, ecosystems, and marine organisms, particularly when they transpire in economically and ecologically vulnerable regions around the world (Upadhyay, 2020).

2. Research Methodology

The study used a non-empirical qualitative research technique, which included conducting a comprehensive examination of relevant literature. This approach allowed for the identification of gaps in the existing body of knowledge, which were then addressed and resulted in the generation of new insights. Authoritative documents found in academic libraries include things like encyclopedic legal dictionaries, reports, laws, regulations, policies, academic publications, government gazettes, and a slew of international and local instruments. These resources have been established to discourage marine pollution and impose penalties on those who engage in such activities.

3. Theoretical stances

Pollution in the ocean is a serious problem all around the globe. It will need international cooperation and significant political will from world leaders to ensure that all mechanisms against marine pollution are adopted and implemented if this problem is to be solved once and for all (Ferraro, Pierre Failler, 2020). In addition, education and raising people's consciousness are crucial to cutting down on pollution. Because so many people damage the seas and oceans without realizing the terrible consequences of their actions. As the rate of marine pollution rises, scholarly works examining the rules limiting and preventing marine pollution become more important. However, there are not many of these works, and those that do exist often lack clarity.

Marine pollution is a term that has to be defined before it can be fully understood. Marine pollution is described as "*the direct or indirect introduction by humans of substances or energy into the marine environment, resulting in harm to living resources, hazards to human health, hindrances to marine activities including fishing, impairment of the quality of sea water, and reduction of amenities*" (Vikas, Mangalore, & Dwarakish, 2015). Rivers, estuaries, coastal facilities, and outfall structures are all named as potential entry points for effluent and waste dumping into the coastal and marine environment in this description (Campos, 2020). The most significant consequences of pollution in the ocean are as follows: Both the social and economic consequences of marine pollution are clear: (i) Ocean pollution taints the beach experience, putting visitors' health at risk from contaminated water and sand (Odeku, Bapela, 2017); and (ii) the production of seafood is a factor in the development of the economy. The economy will take a hit if marine life is harmed due to pollution, since less seafood will be harvested. Several researchers (Bashir, et al., 2020). As a result of the degradation of the marine environment and habitat, many marine species are in danger of extinction, and the reproductive processes of marine creatures may be disrupted (Wang, Jin, 2013).

Minamata, Japan, saw the worst mercury poisoning tragedy in history in 1950. A very large ship went aground between the UK's southernmost point and the Isles of Scilly, spilling almost 100,000 tonnes of

crude oil into the ocean and killing 20,000 seabirds (Tromiadis, Costel, 2014). The tragedy piqued worldwide attention on the threat of marine contamination leading to widespread publicity about the disaster's consequences. Despite the profound lessons the pollution taught Japanese society, a second outbreak of Minamata illness occurred in the mid-1960s in Niigata Prefecture, which is very concerning. Both events' backstories demonstrate a failure of environmental governance in modern Japanese culture. However, worldwide awareness increased, and sensible nations began to take a stance against marine pollution by enacting strict regulations to govern and manage it.

Similarly, in the 1960s and 1970s, a Liberian ship discharged 120,000 tonnes of oil spills into the sea, leading to a phenomenon known as the Torrey Canyon (Ottensoser, 2018). This event has inspired and encouraged nations around to take bold action against marine pollution. To prevent, reduce, or compensate for marine pollution, several legislative frameworks at the national and international levels have been enacted (Tsimplis, 2020). Despite this, marine pollution remains a major global problem, with new incidents occurring every day.

Because of Torrey Canyon, protecting the ecosystem is now an absolute need. Regulation of marine pollution and management of ocean resources became priorities for the international community in the 1970s. As a result, the OSLO Convention on the Prevention of Marine Pollution from Dumping by Ships and Aircraft was ratified in 1972. Specifically, OSLO aims to "control the dumping of harmful substances from ships and aircraft into the ocean and further made a restriction by requiring a permit to dump certain substances like arsenic, lead, copper, zinc, and their compounds" (Bergesen et al., 2018).

The International Convention for the Elimination of All Forms of Pollution from Ships (MARPOL) came into force in 1973. It is important to note that the OSLO and MARPOL Conventions are updated when new pollution events occur to address new pollution issues. Oil, chemicals, dangerous packaging forms, sewage, and waste are all included under MARPOL's purview. It wasn't until 1974 that the OSLO Convention was superseded by the Convention for the Prevention of Marine Pollution from Land-Based Sources.

Convention on the Law of the Sea (UNCLOS) of 1982 "defined the rights and responsibilities of nations concerning their use of the world's ocean, establishing the guidelines for businesses, the environment, and the management of marine natural resources" and was implemented in the early 1980s. International Corporation on Environmental Protection against Land-Based Sources of Marine Pollution is now governed by the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) Convention, which was signed in 1992. Annex V to the Convention was approved at the inaugural Ministerial Meeting of the OSPAR Commission in Sintra, Portugal in 1998 to broaden the cooperation of the Contracting Parties to include any human activities that can hurt the maritime environment of the North-East Atlantic.

Marine contamination is governed by several statutes in Pakistan. The master or owner of an offshore facility that reports an oil discharge to a senior official must implement the actions outlined in the facility's contingency plan, as required by the Marine Areas Act of 2023 unless the senior official gives specific instructions to the contrary. The International Convention for the Prevention of Pollution from Ships, 1973, as amended by the Protocol of 1978, and the Marine Pollution (Prevention of Pollution from Ships) Act No. 2 of 1986 both seek to reduce oil and other ship-discharged pollutants that threaten marine ecosystems.

Wherever they may be, Pakistan ships are subject to the schedule in terms of the Prevention of Pollution by Garbage from Ships Regulations 1992, and small vessels and ships are subject to the schedule within Pakistan, the territorial waters thereof, and the fishing zone. Any violation of the provisions of this legislation will result in criminal liability and a fine for the offender. The punishment is up to five years in jail, a fine, or both. However, the current state of the Criminal Justice System in Pakistan is deplorable, requiring comprehensive reforms across its key components: the Police, Prosecution, and Judiciary (Jamshed et al., 2020).

All forms of contamination in the ocean are now illegal under both international and local legislation (Qayum, Weidong, 2018). The goal is to avoid the intentional or unintentional release of dangerous compounds into the oceans and seas as a result of human activity, protecting marine life and the water itself (Landrigan et al., 2020).

This research aims to provide evidence that there are significant incentives to curb marine pollution. The laws in Pakistan that control marine pollution is also discussed, as is the significance of such legislation in decreasing marine pollution if it is put into practice. It's important to note that marine pollution disrupts the ocean economy and may have negative social and economic consequences for marine ecosystems and resources (Bennett et al., 2021). The importance of protecting the world's oceans and seas from the consequences of marine pollution calls for stricter adherence to existing rules and regulations (Gjerde et al., 2013).

4. Causes and origins of ocean contamination

Coastal and marine environmental deterioration "overall continues but has intensified," as stated by Islam and Tanaka (2004). Yet, attitudes have shifted dramatically, and new problems have surfaced. Pressure on both land and sea natural resources, as well as garbage disposal at sea, contributes to coastal and marine deterioration. Causes of this stress include rising populations and the development of coastal cities and industries. Some sources of water pollution, such as fertilizers, pesticides, and agrochemicals, "are reported to contribute about 50% of the total pollution source of surface water using the higher nutrient enrichment, mainly ammonium ion (NH4) and NO3 derived from agricultural inputs" (Islam, Tanaka, 2004).

Land-based operations, oil spills, pollution from sea-bed activities, noise pollution, air/atmosphere/vessel source pollution, and so on are all potential causes of marine pollution. Below, though, we'll go through the most typical forms of marine pollution.

4.1.Domestic and municipal wastes

The vast majority of rubbish discharged into the ocean is found to be municipal and residential waste, as well as sewage sludge. Effluent from sewage treatment plants comprises a wide variety of materials, including those from factories and municipalities, as well as those from butcheries, homes, and kitchens. The drainage systems of densely populated areas, which often empty into surrounding rivers or aquatic systems, carry away massive amounts of this trash every day. Considering that most manufacturing takes place in or near densely populated regions. There is a larger chance of home and sewage contamination when there is a greater load of pollution from industrial sources. Though it is difficult to conceive of raw sewage being discharged into the ocean, it occurs often, as noted by Capodaglio (2017). Even while this foul liquid may be broken down in the vastness of the seas, it has devastating impacts on marine life. Pollutants and sewage run unimpeded into the sea through drainage systems, rivers, and other waterways. This is a common pathway for mining waste and other materials to reach the sea. When additional chemical fertilizers are dumped into the ocean, oxygen levels drop, plant life dies, and the water quality deteriorates dramatically. Therefore, marine plant and animal life on all levels are severely impacted.

4.2.Oil Pollution

Oil pollution has been a growing concern since the middle of the nineteenth century as a result of the proliferation of oil tanker operations and oil usage, as well as the prevalence of tanker accidents and oil spills at sea. Oil does not dissolve in water and will produce a thick sludge when exposed to water, therefore it's vital to keep that in mind while millions of tons of oil are poured into the ocean (Vesilind et al., 2013). This suffocates fish, prevents marine birds from taking flight, and obstructs light from reaching photosynthetic aquatic plants. Moreover, "heavy metals and trace elements which are by-products of many industrial processes, contributing varying amounts of different metals and trace elements and as such are discharged as waste into the marine environment" (Islam, Tanaka, 2004). The shipping sector has a long

history of negative stigma as "a polluting business. Every day, oil from spills, regular transportation, runoffs, and dumping finds its way into the ocean, polluting it. About 12% of the oil that ends up in the water comes from spills. The other sources include transportation, sewage systems, and landfills. An oil leak from a tanker is a major disaster because of the massive amount of oil that is released all at once.
Every year, between 600,000 to 1,750,000 tonnes of oil are dumped into the ocean as a consequence of "normal shipping operations, especially transportation of oil by tankers and accidents" (Vikas, Mangalore, & Dwarakish, 2015). It has been noted that "many synthetic organic chemicals (e.g., organochlorines, organophosphates, PAHs, and organometals) are of growing environmental concern, because of their high toxicity and high persistence in the environment and in biological systems" (Nair, Anupama, & Sujatha, 2012). In addition, plastic makes up the bulk of the trash that washes up on beaches and other aquatic areas.

4.3.Fragments of Plastic

Researchers discovered that "55 percent of the bird species recorded had plastic particles in their guts" (Provencher et al., 2019) after studying 1033 birds gathered off the coast of North Carolina, USA. Most of the time, these birds will eat tiny particles that float in the water because they seem like the food they would find in the wild. Plastic was identified in the stomachs of 58 seabird species across three groups by Van Franeker et al. (1997). This included 100% of surface-feeding seabirds, 75% of seagulls, and 39% of diving seabirds.
Massive quantities of plastic are discarded in heavily used bodies of water including beaches, lakes, and navigation channels (Zbyszewski et al., 2014). It has also been highlighted that reliable numbers for sediment concentration and discharge are notoriously hard to get in many countries, leading to wildly varying estimates of erosion and sediment transport in the world's main rivers. Mid-20th century estimates put the annual worldwide sediment load to the seas at 20,000 million tonnes, with around 30% coming from rivers in Southern Asia (Crossland et al., 2005). Synthetic organic polymers (Plastic) are manufactured mostly from petroleum and are a significant contaminant in marine litter. As plastics are the most pervasive macro pollutant, their illicit disposal in the ocean poses a significant threat to marine ecosystems. The usage of plastics is one of the most important human influences that present a danger to marine life due to plastic waste contamination (Sharma, Shivika, Subhankar, 2017). Furthermore, Coe, James M., and Donald Rogers (2012) found that "plastics are the predominant among the marine litter," with their percentage of marine litter fluctuating between 60% and 80% year after year.

4.4.Extragalactic origins

The non-point source is a remarkable but highly damaging and troublesome source. According to the National Oceanic and Atmospheric Administration (NOAA), "80% of pollution to the marine environment comes from the land" (Coe, James, & Donald, 2012). Non-point source pollution, which originates from runoff, is one of the most significant causes. In addition to bigger sources like farms, ranches, and forested areas, many smaller sources, such as septic tanks, automobiles, trucks, and boats, contribute to non-point source pollution. Every day, millions of cars and trucks spill tiny quantities of oil onto the ground. When it rains, most of this runs off and into the ocean as well. Some contaminants in water supply systems have their origins in atmospheric deposition. Dust is a potential contaminant. Water in rivers and oceans may become unfit for human and animal consumption due to contamination from diffuse sources. The pollution is so extreme in certain locations that beaches have to be closed when it rains. Non-point source pollution correction is expensive. Numerous organizations are working together to find solutions to the problem of nonpoint source pollution, and substantial funds are being allocated to guarantee that affected regions are safeguarded and rehabilitated. These organizations monitor, evaluate, and contain potential natural and human-caused non-point sources of pollution.

5. Problem Statement

The issue of marine contamination is one of global significance (Beaumont, 2019). There have been national and international legal frameworks put in place to prevent marine pollution, but the situation is becoming worse every day everywhere. (Karlsson, 2018). Oyebode (2018) notes that although most legislative frameworks on marine pollution have established multiple consequences for non-compliance, implementation, and enforcement are usually weak, therefore pollution remains unchecked. It is important to emphasize that no individual or organization has the right to knowingly cause harm to marine ecosystems by their actions or inactions (Eelderink et al., 2020). There have to be severe consequences for everyone who causes or contributes to marine contamination.

6. Discussion

There was not an effective regulatory framework in place to address marine pollution before the Minamata event, which led to the catastrophic devastation of marine ecosystems (Bapela, 2021). The Minamata pollution incident served as a wake-up call, prompting countries throughout the world to agree on the need for stricter controls over marine pollution.

7. The Role of Legislation in Halting Ocean Pollution

Protecting and enforcing environmental protection legislation requires a system in which the rule of law, human rights, and a free and independent judiciary are all upheld (Petersmann, 2008). An increasing body of case law in the field of environmental law addresses issues related to the marine environment, such as pollution, biodiversity loss, endangered species protection, and marine mammal protection. Many national laws preventing marine pollution have their foundations in international conventions governing maritime habitats. However, the future of marine conservation is dependent on states' ability to cooperate in these shared goals and on each state's ability to prescribe and enforce its marine conservation legislation (Harrison, 2017). Pakistan has established several anti-pollution rules at the national level and is a signatory to several international accords that prohibit marine pollution. New, more scientific information about the marine environment and environmental health has replaced the outdated idea that the ocean is a bottomless rubbish dump with boundless carrying capacity and endless ability to give away resources (Levain et al., 2020). Today, people are more aware of the need to protect marine ecosystems than they ever have been before. Ocean pollution is an international issue because of the vastness of the seas. Overfishing, land and sea pollution, irresponsible natural resource extraction, and the loss of marine life are all issues that the global community is working to address (Longo, Rebecca Clausen, & Brett Clark, 2015).

Even more crucially, the sea and its environs have provided many advantages to us. They help us provide for our table, everything from healthcare to energy to transportation to commerce to defense to leisure. Keeping these advantages in mind, we need to work together to preserve our natural spaces. Dangerous chemical compounds are now prohibited from being used in marine environments thanks to several legislative interventions and regulations. By using these resources, countries will be able to better manage their oceanic assets (Dey et al., 2021).

8. List of Legal Instruments relevant to the Environmental Laws/ Marine Pollution

8.1.Pakistan Environmental Protection Act, 1997 (PEPA Act, 1997)

After significant consultation with interested parties, the Pakistan Environment Protection Act (PEPA), 1997 was enacted in December 1997 to replace and improve upon the Pakistan Environment Protection Ordinance (PEPO), 1983. Factories, forests, wildlife, automobiles, municipalities, and canals and drainage systems all have their regulations that supplement this. Issues relating to protecting, maintaining, conserving, rehabilitating, and restoring clean ecosystems; preventing or controlling pollution or pollution; fostering or encouraging sustainable development; Full-fledged system of rules and regulations;

PEPA, 1997. While raising environmental consciousness was the intended result of this law, several technological and legal hurdles remain in the way of its implementation.

While the PEPA, 1997 covers a lot of ground, most of its provisions are conditional on the rules and regulations that will be established later. Since this is the first ever all-encompassing piece of environmental legislation, it includes measures tailored to adapt to the unique challenges posed by climate change. For its part, Pakistan signed the Rio th Declaration in 1992 by Agenda 21 after pledging to do so at the United Nations (UN) Conference on Environment and Development in Rio de Janeiro. The Provincial Environmental Protection Act and Strategies came into effect once devolution and the 18th Amendment were implemented, allowing the federal government to delegate responsibility for some laws to the provinces.

8.2. The Punjab Environmental Quality Standards (PEQS), 2016

The National Environmental Quality Standards (NEQS), which are now known as the Punjab Environmental Quality Standards (PEQS) post-devolution, have been created by the provisions of Section 6 (I) (c) of the PEPA Act 1997. These standards pertain to the quality of liquid effluents, gaseous emissions, noise levels, and drinking water.

Rules and Regulations made under the Punjab Environmental Protection Act, 1997 (Amended) 2012

Ambient air, vehicle exhaust, noise, and drinking water are some of the issues addressed by the Punjab Environmental Protection Council (Procedures) and the Punjab Environmental Court. Other issues include biosecurity, hospital waste management, industrial air emissions, liquid handling, incineration, automotive cracking, microwave and biomedical waste deep burial, municipal waste, and industrial effluent.

On 12 August 2016, new Punjab Ambient Air Quality Standards were issued under the same Act to examine the effects of industrial emissions and prevent future conditions that could negatively impact urban air quality through monitoring. Standards for acceptable levels of ambient air quality are listed below.

9. Relevant Legislation Regarding the Regulation of Pollution Sources

The Canal and Drainage Act, 1873 (Water Pollution Control)

The first regulations managing water pollution in the Indus basin are the Canal and Drainage Act, of 1873 (amended in 1952, 1965, 1968, and 1970) and the Punjab Minor Canals Act, of 1905. Water from canals may be utilized for drinking and other purposes in neighboring communities, and its contamination or fouling is strictly prohibited under the Canal and Drainage Act. Violators of the law face a PKR. 500 fine one month in jail, or both.

9.1. The Forest Act, 1927

By Section 5 of the Forest Act 1927, local governments may restrict the digging, falling, and trimming of trees, branches, and limbs for agricultural, foraging, hunting, or extermination reasons, among other things.

9.2. The Factories Act, 1934 (Amendment 2012)

Effective preparations should be established in all plants for the disposal of waste and sewage from the production process and penalties are imposed for pollutants according to Clause 14 on "Disposal of waste Effluents" of the Provincial Plant Rules of 1952 and the Factories Act of 1934. As per Section 33Q of the Companies Act, provincial governments may impose regulations on companies whose operations pose significant risks of harm to human health (such as via poisoning, disease transmission, and physical harm). The major concerns of this law are the protection of employees from hazards on the job and the prevention of damage to public and private property from the improper disposal of solid waste and sewage. Regulations for the handling and disposal of potentially dangerous poisonous substances are included in

this act as well. Penalties for violating Factories Act sections 2, 13-15, 16-18, 23-33K, and 33-33L (prohibition of dust, smoke, and bad risks) have been raised dramatically in recent revisions.

The Pakistan National Conservation Strategy, 1992

In 1992, the National Conservative Strategy was formally endorsed by the national government of Pakistan. This is the nation's fourteenth comprehensive environmental policy. The NCS's 14 fundamental principles include sustainable development, natural resource conservation, and efficient management and utilization of available resources.

The National Environmental Policy, 2005

The plan's objective is to conserve and repair the environment in Pakistan to improve people's quality of life via sustainable development. The policy's overarching goals are the preservation, rehabilitation, and meticulous administration of natural assets.

- Taking environmental factors into account throughout the planning and decision-making stages.
- Strengthening the abilities of governments and other interested parties at all levels is essential for effective environmental management.
- Effectively fulfilling international commitments by domestic goals.
- Demand generation for the environment via education and organizing of the masses.

9.3.National Sanitation Policy, 2006

To improve the quality of life of the people of Pakistan and the physical environment necessitated by those people, the federal government, provincial governments, federally administered territories, and local governments have been provided with a comprehensive framework and policy guidelines in Pakistan's National Sanitation Policy.

Sanitation in this policy refers to the removal of human waste from residential and commercial areas using a latrine; the collection and proper disposal of both solid and liquid waste; the dissemination of information about the importance of maintaining a clean and healthy lifestyle; and the improvement of the overall sanitation infrastructure of the country.

9.4.Solid Waste Management Guidelines, 2005

The management of solid waste must adhere to both the standards set out by the Tehsil Municipal Authority and the Solid Waste Management Guidelines (draft), 2005 issued by the Pakistan Environmental Protection Agency.

9.5.National Drinking Water Policy, 2009

Pakistan's Constitution mandates that all citizens must have ready access to safe drinking water, and the government takes this responsibility very seriously. Its purpose is to guarantee that all citizens have affordable, environmentally friendly options for obtaining potable water.

To make good on this promise, the Ministry of Environment conducted a national survey and came up with the National Drinking Water Policy by the National Environment Policy and Vision 2030. Sections 6.3, 6.4, and 6.6, as well as subsections 5(a), (b), (c), and (d), and 5(e), are all relevant here.

9.6.Punjab Environmental Policy, 2015

A comprehensive framework for tackling environmental concerns such as contamination of freshwater bodies (7.1 and 7.2), air pollution (7.4), noise pollution (7.5), soil pollution and efficient waste management (7.6), and climate change (7.6) is provided by the Punjab Environmental Policy 2015 (PEP 2015). 7.12). The Punjab Environmental Policy 2015 places a primary emphasis on the promotion of sustainable development as a means to enhance the standard of living of the populace. By the provisions of Section 4(b) of the Punjab Environmental Protection (Amendment) Act 2012, this policy continues to be in effect despite having been given the go-ahead by the Punjab Environmental Protection Commission.

9.7.Policy on Controlling Smog, 2017

Punjab's Environmental Protection Department adopted this plan to address the persistent pollution problem in recent years. The policy lays forth a strategy for dealing with the smog problem and suggests both immediate and long-term solutions. This plan recommends using low-sulfur fuels and promoting environmentally friendly manufacturing practices.

10. Pollution Prevention Practices used to the Regulation of Marine Ecosystems

The idea that people who cause environmental damage should be forced to pay for fixing it is known as the "polluter pays" principle (Barthakur, 2021). However, this approach falls short when applied to marine contamination since other forms of ocean pollution might cause permanent damage. Because maritime contamination often results in the loss of marine creatures and plants, monetary compensation alone is not an adequate cure. That's why it's up to the government, and notably the affluent and their corporations, to impose and enforce strict penalties for pollution (Cohen, 1998). Since they usually have the resources to avoid such a penalty, monetary compensation on its own will not be enough.

Consequently, they have the wherewithal to continue polluting without consequence. Being cautious is at the heart of the precautionary principle, which has the potential to reduce marine pollution (Morodi, 2016). Because of this, would-be polluters will think twice before engaging in activities that might lead to the introduction or discharge of dangerous compounds into the water (Schweitzer, 2018).

According to Chen, & Weiwen (2020), the most essential factor for regulating marine pollution is the use of preventative measures. As a consequence, people are less inclined to take part in actions that might harm marine life. The idea that prevention is preferable than treatment is at the heart of this philosophy. It's possible that it's crucial to remember that implementing all of these steps simultaneously will significantly reduce pollution.

11. Conclusion

Many pieces of legislation on both the international and national levels have been enacted to combat marine pollution. Despite this, the issue is pervasive throughout the coasts of every country, particularly in Pakistan. This is because people in the government are not effectively enforcing laws that ban marine pollution and because polluters continue to operate as normal. In light of this, the article argues that all regulatory measures limiting marine pollution should be strictly applied and enforced to safeguard marine resources, ecosystems, and lives. Therefore, it is advised that all available measures be used to hold offenders of dumping dangerous chemicals in the oceans and seas responsible wherever they operate to ensure the long-term viability of marine resources and wealth.

It's important to note, however, that it's not just the government's job to ensure that the ocean is free of pollution; individuals also have a role to play in this fight by doing their part to keep beaches and waterways free of debris. It is vital to conduct public education and awareness campaigns on the dangers that marine pollution poses to ecosystems, marine life, and human beings as a preventative step. Education and awareness campaigns, as well as the correct application of regulatory instruments connected to marine pollution, are both important steps that need to be taken to make considerable progress toward achieving this objective and reducing the amount of dangerous chemicals that are dumped into the seas.

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