

Socio-Ecological Analysis of Karachi Harbour Area – Non Adherence of Marine Pollution Laws

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Abstract

The environmental degradation of Pakistani waters especially in Karachi coast became a serious threat to the human health, marine environment, life & marine vessels since long. This long-standing issue and pollution created by many sources is major contributing factor. At ancient times, it was considered that Earth can sustain all the human activities and oceans cannot be polluted by these activities but later it is experienced that Earth has limited capacities to absorb human waste & oceans can be polluted. A close analysis of the existing state of degraded marine environment/ecosystem (a great challenge for the concerned authorities) reveals that ignorance of laws, less interest of responsible organizations and non-cooperation by public are the main reasons of socio-environmental threats, which are social crimes. This research article gives an unambiguous and broad picture for correct understanding of the major issues threatening the social life in Karachi Harbour & its adjoining coastal areas due to non-adhering of Marine Pollution laws. The deteriorating environment at Karachi Harbour warrants immediate corrective actions in order to curtail further destruction by this menace & social crime. For Socio-economic uplift the Maritime Policy 2002 incorporated for protection and promotion of strategic and maritime interests, conservation of maritime environment, including development of coastal zones, ports and harbours has been enforced. The implementation of existing laws in a true letter and spirit merits the best possible solution to meet the challenges regarding sociological threats in the Pakistani waters.

Keywords: *Marine Pollution, Hazardous Effects, Marine & Human Life, Sociological Crime, Marine Pollution Laws*

Introduction

As the body requires health to be active and productive, the environment also needs to be healthy in order to benefit the living

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creatures & life on this earth. Polluting the marine environment/ecosystem is one of the main issues in many developing coastal countries, which is badly affecting social life in these areas. Some of the developed countries such as US have quite successfully solved the environmental issues by enacting and implementing certain laws. Since independence, in Pakistan the pollution issues are at rise in Karachi harbour area due to industrial growth being ex-capital and only hub of marine activities. Many issues in effective implementation of enactments like awareness among people and control of land based pollution (a major source) are persist.

With this premise in mind, this article determines the level and the distribution pattern of heavy metalsⁱ in coastal waters receiving a continuous discharge of untreated domestic and industrial effluent through Lyari River. The root causes which led to the legal frameworks and globalisation of the issue in 20th century discussed. The common environmental cum social crimes are the illegal emission or discharge of substances into air, water or soil, the illegal trade in wildlife, ozone-depleting substances and illegal shipment & dumping of waste is discussed.

Definition of Marine Pollution

A leading scholar of Marine Pollution Dr. Geert Potters states that “**Marine Pollution** is defined as change in chemical or physical condition or the biological contents of water in a supply that prevents or limits further use of the water impairs man’s aesthetic enjoyment of the water. Aesthetic enjoyment means that only human use of water that allows it to be returned to the stream, lake or other source of supply unchanged in quality or quantity”.

As per the “**UN Convention on the Law of the Sea (UNCLOS)**” the marine pollution is defined as "A substance that, if added to any waters, would degrade or alter or form part of a process of degradation or alteration of the quality of the waters to an extent that is detrimental to their use by humans or by an animal or a plant that is useful to humans and any water that contains a substance in such a quantity or concentration, or that has been so treated, processed or changed, by heat or other means, from a natural state, that it would, if added to any waters, degrade or alter or form part of a process of degradation or alteration of the quality of the waters

to an extent that is detrimental to their use by humans or by an animal or a plant that is useful to humans(UNCLOS, 1982)."

Environmental Management Act of British Columbia, Canada defines pollution as "the presence of substance or contaminants in the environment that substantially alter or impair the usefulness of the environment." Spreading of marine pollution is a social crime which should be dealt severely under the applicable laws (Environmental Management Act, 2003).

Types of Marine Pollution

There are many forms and types of Marine Pollution according to their nature and effects. However, followings are its major types:-

- a. Oil Pollution
- b. Industrial Pollution
- c. Organic Pollution
- d. Domestic Pollution
- e. Land Pollution
- f. Ocean Pollution
- g. Water Pollution
- h. Noise pollution
- i. Solid waste
- j. Garbage & Wastes

State of Pollution in Karachi harbor

The population of Karachi was 20.269 million according to census 1998, increasing rapidly and has reached about 24 millions in 2015 (World Population Review, 2003).

Karachi generates approximately 12000 tons of waste & garbage and about 500 MGD of untreated chemical mixed water. The Karachi Harbour spreaded over an area around 60sq kms receives diversified pollutants from Land as well as Marine Based sources, including 472 MGD of untreated industrial cum Municipal water from the city through hundreds of fishing crafts operating in Karachi Fish Harbour, refuse from various industrial and commercial premises situated on the perimeter of the Harbour & Shipping emissions. These pollutants play havoc and jeopardize the Marine Ecosystem. Further, chemicals present in industrial effluents cause degradation of hull and machinery of ships in harbour due to their corrosion effects (Waste Disposal on Daily Basis in Karachi Harbour, 2015).

Sources of Pollution

According to the Global findings, 80% of marine pollution generates from land-based sources. Karachi generates 472 Million Gallons per Day (MGD) of wastewater. The prominent drains that transport the land-based industrial cum municipal waste to Karachi harbour are as follows:-

a. Lyari River	-	220 MGD
b. Nehre-e-Khyyam	-	16 MGD
c. Soldier Bazaar Nullah	-	30 MGD
d. Pitcher Nullah	-	7 MGD
e. Karli Nullah	-	7 MGD
f. Railway Nullah	-	4 MGD
g. Other Sources	-	188 MGD

Sewerage Treatment Plants

The capacity of existing sewage treatment plants and their present working status are charted below:-

Sewerage Treatment Plants	Optimum Design Capacity	Actual Treatment at present
STP-I - SITE	51 MGD	20 MGD
STP-II - Mehmoodabad	46.50 MGD	00 MGD
STP-III - Mauripur	54 MGD	30 MGD
Total	151.50 MGD	50 MGD

The above chart shows that out of 472 MGD of the generated municipal effluent only 50 MGD is treated and the rest passes untreated on to the sea through the drains mentioned in section-3 above. The existing Sewage treatment Plants are operating at reduced capacity due to inadequate transmission capacity of interceptors.

Effects of Marine Pollution

Effects of Marine Pollution are hazardous, very diversified and severally harmful both for human & marine life. The human life is almost dependent on the environment of earth & its natural resources. The Earth is currently facing lot of environmental concerns and environmental problems. According to Maritime Policy of Pakistan, 2002 "protection and promotion of strategic and maritime interests, conservation of maritime environment, including development of coastal zones, ports and harbours" is guaranteed. To live in neat and clean pollution free friendly

environment is very essential and can be existed with the interaction/present of forest and forest/wild life (Maritime Policy of Pakistan, 2002).

a. Human Life

The current environmental concerns represent a considerable measure of danger to well-being of people and living creatures. Dirty water is the highest danger to well-being of the world and poses a risk to the health and lifespan of people as well as marine animals. Pesticides & dangerous chemicals present in the polluted environment can enter the body through inhalation of aerosols, dust and vapor through oral exposure by consuming food/water and through skin exposure by direct contactⁱⁱ. Effects of different pesticides & chemicals on environment are given in (Table 1).

Table-1: Specific Pesticide & Chemical Effects on Environment

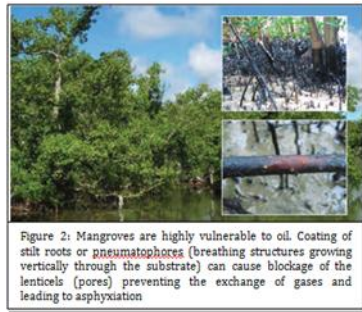
S.No.	Pesticide/Class	Effect
1	Organ chlorine DDT/DDE/ Organophosphate/ Anticholinesterase	Egg shell thinning in raptorial birds and endocrine disruptor. Thyroid disruption, birds amphibians and fish. Immunotoxicity, birds poisoning, acute mortality to inhibition/ esterase activity Oxidative damage Modulation of signal transduction pathways
2	DDT/Diclofol, Dieldrin and Toxaphene	Carcinogen Endocrine disruptor Juvenile population decline and morality in wildlife reptiles
3	DDT/Toxaphene/Parathion	Susceptibility to fungal infection
4	Triazine	Earthworms became infected with monocystid gregarines
5	Chlordane/ Carbamates/ Atrazine	Interact with vertebrate immune systems
6	Pyrethroid/Triazine/Triazole/ Thiocarbamate	Thyroid disruption properties in rodents, birds, amphibians and fish
7	Nicotinoid	Respiratory, cardiovascular, neurological and immunological toxicity in rats and humans.
8	Imidacloprid, Imidacloprid/Pyrethroid cyhalothrin	Impaired foraging, brood development and colony success in terms of growth rate and new queen production
9	Thiametoxa	High honey bee worker mortality due to homing failure
10	Spinosyns	Effects on physiological and behavioral traits of beneficial arthropods, particularly hymenopterans
11	Bt corn/Cry	Reduced abundance of some insect taxa, predominantly susceptible Lepidopteran herbivores as well as their predators and parasitoids.
12	Herbicide	Reduced food availability and adverse secondary effect on soil invertebrates and butterflies. Decreased species abundance and diversity in small mammals.

b. Marine Life/Living Creatures

The maritime zone of Pakistan is about 30% of the land area very rich in fisheries as per assessment of marine living resources. The amount of carbon in the water and the atmosphere is continuing to be a problem in the world around us. The oil through many sources washes up on beaches and thus contaminates breeding as well as feeding areas of marine mammals. Skin and eye irritations, blindness, lung and liver failures can be observed on marine life of all types if contact to oil spills over a long period (Maritime Policy of Pakistan, 2002).

c. **Mangroves**

Mangroves are salt-tolerant trees and shrubs growing at the margins of sheltered tropical and sub-tropical waters (UNCLOS, 1982). Mangroves provide a valuable habitat for crabs, oysters and other invertebrates as well as important nursery areas for fish and shrimp. In addition, mangroves are also considered



extremely sensitive to contamination by oil, dependent largely on the substrate in which the mangroves are growing (Figure 1). Heavy oil inundation of the root system may block this oxygen supply and may cause the mangroves to die.

Chemical Effects of Pollution on Living Elements

Chemical contamination among plastics, toxins in the wastes like chemicals seep and anti-freeze into the ground is the one of the biggest threats by land pollution to the eco-system. In the recent modern life pattern has invented many chemicals and other un-biodegradable & unsolvable even after long duration. These material and their particles poison itself the earth where they are dumped. Humans, animals and all other living creatures all are affected by consuming the food etc growing on the same soil due to presence of chemical.

Effects on Shipping

Presence of floating pollutants/solid waste and mixture of untreated industrial & municipal waste is a source of sever marine pollution in Karachi Harbour. PN warships, submarines, other small vessels and Merchant Ships berthed at Karachi Harbour make use of sea water for cooling of various equipment/ machinery, which frequently malfunction/ fail due to presence of floating debris/ plastic bags and toxic sea water, thus affecting the efficiency and performance of these system significantly. Chemicals present in industrial effluents cause degradation of hull and machinery of ships in harbour due to their corrosion effects.

Corrosion can also occur in the presence of moisture, resulting in the chemical corrosion. For example when iron is exposed to moist air, it reacts with oxygen to form rust.

Life Cycle of Different Pollutants in the Sea

Some pollutants when dumped into sea take very long time to dissolve and remain hazard for marine life. Plastic bottles take 450 years, disposable diapers 550 years, fishing line 600 years and plastic bags take even upto 1000 years to dissolve when dump or manage to reach into sea.

Environmental Crime

The definition of “environmental crime” and particularly “maritime crime” is violation of environmental laws are enacted to protect the marine environment/ecosystem, these crimes include all illegal acts those are harmful for environment. Violation of environmental laws are subject to criminal sanctions. The environmental crimes can describe as acts or conducts that breach

environmental legislation and cause considerable harm or threat to the environment and human health for which criminal sanctions can prescribe (Clifford, 1998).

The common environmental cum social crimes are the illegal emission or discharge of substances into air, water or soil, the illegal trade in wildlife, illegal trade in ozone-depleting substances and the illegal shipment or dumping of waste.

Causing Marine Pollution is Crime

At ancient times it was considered that Earth can sustain all the human activities and oceans cannot be polluted by these activities but later it is experienced that Earth has limited capacities to absorb human waste & oceans can be polluted. The continual economic growth, urbanization & huge industrialization caused environmental degradation and observed that it could not sustained forever. The raising awareness of environmental offences as a serious and growing global problem with devastating effects on the environment and human health compelled the international community to adopt relevant regulations against environmental & social crimes.

Penalties of Crime

There are six general environmental principles that have been incorporated worldwide: "the sustainability principle, the polluter pays principle, the precautionary principle, the equity principle, human rights principles and the participation principle" (Boyle, 1992).

Criminal law and procedural criminal law are generally deemed to be basic segments of State's sovereignty. Undeniably, for very first time the MARPOL Convention described the whole issues of marine pollution. Earlier anti-pollution conventions were limited to pollution by oil, MARPOL aimed at all kinds of sea-borne pollution: oil, chemicals, sewage, garbage, and other harmful materials. General environmental standards on marine pollution are enacted by the United Nations and specifically by the International Maritime Organization (IMO) such as MARPOL 73/78, CLC 1992, HNSC, UNCLOS 1992, SOLAS 1974 & such other treaties & conventions which also imposed financial penalties on the polluters and upheld of polluting vessels or vessels in lieu of the same company. The

penalty can also be in shape of detention of master of the ship and crew, responsible for the pollution.

Our national legislation such as KPT Act, Fisheries Act, PEPA, PMSA, Merchant Shipping Ordinance 2001, NEQS, SEPA and many other enactments also impose financial penalties and other such punishments to the polluters committing social crimes.

Applicable existing laws on Marine Pollution

Many laws & conventions are applicable to govern the marine pollution in Pakistani waters, separate legislation on the field of land, harbour and fishing already exists for the protection of marine environment. Hence, sufficient laws are enacted to control & prevent marine ecosystem from pollution and unfortunate marine disasters in and around the coastal areas, harbours, ports, estuaries and all marine domainsⁱⁱⁱ but ignorance and non-adherence of existing legislation brought Karachi harbour to the existing deteriorated condition of marine environmental pollution.

Apart from lack of implementation of applicable laws, this unwanted situation of harbour relates to lack of coordination between different government agencies like CDGK, FPCCI, EPA, PMSA and KPT. The applicable existing laws to control the pollution on land and in harbour areas of Pakistan are given below:

1. Pakistan Panel Code, 1860
2. Karachi Port Trust Act 1886
3. Fisheries Act 1897
4. Ports Act 1908
5. Factories Act 19-TX4 (Act XXV of 1934)
6. Constitution of Pakistan, 1973
7. Pakistan Territorial Water and Maritime Zone Act 1976
8. The Sindh Buildings Control Ordinance 1979
9. Pakistan Environmental Protection Act, 1997
10. Pakistan Maritime Security Agency (PMSA) Act, 1997
11. National Environmental Quality Standards (NEQS), 2001
12. Pakistan Merchant Shipping Ordinance, 2001
13. Maritime Policy of Pakistan, 2002
14. Pakistan Navy Manual of Pollution Control
15. The Sindh Local Government Act 2013
16. Sindh Environmental Protection (SEPA) Act, 2014
17. International Convention for the Safety of Life at Sea 1974"

18. Marine Pollution (MARPOL 73/78)
19. International Convention for the Prevention of Pollution from Ships 1974
20. United Nations Convention on Laws of the Sea 1982
21. International Convention on Oil Pollution Preparedness, Response and Cooperation 1990 (OPRC)
22. Convention on Civil Liability for Oil Pollution Damage (CLC), 1992
23. Other International treaties & conventions

Challenging Situation

The day by day deteriorated Marine Environment is becoming a challenge for all responsible Organizations/Agencies to control the present situation, if it continues then marine ecosystem of Karachi coast & its adjoining will be drastically damaged. Concerned organizations are responsible for controlling social crime destroying social life of citizens. People living in coastal areas, require most of resources from the sea. Karachi, like other coastal areas is thickly populated because of better and diversified job opportunities is challenging the ecosystem.

Pakistan is a developing country where the greatest threat to Coastal environment is dumping of untreated sewage directly into the sea. It is estimated that hardly 25% of city sewage are treated while remaining passes into the sea untreated. The rapidly increasing population is putting continuous challenge to existed treatment plants and disposal facilities. After start of China Pakistan Economic Corridor (CPEC) and development of Gwadar Deep Water Port project will generate economic activity & enhance shipping will also increase in marine pollution.

In addition, following serious threats considered as social crimes by one or the other pretext are persist for marine ecosystem:

- a. The smoke from vehicles, factories, and chemical waste from dumping of garbage, sewage, alien species and oil has a negative effect on marine ecosystem, which is poisoning and contaminating the marine life in the sea.
- b. Areas like Indus Delta where there is an abundance of resources such as wild habitat, fish, and wetlands are more vulnerable from the cumulative danger of manmade pollution.

- c. The port induces polluting industries to set up shop nearby in order to expedite exportation. These industries are badly affecting the environment and committing social crimes as they release untreated effluents directly into the port area.
- d. In 1992, a United Nations study noted that the "concept of wastes recycling, treatment and disposal does not exist in the industrial sector [in Pakistan.] (Environmental Management Act, 2003). Even the highly polluted wastes discharged irrationally into water bodies, on soil and in the air. Industrial waste treatment systems are virtually non-existent in the country.
- e. The shipping industry, as a form of transportation pollutes the environment. The polluted port and coastline diminishes the quality life of Pakistanis.
- f. Biodiversity Loss owing to environmental changes resulting from pollution and degradation of resources, there has been a change in marine species composition, health, and diversity.

Core issues of Marine Pollution

The core issue of marine pollution in Karachi Harbour is the flow/dumping of Land Based Pollution in harbour especially during rainy session. Similarly, the industries directly discharge untreated chemical waste into the drains, which ultimately reaches to Karachi coast and severely degrades marine environment. Following legislation is enacted to control the marine pollution:-

- a. According to PEPA 1997, the term 'environment', inter alia, means the land, air and water. Hence, the pollution also relates to these three major sources. Water Pollution is a major problem in Pakistan. There are many sources of water pollution in Pakistan most of them are found in Karachi, being an industrial city.
- b. Despite government policy for filtration and release into the sea of industrial waste, several industries discharge contaminated water into sea is threatening to extinct marine life and polluting the sea-water. Karachi's sewerage is plonked into rivers which ultimately ends up in the sea. The oil spill incident of Tasman Spirit further increased the pollution caused beach areas unworthy & unhealthy for visit. The incident has also annihilated millions of fishes and ruined the marine ecosystem.

Conclusion

Since last 30 years, deterioration of marine ecosystem of Karachi harbor & adjoining coast has become a great challenge for the Karachi Port Trust and other responsible organizations. The marine environment of Karachi harbor & Port area is deteriorating due to continuous ingress of different pollutants. At present garbage/solid waste from mega city of Karachi is not being properly disposed off. The situation to control the marine pollution has worsened with the passage of time due to the manifold increase in population of metropolitan industrial city. The non-implementation/adherence of existing laws and less interest of responsible departments led to the present deteriorated situation of marine environment in Pakistani waters. Maritime Policy of Pakistan, 2002 guarantees "the protection and promotion of strategic and maritime interests, conservation of maritime environment, including development of coastal zones, ports and harbours", for neat & clean pollution free environment can be achieved by increase in forest/wild life. Concerned organizations to be held responsible for committing social crime by destroying the social life of citizens. Detail study & scrutiny of applicable laws reveals that there is no deficiency in any of existing laws if implemented in true spirit and intension of lawmakers.

Recommendations

Major source of marine pollution worldwide consist of almost 80% from Land Based sources. If the situation remains, same the health and even life of approximately 2.2 billion populous of the world is not only threatened also will be at high risk as issue of marine pollution is trans boundaries/international.

Followings recommendations are given to minimize & control the dangerous effects of marine pollution, a challenge for our marine environment/ecosystem.

- a. All industries discharging pollutants in form of waste in Layari and Malir rivers should be bound by law to have a proper sewage treatment plants where they should treated the all their effluents before discharging them into these rivers/Nullahs Concerned organizations to be held responsible for committing social crime by destroying social life of citizens.

- b. KPT/PQA must have adequate number of dump barges and treatment plants in harbour to cater for all ships berthed in the harbour.
- c. All vessels should be well informed and well educated about marine pollution and its effects, thus not to pollute marine environment.
- d. Recycling and reusing the waste policy must be enforced in the city/country.
- e. Article 9 of Constitution of Pakistan, 1973 guarantees the security of life of a person but it does not mention the right to live his life in neat and clean pollution free friendly environment. Constitution may be amended to guarantee the rights to live in pollution free, neat & clean environment. It will protect & prosper social life of citizens against social crime/injustice.
- f. Public awareness program through electronic/print media be run to educate the general public.
- g. Incentive on depositing of garbage from household users be introduced.
- h. Above all these recommendations there is a need of time to formulate a Joint Action Committee (JAC) consist of a authoritative & well conversant reps of all stakeholders preferably under the umbrella of MSA or Ministry of Port & Shipping to undertake the responsibility to curb the menace of marine pollution by implementing existing laws on the issue. Committee must meet on fortnightly basis to review the progress and to launch further modalities.

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