Mechanism of Marine Pollution - The Case of Pakistan

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Abstract

"Cleanliness is half of Eman"

The aim of this paper is to study the major causes of marine pollution & its negative effects on coastal areas of Sindh and Balochistan in Pakistan; the role of the regulatory setup to control marine pollution; and the status of local & international legal implications in Pakistan. In addition, due to ports & shipping developments/activities, they are causing environmental and human health problems by disrupting the ocean ecosystem and biota. This paper also identifies the direct and indirect sources of marine pollution through ports & shipping activities, infrastructural developments, and the discharge of wastes into the sea from different sources. It also explores the failures of the system to control marine pollution due to the lack of political will, unsustainable management practices, lack of traditional knowledge and modern standards and technologies, lack of community participation, and not ratifying the mandatory laws and conventions on marine pollution nor proper implementation of them. The analysis indicates the weakness of the implications of the legal setup as per international standards (by the International Maritime Organization (IMO)). The results showed that only pollution by ports and shipping activities is an insignificant reason for the weakness of the shipping business. The analysis shows that legal bodies, the Ministry of Maritime Affairs (MOMA), associated organizations, policy matters, the role of ports of Sindh and Balochistan, and coastal communities have less understanding about management and procedures to control pollution in the coastal areas and in the sea. It can be concluded that pollutants can cause a variety of biological effects, including metabolic dysfunction, genetic

damage, and phonological changes. Therefore, it is recommended that the government formulate specific policies within the framework of Sustainable Development Goals (SDGs 14)-2015-2030 and UN Ocean Decade Challenges for 2021–2030 that would develop the significant objectives and implementation plans for the green environment, which would contain potential procedures for the sustainable growth of ports and shipping businesses through compliance with IMO standards and maintain the positive relationship between national and international levels.

Keywords: Marine; Environment; Pollution; Ecosystem; Contamination

"Not only are plastics polluting our oceans and waterways and killing marine life – it's in all of us and we can't escape consuming plastics."
Marco Lambertini

Introduction

1. Background

Marine contamination as a result of human activities has now become a global environmental issue. As a result, continuous monitoring of the maritime coastal environment is required to develop a feasible management strategy. Pollution in the marine environment is progressively causing environmental and human health problems by disrupting the ocean ecosystem and biota. Pollutants can cause a variety of biological effects, including metabolic dysfunction, genetic damage, and phonological changes. Reduced numbers of sensitive species are reducing biodiversity, habitat, and food chain changes, as well as changes in productivity patterns, which may induce ecosystem function changes (U.Dahms, 2014).

One of the most dominant cause of pollution at sea is the shipping sector, which is solely responsible for marine and freight transportation (Singh, Marine Pollution by Ships -Tips for Reducing & Recycling Waste at Sea, 2021). With over 71% of our globe covered in water, the maritime sector is growing by the day. With such fast growing industrial development and due to undesired causes of pollution consequences are certain to disrupt the natural system of marine environment (Singh, Marine Insight, 2019).

1.1. Objective

Identifying the significant sources of pollutants in the marine environment, and their negative impacts, explores the roles of the associated regulatory bodies and stakeholders for the betterment of marine environment.

1.2. Problem Statement:

Oil spill is a serious issue with sea and land. Marine environment is continuously depleted by the oil pollution such as; depletion of mangroves, loss of marine life, and involvement of noxious and harmful substances in the marine environment has directly affected on the marine life, ecosystem (Saadoun, 2015). The highest value of pollution was observed at Karachi harbor which is near the Lyari river mouth, where the domestic and industrial effluents with organic and inorganic wastes have a larger impact on the water quality and marine environment through Lyari nala. At present, there is no effective controlling mechanism for industries to treat their waste, nor has any investigation to assess increasing marine pollution been carried out. Furthermore, the lack of coordination between government and private sector is unable to avert marine pollution and cannot attain total environmental sustainability without integration at all levels (Yasmeen Nargis, 2021).

"*The introduction by man, directly or indirectly of the substance of energy into the marine environment, including estuaries, which results or it is likely to result in such deleterious effects as harm to the living resources and marine life, hazards to human health, a hindrance to marine activities including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities*".

(UNCLOS, 1982)

This study highlighted the theoretical research gaps and it focused on the sources of marine pollution caused by home and industrial waste in Karachi. Moreover, highlighted marine contaminants in general and their negative consequences. It also encompasses the development of international legal instruments for marine pollution and some regional agreements are also discussed. This paper describe the marine pollution related regulatory framework by IMO, legal aspects of marine pollution and specialy emphasis on the LC 72 (London Convention) and MARPOL 73/78 (International Convention for the Prevention of Pollution from Ships) and needs to specifically highlight the important role of local bodies for compliance the rules and regulation.

1.3. Characteristics of Pakistan Coastal Area

The coastline is over ~1000 km long, of which 30% is part of Sindh and 70% coast is part of Balochistan. The coastal ecosystem of Karachi is vulnerable due to the major threat of marine pollution i.e. discharge of untreated industrial waste and irrigation are the major sources of coastal and marine pollution. Most of the waste – especially from regions adjoining the coast – is discharged into the ocean because of an absence of a legitimate waste administration ssystem in the city and the carelessness of concerned offices like the Karachi Metropolitan Corporation, Cantonment Boards, Karachi Port Trust, Port Qasim, and different marine sectors. For numerous years, the Karachi city locale

government, KWSB, ‘wanted' to assemble new sewage and wastewater treatment plants (Humayun, 2015).

1.3.1. Karachi Coast

The Karachi coastline, which spans about 135 kilometers, is severely polluted as a result of a mix of industrial, port, municipal, and traffic activity (Hameed, 2012). The shoreline is being overburdened by waterborne pollutants released into the maritime environment during the shipping operation (Walker, et al., 2019). Some of the marine life was tainted with lead, which has been linked to anemia, renal failure, and brain damage in people when taken through seafood. In reality, this pollution threatens the mangrove trees that shelter the feeder streams from sea erosion and provide food for fishermen.

Figure 1: Coastline of Karachi (Source Google Maps)

Pakistan's biological system is being hurt in an assortment of ways, one of which is sea contamination. People dumps plastic, shipping waste, sewage, and conceivably infectious medical clinic squander into the ocean. The regular blue-hued water in Karachi's well-known traveler objective, Sea View, has become dark because of this boundless break of the incident (Diplomat, 2021). The London Dumping Convention-72 (LC-72) has been ratified by Pakistan. Contracting Parties of LC-72 should find managerial or authoritative ways to

ensure that grants are given and license prerequisites are met as per Annex 2's (LC 72) arrangements. Freedoms to limit unloading for environmentally better choices will be given unique consideration.' Waste anticipation review, assessment of waste administration choices, substance, physical, and organic characteristics, dump-site choice, appraisal of potential results, observation, license and grant limitations are depicted in Annex 2 of the LC Protocol (ERIA, 2021). The shipment of oil put negative effects on the coastal ecosystem. However, the transport of oil is one of the principal commodities imported from the Karachi coast (Park, 2013). Importing oil is a crucial requirement for increasing energy output in our country (Sadia Malik, 2019). Oil pollution from ships can come from a range of different activities, including legal discharges, intentional or illegal discharges, and accidental spills. Illegal discharges occur when a ship fails to adhere to the relevant discharge standards for operational activities (Carpenter, 2018). The dredged debris is discharged into the sea to ensure the port's long-term viability. However, port officials, coastal stakeholders, and government entities lack a reliable method for monitoring trace metal in dredging debris, which is likely causing the ecosystem to deteriorate further.

1.3.2. The Industrial Area

There are 2500 industrial units in the Korangi Industrial Area (Corporation, 2012). More than 100 re-rolling companies are located in the Bin Qasim site region. Bin Qasim, Korangi, and Shershah site regions are home to Karachi shipyard engineering works, car industries, and different industrial companies that use metal and its alloys in the creation of products. There are no wastewater treatment or recycling plants in any of the industrial sectors. Karachi's spontaneous development and industry have brought about ecological decay of the city and its coastal surrounding area, including significant mangroves,

air, water, fisheries, and farming, representing a danger to the existence of more than 10 million individuals. Scrap, rubbish, and contamination are on the whole natural worries in metal-related areas (Jokhio, Abro, & Essani, 2005).

Rather than modern strategies, ecological approaches and guidelines straightforwardly focus on the reason for natural difficulties. Pakistan's first law, the Environmental Protection Ordinance, was passed in 1983, yet it didn't have an exact plan to follow until 1997 when the Pakistan Environmental Protection Act was passed by parliament (1997). This law covers land use, water, and air quality additionally risky substances, strong waste and effluents, sea-going and fisheries, forest protection, mineral turn of events, energy, state-subsidized wellbeing, etc. On account of the low fines for infringement and the straightforwardness with which they might have stayed away, this law has not been demonstrated to be viable (UNIDO, 2000). It is suggested that government need to take serious initiatives to protect beaches and Sea through increase awareness about plastic usage and the promotion of recyclable materials. Most plastics that enter the environment are non-biodegradable, posing a serious threat to marine life (Ilyas, 2014).

1.4. Sources of Marine Pollution

There are five primary origins of marine contamination sources in Karachi. Before starting the details, here need to add some data on the volume of water waste pollution from land to sea; mentioned below:

S.No.	Pollution Routes	Quantity
1.	Lyari River	472 MGD
2.	Nehr-e-Khyyam Lake	650 MGD
3.	Soldier Bazar Nala	30 MGD
4.	Railway Nala	5 MGD

5.	Pitcher Nala	7 MGD
6.	Karli Nala	7 MGD
7.	Other Sources	8000 MGD

Table 1:KWSB

1.4.1. Pollution from Land-Based Activities

1.4.2. Ship Generated Pollution

This marine contamination starts from the ship or waste produced by the ship, which contains a functional and unintentional release of oil and shipborne toxins that incorporate trash, strong waste, and antifouling paints on transport structures and other harmful substances.

1.4.3. Dumping at Sea

This contamination is brought about by the unloading or waste material by consuming modern or city squanders and material from digging exercises adrift.

1.4.4. Seabed Activities

International Seabed Authority characterized the three kinds of exercises with potential for ecological effects on the seabed (ISA, 2008):

a) Exploration for business stores;

b) Small-scale and model trial of business recuperation mining frameworks; and

c) Metallurgical handling, on the off chance that it happens in the Area.

The International States need to take on pivotal measures to shield and safeguard the marine environment from contamination via seabed exercises.

1.4.5. Atmosphere Pollution

Even though environmental contamination can be connected with land-based exercises and need to classify it separately since it gives an extremely enormous measure of the general marine contamination. It is in particular due to the release of dangerous materials into the ecosystem due to human exercises ashore or locally available a vessel or airplane which enters the marine environment.

Additionally, many waste treatment plants (in Figure 2) ought to be set up all around Pakistan.

Sewage Treatment Plant		
Sewage Treatment plant	**Sewage Treatment plant**	**Sewage Treatment plant**
Sewage Treatment Plant-I Site	51.00 mgd	20 mgd
Sewage Treatment Plant-II Mehmoodabad	46.50 mgd	0 mgd
Sewage Treatment Plant-III Mauripur	54.00 mdg	35 mdg
Total	**151.50 mdg**	**55 mgd**

Figure 2:https://www.kwsb.gos.pk/sewerage-system/

1.5. Advancement in Legal Instruments (International & National Regulations to Control Marine Pollution)

Sustainable Development Goals (SDG) was adopted in 2015 by the United Nation for the prosperity of human lives and to safeguard the environment (UN, Department of Economic and Social Affairs Sustainable Development, 2015). SDGs consist of 17 goals and goal 14 in Figure 3 is specifically related to *"Conserve and sustainably use the oceans, seas and marine resources"*

(UN, Department of Economic and Social Affairs Sustainable Development, 2015).

1.6. HNS 96

Unsafe and dangerous compounds are cut into the marine environment, according to International Convention on the Liability and Compensation to harm under the OPRC-HNS Protocol 2000. The Convention is forced severe responsibility on the shipholder for contamination occurrence by HNS.

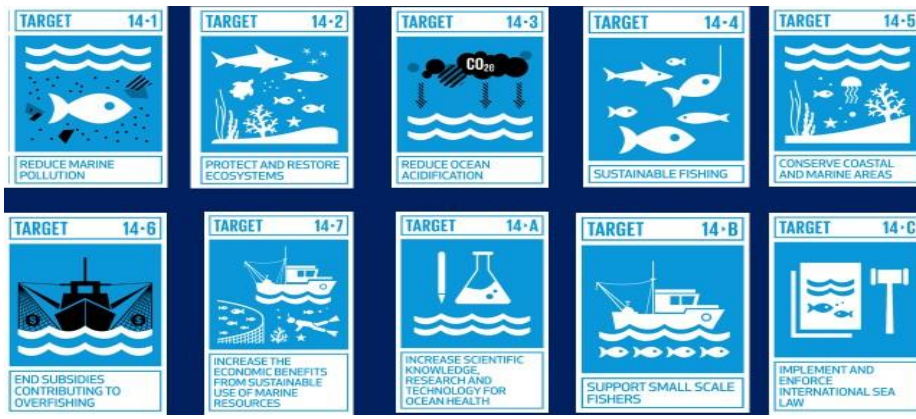


Figure 3:UN-SDG Goals 2015

1.7. OPRC 90

The International Convention on Oil Pollution Preparedness, Response, and Cooperation (OPRC) 1990 is another significant IMO legal development that provides means to tackle oil pollution on a global or territorial scale. The Contracting States are required to set up procedural frameworks to battle the oil contamination rate at their levels. Contracting states are obliged to help different States in a significant debacle.

1.8. Ordinance on Environmental Protection in Pakistan

The marine environment-related strategies are not effectively carried out in Pakistan and some significant shows are not marked nor sanctioned. As per the Pakistan Environment Protection Ordinance of 1983, there had been heaps of endeavours to decrease the expanding contamination in the country.

1.8.1. PEPA (Pakistan Environmental Protection Act)

1.8.2. The PEPA was established by the Ordinance of 1983 under the direction of the Council.

1.8.3. Role of PEPA

Any development project that is likely to harm the environment must consult with PEPA during the planning phase and submit a detailed environmental impact statement (EIS) that includes construction and project-related information, and project proponents have to be responsible for the following:

a. The planned industrial activity's to environmental impact
b. The proposed projects for treatment work
c. The project's unavoidable adverse environmental impacts
d. The procedures recommended being done by the project proponent

1.8.4. Environmental Protection Agencies define:

"An Act to accommodate the security, protection, restoration, and improvement of the climate, for the counteraction and control of contamination, and advancement of manageable turn of events".

1.9. International Maritime Organization (IMO-82)

The fundamental reason for the association was to give apparatus to co-activity among legislatures in the field of sea laws to work with oceanic security and marine environment (IMO, 2020).

1.10. MARPOL 73/78

Port Authoritative will be the reason for forestalling, decreasing, and controlling contamination from vessels. Inside the edge of commonly acknowledged worldwide guidelines and principles, any standard directing vessel source contamination like the International Conference of Pollution from Ships, 1973, to change by the regulations of the conduct of 1978 (UN, Ocean Capacity, 2013).

From there on, sea transport-based contamination has become more significant and observable, the oceanic local area has worked determinedly to relieve it for a very long time since. All the more urgently, the disaster impacted the formation of the International Convention for the Prevention of Pollution from Ships (MARPOL) 1973/78. This code is the most extensive peaceful accord covering transport-based marine contamination. MARPOL came into force in 1983 and was replaced with OILPOL 1954. This code has 6 Annexes sanctioned by 100 sea countries remembering Pakistan for 1995, a somewhat late approval. MARPOL 73/78 arrangement with the oil, and all types of vessel-based contamination. The Annexes, which manage different sorts of waste made installed ships, contain most of the specialized measures (UN, Ocean Capacity, 2013).

1.11. London Dumping Convention

Since 1972, the agreements related to Marine Pollution to the Dumping of Waste and Other substances into the sea like the London Convention, this is main peaceful settlements for shielding the marine environment from human activities, and also other arrangements have already begun around the world. Its motivation is to work on effective control of all reasons for marine contamination along with to make commonsense answers for keeping wastes and other trash from dirtying the sea. This Convention is currently ratified by

87 countries. The "London Protocol" was agreed upon in 1996 to update the Convention and, in the long term, to replace it (IMO, Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 2019).

1.12. FUND 71

The International Fund Convention for Compensation for Oil Pollution Damages, 1971, went into force on 16 October 1978.

Different sessions that are related to the LBMP (Land Based Marine Pollution) following regional conventions are as follows:

- **Helsinki Convention** is a treaty that was signed in Finland. The seven states endorsed that pact on March 22, 1974, to combat growing marine pollution caused by human activities and industrialization. On May 3, 1980, show formally assumed power.
- **Paris Convention** to anticipate and take out contamination of the marine climate from all sources of contamination, for example, ocean squander and perilous substances and it was endorsed between North-East Atlantic on 4 June 1974.
- **Barcelona Convention:** The objective of this treaty is the assurance of the marine climate from transport-based contamination, land-based contamination, unloading and release, and security of the Mediterranean Sea. It was endorsed between 13 states and adopted on 16 February 1976 after the change on 10 June 1995.
- **Lima Convention:** The target of this treaty is to ensure the marine environment and oceanic zones (200miles) of the South-East Pacific and then some (UN, Ocean Capacity, 2013).

1.13. CLC 69

In June 1975, the International Conference Civil Liability and Oil Pollution Damages (CLC) 1969 came into the effect. According to the Convention, the owner of the vessel from which contaminated oil escaped or was released bears the risk of such harmful act. All self-propelled ships are included in the convention. Except for Pakistan, which is not part of CLC 69, all 98 states are participating in this event (FUND, 2019).

1.14. INTERVENTION 1969

The Intervention 69 commemorates the 1969 International Convention on High Seas Intervention in Cases of Oil Pollution Casualties. The explanation for the improvement of this was to raise the issue of the forces of the coastal state to meddle when a genuine danger was presented to its shore after the establishment of Torrey Canyon in 1967. This show gives restricted freedoms to seafront states to go to preventive lengths on the high oceans against ships which can make approaching risk for shore. The absolute 70 expressed confirmed this treaty including Pakistan approved and its 1973 Protocol and came in to force on 06 May 1975.

1.15. International Convention for the Prevention of Pollution of the Sea by Oil (OILPOL/1954)

OILPOL was the main settlement embraced in 1954, to make the marine environment contamination free. OILPOL directs the release of oil and slick combinations from big haulers and different ships.

1.16. Role of Protection & Indemnity Club (P&I Club/1869)

P and I Insurance has steadily extended over many years covering a variety of outsider liabilities barring the 'Hull and Machinery' asserts yet including among others – Oil contamination from ships or fixed/drifting structure. In this

manner, the primary point of the International Group addressing the interests of the P&I backup plans is to work with the plans of forestalling oil slicks and speed up reactions (Insight, 2021).

"The oil market has been healing faster than people have been ready to give it credit for"

(Saad Rahim)

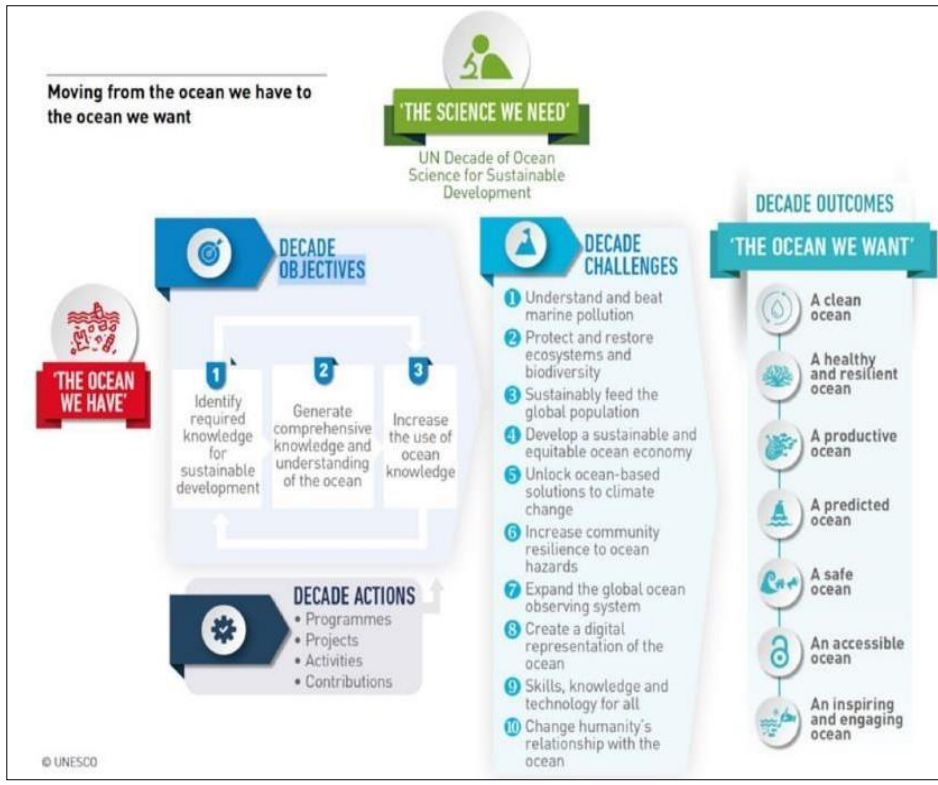
1.17. Reliability of Analysis/Findings

The reliability of data is based on finding from the questionnaire. The questionnaires were prudently verified with the help of marine and maritime experts.

UN prepared 10 years Ocean Decade Plan on the international level ***"To achieve sustainable development, good science is needed to inform policies and raise the knowledge bar of all stakeholders"*** (UN, Environmental Coastal & Offshore, 2021)**.** This plan is directly linked with SDGs-(Number 14)-2015, which is focused on the protection of the sea and environment (Ryabinin, 2019). The fundamental goal of the UN Decade of Ocean Science for Sustainable Development is to aid efforts to reverse the downward trend in ocean health and improve circumstances for the ocean's long-term development (Sciences, 2021). In 2021, for further ocean sustainable development the Moreover, the UN is presenting the following ocean decade

challenges for protection and continuous improvements in the marine environment:

Figure 4:http://digital.ecomagazine.com



2. Recommendations:

The proposed following recommendations are as under:

1. The strict implications of laws, conventions/codes related to the protection of the marine environment, and the need to maintain immediate compliance with international standards and bodies.
2. Needs to make strong relationship between different government and local bodies like KW&SB, PEPA, Pak Navy, ports and industries with bureaucracy.
3. PEPC needs to take resourceful steps, it may create linkages and

resolve the issues between stakeholders to clear up the environmental issues due to marine pollution in coastal areas.

4. Marine environmental issues can solve at both federal and provincial levels are required and with the 18th amendment in the constitution of Pakistan 1973, provisional authorities have maximum powers to regulate their problems. After the mentioned amendments, the Environmental Protection Agency of Sindh is responsible to control marine pollution. But, agencies have problems because of the restricted role or specific responsibilities assigned to the pollution control agencies.
5. It is further recommended that proper accounting procedures should be established so that the polluter is punished. PEPA is responsible authorities should perform their duties religiously and judiciously according to their roles and laws.
6. Industrial discharging waste dumping should be bound in Layari and Malir rivers by law without proper sewage treatment process. The punishment and penalty of fine should be remarkable for all defaulters.
7. According to PEPA ordinance 1983/87 "The polluter will be fined according to the law and the proposed fine amount was 100,000 PKR, or the polluter will be sent to imprisonment of 2 years. Depending on the situation fine amount can be added or both punishments can be given to the polluters as per the severity of the offense."
8. Media and academic institutes with collaboration should be used for awareness of the public about hygiene/dumping wastes and personal and local sanitation.
9. New treatment plants in other areas should also be installed to treat the

domestic and industrial wastewater before its discharge into coastal areas with legislation in this regard needs to be strictly enforced.