Safeguarding Pakistan's Maritime Infrastructure: A Call for Sustainable Protection Against Marine Pollution

Commodore

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Overview

- Pakistan has over 1000 KM long coastline.
- There are four major, and six minor fish harbors in Pakistan.
- Besides, there are several other places which are serving as makeshift fish harbors for the local fishermen all over the coastline.

Major and Minor Fish Harbors

Major Fish Harbors			
Karachi Fish Harbor		Sindh Coast	
Korangi Fish Harbor		Sindh Coast	
Pasni Fish Harbor		Makran Coast	
Gwadar Fish Harbor		Makran Coast	
Minor Fish Harbors			
Makran Coast		Sindh Coast	
Jiwani	Ormara	Keti Bunder	Shah Bandar
Pasni	Sonmiani		

Karachi Fish Harbour

- Karachi Fish Harbor is situated in the Sindh region of Pakistan.
- This harbor is responsible for more than 90% of Pakistan's seafood exports.

Korangi Fish Harbor

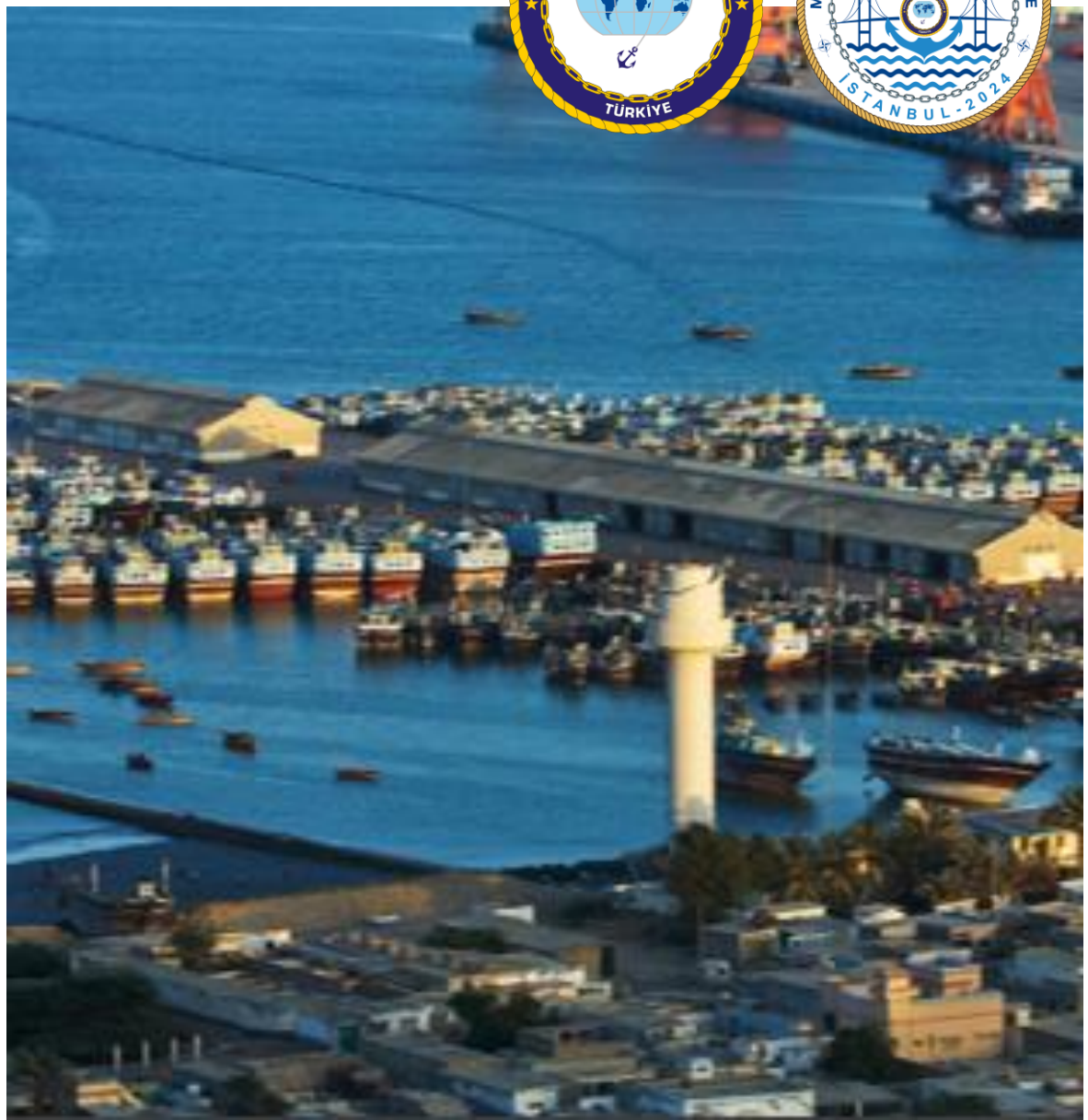
- Korangi Fish Harbor is in Malir district of Karachi.
- The harbor is managed by Federal Ministry of Maritime Affairs of Pakistan.

Pasni Fish Harbor

- Pasni Fish Harbor is in Pasni, Balochistan.
- It is operational since 2016 and operated by the Government of Balochistan.

Gwadar Fish Harbor

- Gwadar Fish Harbor is in Gwadar District of Balochistan Province.
- With the expansion of Gwadar port, the harbor is planned to be relocated.



Introduction

- Karachi harbor has an immense operational infrastructure of Pakistan National Shipping Corporation (PNSC), Pakistan Navy (PN), and Pakistan Maritime Security Agency (PMSA).
- Being a commercial port, all merchant ships and oil tankers are berthed at this port.
- It is significant for the readiness of PN and PMSA for peace and wartime operations.

- Although the Government of Pakistan has declared Karachi Port Complex a National Vulnerable Area owning to pollution, Karachi's coast receives massive pollutants from various land-based sources.

- The primary sources include liquid discharge from industry and solid effluents of the municipality.
- The non-availability of disposal facilities and the absence of effluent treatment plants add to the misery.
- Toxic liquids and solid pollutants remain in the harbor for extended intervals.

- This pollution threatens the marine environment and ocean life and degrades water quality.
- These pollutants also affect the life of assets and infrastructures, including berthed and underway ships.

Karachi’s dirty water flowing to ocean untreated.

Results

- This study estimates that a total of 472 million gallons per day (MGD) of sewage is produced by Karachiites on the daily basis, out of which, at least 411 MGD is directly discharged into the sea, most of it into the Karachi Harbor and the surrounding coastal waters every day . Whereas 55 MGD of treated water is also discharged into the harbor. On the other hand, 6 MGD of polluted water from the raw sewage is used by farmers in the nearby fields.

Figure:
Current Ratio of Sewage Treatment/discharge from the Total of 472 MG/Day

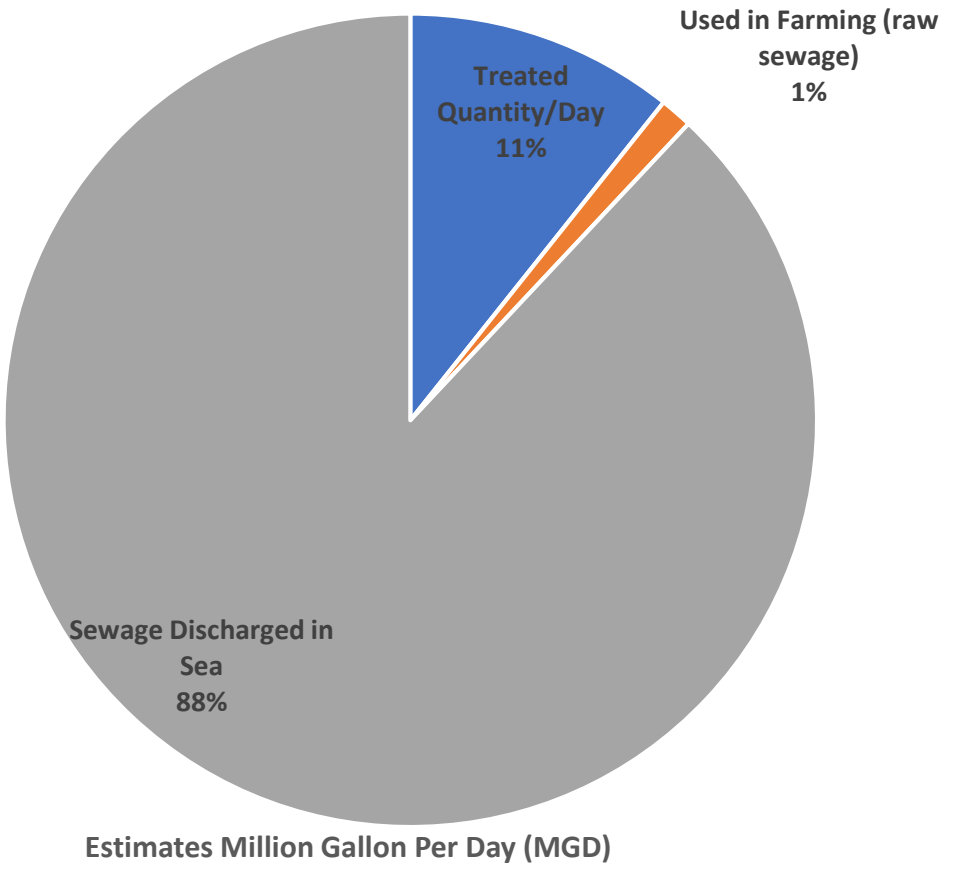
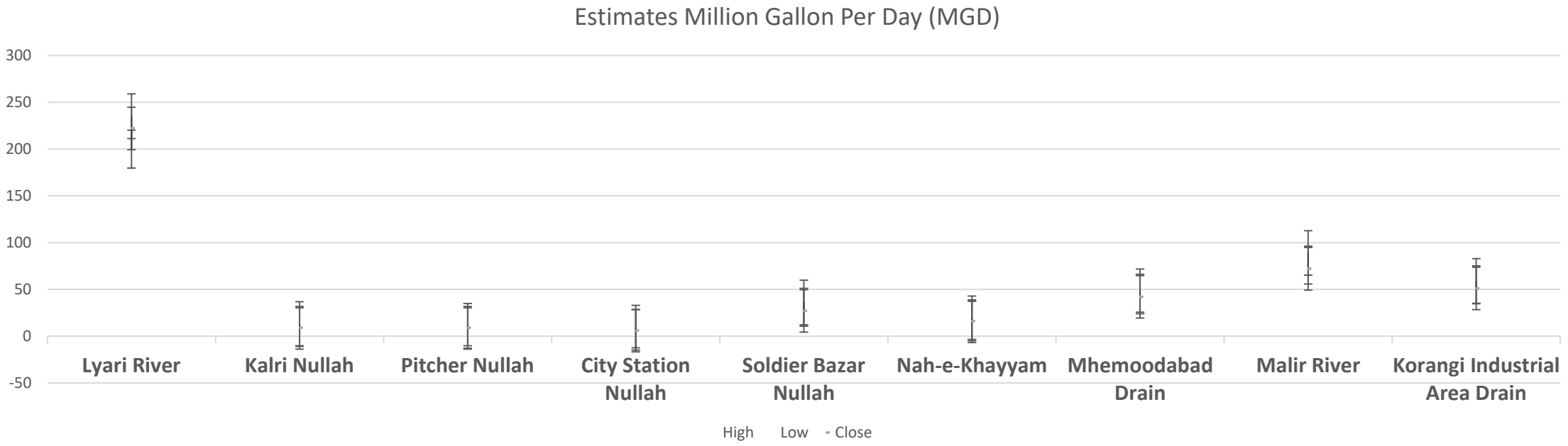


Figure: Land-Based Sources of Marine Pollution Dumped into Karachi Harbor



2 Rivers – 7 Drains

- To resolve the issue, there are three Sewage Treatment Plants (STP) with an optimum design capacity (ODC) of around 150 MG/day.
- STP 1: 51 MGD
- STP 2: 46.5 MGD
- STP 3: 54 MGD
- However, these plants are working below their capacity.

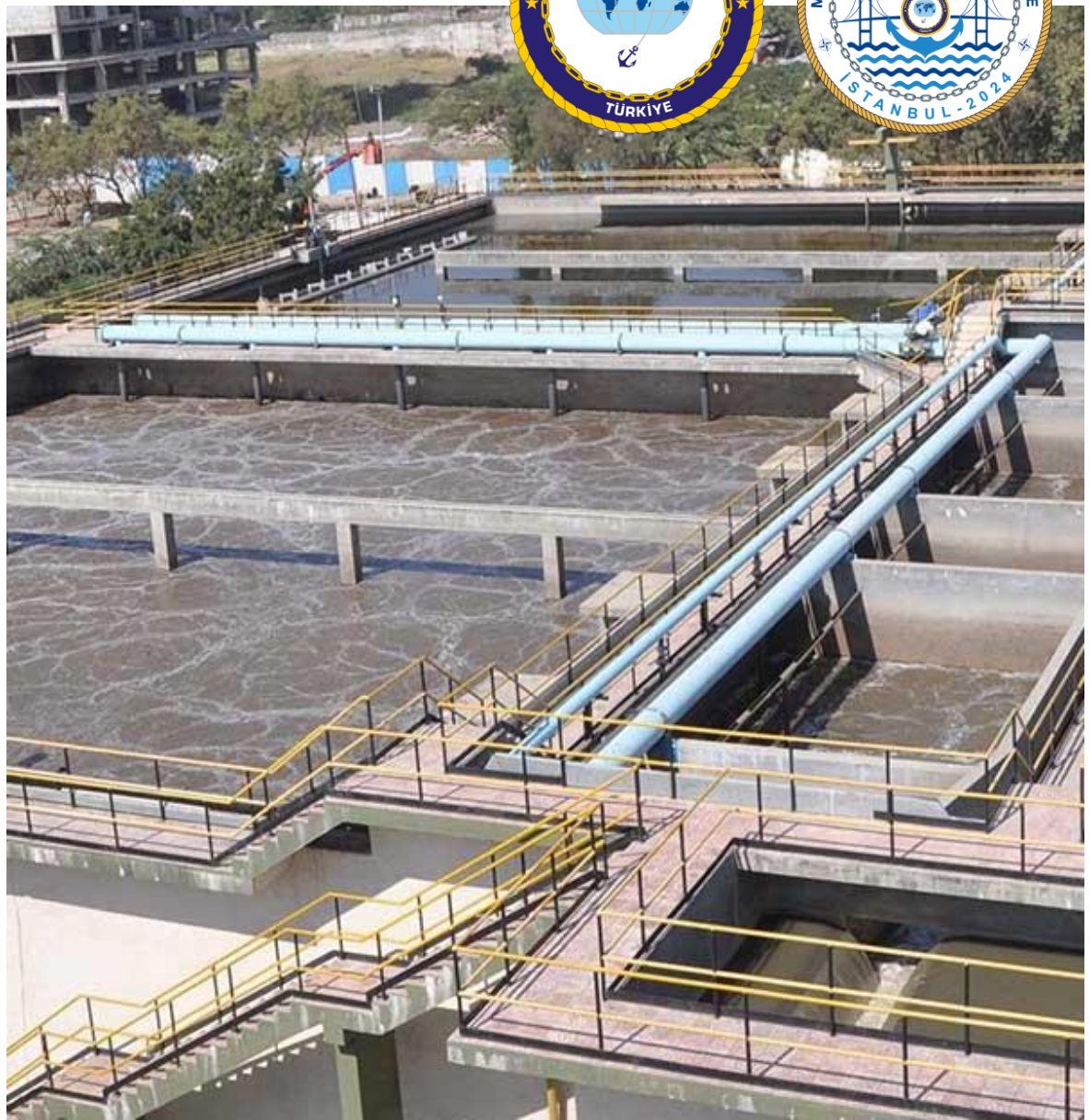
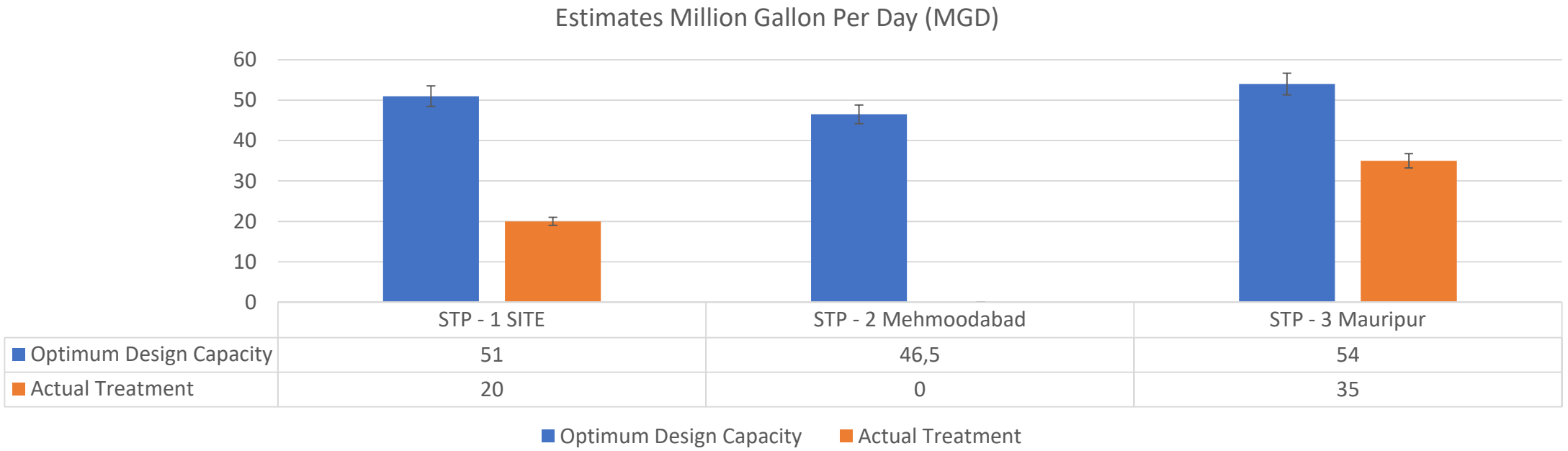


Figure: Status of Sewage Treatment Plants (STP) in Karachi with a Comparison of Optimum Design Capacity and Actual Treatment




The ocean needs our help

- Karachi’s domestic and industrial wastes continuously discharge which is degrading water quality in Karachi Port, particularly near the Lyari River mouth, which drains into the Karachi Harbor.

- Scientific analysis shows that the western backwaters of Karachi Harbor, where organic and inorganic wastes from domestic and industrial are dumped into the Lyari River, have a excessively negative impact on the marine ecology of the harbor.
- Further, the residents' untreated household garbage also drains into Karachi Harbor.

Table: Standard Reference Value of Elements in the Seawater

S#	Element	Standard Value	East Wharf	West Wharf
a.	Chloride	19.35	17800	18400
b.	Sodium	10.76	10500	10500
c.	Sulphate	2.71	2256	2240
d.	Magnesium	1.29	1282	1350
e.	Calcium	0.41	370	365
f.	Potassium	0.39	360	360
g.	Alkalinity	1.2	130	152

Trash at Karachi Harbor

Discussion

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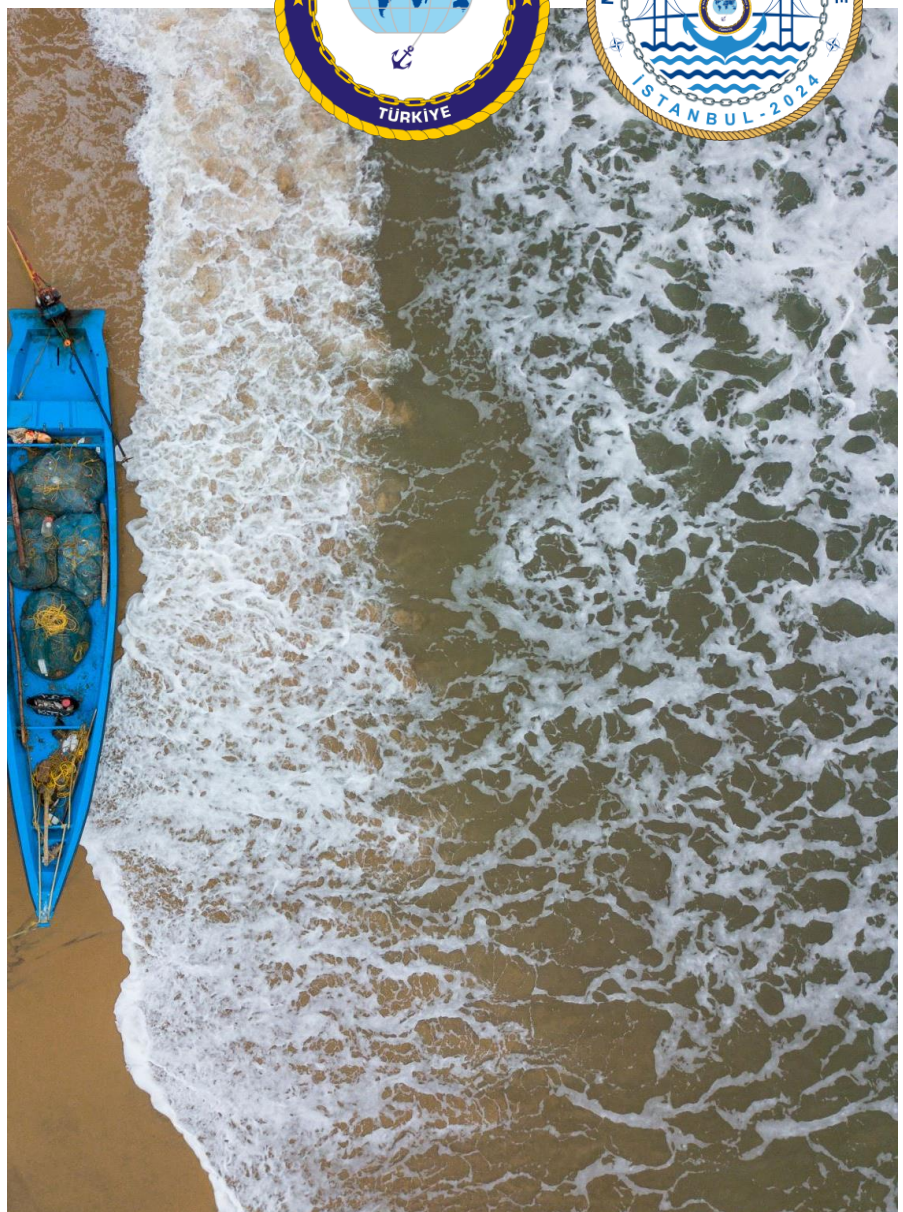
Karachi Harbor Suffers from Marine Pollution

- While much of Pakistan’s coastline is clean, both inland and coastal sources often pollute Karachi Harbor mainly.
- Land-based sources, including liquid effluent of industrial and municipal origin and solid trash, specifically pollute Karachi Harbor.
- The debris also cause damage to fish and other creatures that is used for food. Thus, they also become a health hazard.



Plastic Bottles, a potential danger to the life at sea

- Karachi is the hub of most polluting industries, where poor sewage treatment, disposal infrastructure, and a lack of effluent treatment plants are to blame for the city's pollution crisis (Javaid and Shahzad 2016).

- Thousands of tons of household, commercial, industrial, and medical trash are produced daily in Karachi alone (Javaid and Shahzad 2016).
- Much of this garbage is not collected and flushed away on land-based dumping sites, so it ends up in Karachi Harbor.

- Toxic chemicals, metals, oil, and grease make their way into the coastal food chain from around 1% of untreated sewage and garbage, devastatingly affecting human health (PJ, et al. 2020).
- The chemicals make seawater more corrosive by changing its chemistry (Parvin, et al. 2020).

Effects of Marine Pollution on Ships and Port Infrastructure

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- Liquid and solid pollutants remain in the harbor for prolonged periods as they are not wholly flushed out into the open sea due to the natural geography of the Harbor, making harbor waters even more hazardous (PJ, et al. 2020).
- Polluted saltwater accelerates corrosion, which speeds up the hull degradation of boats, ships, submarines and other marine infrastructure.

- The lab tests found that mild steel loses 5.48 grams per square meter per day in open saltwater, whereas in Karachi Harbor, the loss is higher at 9.20 grams per square meter per day. This implies that the corrosion rate of mild steel is greater in Karachi Harbor compared to open saltwater.
- The researchers estimate that Karachi Harbor marine pollution shortens ships' lifespan by roughly 33 percent.

- Frequent breakdowns and flaws in ship machinery, equipment, saltwater pumps, and pipelines directly result from seawater's high corrosion rates.
- Polluted water used for cooling purposes in ships' engines shortens their lifespan owing to corrosion of the water circulation channel and scaling of the intake (Nanan 2020).

- Sheet piles of jetties, berths, docks, port terminals, and other harbor appliances deteriorate more quickly than other parts of the maritime infrastructure and need more regular repair (Nanan 2020).
- Hydrographic equipment, beacons, anchors, floats, and other installations are all susceptible to corrosion and malfunction when exposed to polluted and highly corrosive water.

Plastic Trash, a Big Problem for the Karachi Harbor

- When the floating trash, particularly polyethylene bags, clogs the cooling water intake of ships and boats, it causes problems for their operations in the harbor.
- Multiple times, solid garbage in the port has damaged the engines of jet-propelled Fast Response Boats (FRBs).

- Floating trash and extremely harmful pollutants reduce the aesthetic value and quality of life in and around the port and pose operational and maintenance challenges.
- The approximate cost of a modern, large navy ship is $300 million.

- For the Navy, losing a ship with a 33 percent life expectancy costs almost $90 million.

Conclusion

- The study estimates that over the course of their service careers, marine pollution will cost the Navy over $1 billion in repairs of ships, submarines, and equipment.
- In September 2021, the lab tests confirmed this by testing water samples from Karachi Harbor.

Recommendations

Recommendations

Abide by the country's laws about protecting the ocean

Install eco-friendly netting of reasonable mash size to collect trash, especially plastics at the mouth of the drains.

Industries must cleanse their wastewater prior discharged into Karachi Harbor.

Enhance capacity and construct new water/sewage treatment plants.

Glimpses of Pakistan’s Incredible Coastline

- From the previous discussions, you have seen the troubles caused by pollution in the vicinity of Karachi Harbor.
- Now, let me take a moment to show you the glimpses of Pakistan's incredible and beautiful coastline which is natural, protected and almost free of pollution.

Kund Malir Beach, Balochistan

Sea View Beach Karachi, Sindh


Do Darya Karachi, Sindh

Chhota Anda/Bara Anda Karachi, Sindh

Port Grand Karachi, Sindh

Clifton Beach Karachi, Sindh


Sapat Beach, Balochistan

Astola Island, Balochistan


Ormara Beach, Balochistan

Kund Malir Beach, Balochistan

instagram.com/Lumia_Focus


Gwadar Beach, Balochistan

Thank You

Methodology

The methodology involved a detailed literature search on the current and previous literature including research articles, reports, and documents from the relevant authorities in the sector to establish cases of pollution in Karachi harbor. An observational survey was also carried out to establish visible sources of pollution in the harbor. Water samples were also taken from different points in the harbor for laboratory analysis since they form sources of information on pollution impact in the harbor. Chemical analysis of water was conducted to determine the presence of chemical pollutants and determination of hazardous substances in the soil samples and the biological effects of contaminated water.

Quantitative techniques were used in analyzing the data with a view to identifying unusual trends, changes and existence of regions with high levels of pollution. The impact assessment given, investigated the potential environmental consequences of social harm on the sea and its inhabitants, water quality and structures of the maritime industry estimating possible future consequences of pollution. Lastly, implication and application toward waste management reforms as well as advancing protective measures for marine structures were written into policy recommendations.