THE MARINE LITTER ACTION PLAN - STATUS REPORT (PAKISTAN)

Abdul Munaf Qaimkhani

Off French Beach, Karachi (Moazam Khan, WWF-Pakistan)

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Contents

Foreword

Pakistan's coastal areas lie on the fringes of the tropical zone, spread around thousand kilometer long coastline shared by the coastal provinces of Sindh and Balochistan that feature marvelous geophysical and ecological landscapes. The coastal and marine resources constitute an important integral part of the country's economy. Three operational seaports (Karachi port, Port Qasim & Gawadar deep-sea port) and major urban and industrial centers including mega city like Karachi located along the coast are considered as hubs for economic activities.

The coastal areas of the country face severe environmental challenges among them Marine litter is one of the area of concern facing the sea waters of Pakistan. This challenge of floating debris in the coastal and marine areas of Pakistan could be effectively dealt with strategic planning and effective coordination between the relevant stakeholders working along the coast by adopting best waste management practices.

It is encouraging that the South Asia Co-operative Environment Programme (SACEP) has initiated a process of developing sub-regional action plan on marine litter with the support of UNEP to promote a strategic resilience approach in South Asian Sea (SAS) region. Ministry of Climate Change feels privileged to steers SACEP regional agenda at country level on behalf of the Government of Pakistan, which provides overall coordination function for all the stakeholders and oversight.

The marine litter national status report developed with the technical and financial support of SACEP and UNEP gives an overview of the coastal and marine areas with specific focus on marine debris. The report contains updated baseline information which will be useful in formulation of marine debris regional action plan. The release of marine litter including plastic debris into coastal waters due to poor waste management practices and illegal dumping has serious environmental and economic consequences on marine biodiversity, fisheries, tourism and navigational activities.

This report in the context of Pakistan presents useful information and recommendations both short and long term to tackle the problem of marine litter related pollution. It provides an overview of the marine debris and points out areas requiring actions for improved waste management to reduce the flow of litter with huge quantity of plastic material into our ocean. Further this report could also be used as source for awareness material to sensitize the decision makers and bring change in public behaviour.

Hopefully regional action plan on Marine Litter will not only address transboundary concerns but also provide guidance for governments, plastic consumers and industry identifying how to move jointly and prevents our sea waters from the serious threat of this new kind of ocean pollution. The implementation on this plan at regional level as well as at national level will help and contribute towards the achievement of targets to be set under SDG-14.

I would like to express my sincere thanks to various federal as well as provincial institutions and NGOs and individuals who extended their support with valuable contribution to the national consultant in preparation of this national status report.

I am hopeful that the information contained in this document will be useful to all the coastal stakeholders for their extensive use in future efforts to reduce the marine litter pollution and translate recommended suggestions into actions on the ground.

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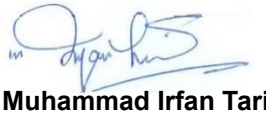

Muhammad Irfan Tariq
National Focal Point for SACEP
Director General (Environment and Climate Change),
Ministry of Climate Change,
Government of Pakistan, Islamabad

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Abdul Munaf Qaimkhani
National Consultant/Ex-DIG (Forests),
Islamabad - Pakistan.

Abbreviations

ADB	Asian Development Bank
ADP	Annual Development Programme
CBD	Convention on Biological Diversity
CDA	Coastal Development Authority
EEZ	Exclusive Economic Zone
FAO	Food and Agriculture Organization of the United Nation
GDP	Gross Domestic Product
GIS	Geographic Information System
GTS	Garbage Transfer Station
ICC	International Coastal Clean-up
ICZM	Integrated Coastal Zone Management
IUCN	International Union for Conservation of Nature
KPT	Karachi Port Trust
MPCB	Marine Pollution Control Board
NCMPR	National Center for Maritime Policy and Research
NGO	Non-Governmental Organization
NIO	National Institute of Oceanography
NSC	National Steering Committee
Pak EPA	Pakistan Environment Protection Agency
SDG	Sustainable Development Goals
SEPA	Sindh Environment Protection Agency
SWM	Solid Waste Management
SSWMB	Sindh Solid Waste Management Board
SUPARCO	Pakistan Upper Space and Atmosphere Research Commission
UNEA	United Nations Environment Assembly
UNFCCC	United Nations Framework Convention on Climate Change
UNEP	United Nation Environment Programme
WWF	World Wide Fund for Nature

Executive Summary

Any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment is known as marine litter. In recent past the adoption of different resolutions by UN bodies on Management of Marine Debris indicate that the issue of marine plastic litter and micro plastics has continued to receive much international attention. Marine litter has tremendous economic, health and biodiversity costs. It pose serious threat to marine life to disturb ocean biodiversity and create hindrances in smooth navigational operations. Another effect of marine litter is that a lot of the dumped waste in the ocean eventually washes up on beaches, and hence ruins beach aesthetic values and tourism.

Pakistan borders the Arabian Sea with a coastline stretching upto one thousand kilometer along the Sindh and Balochistan provinces. Pakistan roughly generate more than 20 million tonnes of municipal solid waste with annual growth rate of 2.4 percent. All major cities including Karachi, Lahore, Peshawar, Quetta and Islamabad are facing enormous challenges in tackling the problem of urban waste. Particularly environmental pollution along the coastline of Pakistan including Karachi city harbor areas and their serious impact due to unmitigated release into the sea is effecting millions of coastal population and marine ecosystem. The most of marine litters enter into the coastal water are from land-based sources through sewerage flow, beach visitors, inadequate waste disposal, commercial fishing, shipping and various industrial activities including ship breaking. However, this issue is of marine pollution and its negative consequences are not yet fully recognized in Pakistan and no single institution is established or assigned to take lead role in mitigation of this problem.

The national report on the marine litter status and issues in Pakistan is prepared in the context to assess the situation of waste management and its impact on our coastal and marine ecosystems. The introductory part of this report sets out the purpose and background of the issue. The second chapter describe the present status of marine debris including origin, trend, source and quantification of data in Pakistan. Section three presents on ground situation of land and sea based generation of wastes and responsibility of different agencies in respect of waste management. The fourth chapter highlight the impacts of marine litter in terms of social, economic and ecological aspects with highlighting the biological hotspots exists along coastal areas of the country. The last three sections focuses on the management, monitoring and gaps related interventions. The concluding way forward section of this report synthesize the outcome of situation review and presents specific recommendations about how the things could be improved. It also looks at the importance of strengthening institutions to manage and monitor marine litter in our waters.

The unsafe and untreated waste at upcountry and major urban areas along the coastline are main source of marine debris. Pakistan is required to develop strategy to control entering of untreated waste in its coastal waters with strong monitoring mechanism. Further to this, at national as well as provincial level an awareness campaigns for beach cleaning and SOPs for recreational and harbor activities are required to tackle the issue of marine litter.

The existing institutional arrangements at some extent allows KPT, NIO and Maritime Security Agency to deal with the issue through proper monitoring. However there are no clear-cut mandate supported by specific legislation for single agency to manage ocean wide marine debris problem in the coastal and marine areas of Pakistan.

During national consultative workshop held in Karachi decision makers, experts and representatives of an environmental NGOs suggested that after formulation of regional action plan, a similar type of national level action plan will be required to cope with this challenge of marine pollution, particularly of plastic debris.

Marine Litter at Karachi beach area – Photo by Moazam Khan (WWF-Pakistan)

1. Introduction and background

This marine litter country status report is the outcome of desk review of published literature, meetings with individual experts of different coastal authorities of Sindh, Balochistan and relevant federal organizations. This report broadly discusses the state, magnitude and issues of the marine debris in Pakistan and future strategy to deal with this emerging threat to our marine life. During preparation of this report national level consultations with diverse stakeholders were undertaken including concerned federal and provincial departments, civil society organizations, and NGOs, to assess the present situation of marine litter, discuss ongoing efforts and future course of action and to verify the data used in this study **(Annex-1).**

The total geographical area of Pakistan including AJK and Gilgit-Baltistan is 87.98 million hectares with a current estimated population of more than 200 million people (Census 2017), the sixth most populous country of the world. At an average economic growth rate of 4.9 percent from 1952 to 2015, current gross domestic product (GDP) of Pakistan stands at nearly US$ 284 billion.

Pakistan coast is about 1001 km long extending from the Indian border in the east to the Iranian border in the west. A total of 266.5 kilometers (km) of coastline extends along the province of Sindh between the Indian borders along Sir Creek in the Indus Delta on the east to Hub River coast on the west. The Balochistan Coast is about 734.5 km extending from Hub River coast in the east to Iranian border in Jiwani Coast on the west. The coastal and marine areas of Pakistan are rich with plenty of biological resources and variety of unique landscape. Karachi is the only big city located along the coastline in an arid hot desert environment, which is characterized by low average precipitation (250 mm per annum).

The maritime area of Pakistan extends up to Exclusive Economic Zone (EEZ) of 200 NM covering an area of about 240,000 sq. km. In addition, an area of about 50,000 km^2 of the Continental Shelf has been recently added to the maritime areas of Pakistan. The coastal zone of Pakistan has two distinct parts, 1) Sindh coast, and 2) Balochistan coast. The landward limit of the coastal zone in Sindh province varies between, 2 to 5 km while seaward limit of the coastal zone extends up to 100 km (about 54 nm) offshore following the depth contour of 200 meters. In addition to EEZ, the Article 77(4) of the UN Law of the Sea Convention vests Pakistan with sovereign rights over the natural resources of the Continental Shelf (NIO, 2016). The marine resource is primarily in State ownership and the State has responsibility for its protection and sustainable development.

The oceans play a vital role in the regulation of climate change. The world oceans contain important resources from food to energy and minerals. The oceans, as the largest habitat on the planet, are still mainly unexplored, but are in constant change through human interference and natural processes.

According to the United Nations Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP 1991), land-based sources account for up to 80 % of the global marine pollution. However, substantial quantities of plastic debris, which are buoyant, durable and slow to degrade (Williams and Simmons 1996), enter beach fronts from far-flung continents and remote islands through the ocean currents, tides and winds. These floating debris are not only cause large scale disturbances but also emerged as potential threat to marine ecosystems as a whole.

In recent past the adoption of different resolutions by Convention on Biological Diversity (CBD), Convention on Conservation of Migratory Species of wild animals (CMS) and the United Nations Environment Assembly (UNEA) on Management of Marine Debris indicate that the issue of marine plastic litter and micro plastics has continued to receive much international attention. On this issue research has also been published, allowing a better understanding of the sources of debris, both on land and at sea, the pathways it takes to the ocean, and the impacts on the marine ecosystems. It is believed that the marine debris come from land based sources cause harm to millions of marine animals.

Pakistan generally produced roughly more than 20 million tonnes of municipal solid waste with annual growth rate of 2.4 percent. All major cities including Karachi, Lahore, Peshawar, Quetta and Islamabad are facing enormous challenges in tackling the problem of urban waste and thousands of people are at risk to waste related diseases. The Government of Pakistan recently announced its plan regarding waste based power plants which have dual benefits – disposing off garbage and generation of electricity through garbage. It will also create employment opportunities and play a role in economic growth of the country. The Sindh administration is also negotiating with a Chines enterprise for a waste-to-energy unit that could generate about 200 megawatts of electricity at one of Karachi's landfills.

Environmental pollution at the coasts of Pakistan including Karachi city harbor and coastal areas and their poisoning due to unmitigated release of industrial waste and solid waste into the sea is a serious environmental issue effecting millions of coastal population and marine ecosystem. It was observed during the apex court hearing in December, 2017 that 450 million gallons of untreated water was being discharged into the sea daily since no sewage treatment plant was operational in Karachi and other coastal cities including Ormara and Gawader. Resultantly sea pollution due to untreated flow of sewage and industrial waste influencing coastal and marine ecosystem badly. Presently two treatment plants (TPs) of Karachi are completely not functional where as another TP is partially in working order. There are five industrial zones exists in the city where no separate industrial waste treatment plants for any zone was installed yet. The installation of more treatment plants are immediately required since the capacity of the current ones was not more than 150-200 million gallons daily (MGD), which is too short to cope the inflow of around 500 MGD of sewage. Similarly 12,000 plus tons of solid waste was being produced every day in the city and despite such huge load, the city had no garbage transfer stations (GTSs). It is believed that 7,000 plus tons solid waste was being dumped in nullahs (drains) every day, which ended up in the sea. The dumping and disposal through open burning/smouldering of hazardous, hospital, industrial and municipal solid waste in Malir River at Korangi Causeway and Lyari River resulting in adverse environmental and health impacts on the residents of the area. In the mean while on Balochistan coast due to multi-billion dollar China-Pakistan Economic Corridor (CPEC) investment, a small Gwadar town is transforming into a new international port city. In future this mega urban center on the strategic mouth of the Arabian Gulf will also be a major source of marine debris.

The Sindh Industries and Commerce department has drafted a new law (still unapproved) making it mandatory for industrial units to install a pre-treatment plant within the factory premises to treat toxic waste. The new law – The Sindh Industries Registration Act, 2017 would also make it mandatory for all industries established since 1991 to get registered with the department.

Marine litter issues are not yet fully recognized in Pakistan and no single institution is established or assigned to take lead role in mitigation of this problem. Tackling marine debris entering the ocean and at the same time managing waste effectively is the most proper way to reduce the

annual input of plastic waste and other marine litter into the sea. However, there is hardly any monitoring mechanism in place on solid waste or industrial waste management and mandatory installation of effluent treatment plants in Pakistan. The lack of preparedness may increase the devastating effect of marine debris in any event of future disaster in the ocean. However, such risks can be minimized with better planning, timely corrective measures, and proper management actions. The other aspect of this issue in nature is transboundary which could only be managed by working together through initiation of strong and effective regional programme to protect precious marine ecosystems and its biodiversity.

2. Marine Litter Status at National Level

There are a number of environmental issues in the coastal zone of Pakistan such as disposal of domestic wastes and untreated industrial effluent causing marine pollution problems along the urban centres are the most significant (Khan *et al.,* 2006). The pollution problems have arisen mainly due to the indiscriminate discharges of effluent from coastal industries and agricultural sources together with untreated liquid and solid wastes generated from domestic sources into the coastal environment that could be sources of deterioration of coastal environment, depletion of marine resources, human health risks and loss of biodiversity (Masroor, 2005).

The plastic pollution has become very prominent on the beaches of Pakistan because of the indiscriminate use and uncontrolled disposal of polyethylene shopping bags which litter the common beaches of Karachi. The other important form of plastic pollution is the presence of plastic pellets (polyethylene and polystyrene balls) of plastic products. These balls are common in beach sands along the high water mark. However, no study has been conducted on the plastic pollution with reference to marine environment of Pakistan.

As compare to Sindh coast, the Balochistan coast is sparsely populated with scattered fishing communities. Natural mangrove vegetation is limited. A deep seaport has been constructed in Gwadar. A Pakistan Navy facility exists at Ormara. Fish harbours have been developed at Pasni, Gwadar Dam and Jiwani. A coastal highway links Karachi with all the coastal towns of Balochistan. The coastal area therefore, has the potential of witnessing greater commercial activity and infra-structure development. These ongoing developmental activities along Balochistan coast are also emerging as a potential source marine debris.

2.1 Origin, Typology, pathways and trends

Solid waste in Pakistan is generally composed of three categories i.e. biodegradable such as food waste, animal waste, leaves, grass, straws, and wood. Non-biodegradable are plastic, rubber, textile waste, metals, fines, stones and recyclable material includes paper, card board, rags and bones. The waste is disposed of within or outside municipal limits and flows through drains, streams and Rivers to enter into the marine ecosystem. Due to increased industrial activities and population pressure disposal of such waste material into coastal areas is on higher side.

Some of the marine litter is also introduced by people that use the beaches for recreational activities such as swimming, sailing and scuba diving. However, as marine debris travel long distances, therefore determining its exact origin is very difficult. The pathways that led the item to enter the marine environment (*e.g.* direct release in the sea/coast, riverine, sewage) requires full scale assessment to determine the actual status of marine litter at national level so that appropriate actions and measures to address the issue in a given area could be recommended as a long term strategy and solution.

An assessment of distribution and abundance of marine debris along the coast of Karachi (Arabian Sea), Pakistan was made in 2012. During study nine different types of debris comprising of plastics, glasses, thermopore, clothing, rubber, paper, pot pieces and cigarette filters were collected. The study revealed that, plastic was found in high quantity at all beaches of Karachi (Rashida Qari & Moniba Shaffat, 2015).

Different types of pollutants including wastes containing debris on coasts of Pakistan assessed by the National Institute of Oceanography (NIO) during 2010-2014 is given in tabulated form at **Annex-2**.

2.2 Sources and kinds of Marine Litter

The source of Marine debris in Pakistan is mainly a man-mad waste that gets through coastal environment intentionally or unintentionally by disposal of solid waste, untreated effluent, careless handling of ship breaking activates, fishing activities, beach tourism, as well as due to natural disasters such as annual floods in Indus River and rain feed streams. Most of the items found at the beach or in the ocean itself are made of plastic or other synthetic materials. The deforestation in Indus delta mangrove forest is also a source of floating debris into the coastal waters.

A different kind of marine debris founds in Pakistan are includes; plastic bags, balloons, buoys rope, medical waste, glass bottles, beverage cans, styrofoam, lost fishing lines and nets, and various wastes from ships such as oil laden rags are among the items commonly found to have washed ashore.

Marine debris or marine litter is one of the global marine pollutions produced by human and released accidentally or deliberately in the ocean. Marine debris not only affects the marine organisms (animals and plants) and environment qualitatively but also hampers the commercial economy activities related to marine foods (e.g., fish). Many types of debris materials are released in the ocean. Cigarette filters, beverage bottles and cans, food wrappers, fishing line, nets and gear are some of the most common debris type that enter the ocean environment from any source (Coe and Rogers, 1997).

Karachi Harbour, covering an area of 65 sq. km receives a wide variety of pollutants from numerous sources. The material can be thrown directly, swept, or blown off from the vessels and stationary platforms at sea (Fayyaz Rasool, 2010).

Intentional or unintentional disposal of domestic or industrial wastes on land or Lyari River or streams can contribute to the marine debris problem. It is common scene at the Jinnah Bridge where people throwing the garbage and holy books into the waters and throwing the animal parts for flying kites and crows and food material for fish – thinking to remove their sins. The data of the City District Government of Karachi revealed that this metropolis generates more than ten thousand tonnes of garbage daily. Half of it is being collected and disposed by the CDGK and other remains on the streets (Fayyaz Rasool, 2010).

Some water that flows along streets or along the ground as a result of rain can carry street litter in to storm drains. Storm drains carry this water and debris to a nearby river, stream, canal, or even directly to the ocean. Marine debris from storm water runoff includes street litter (e.g. cigarette butts and filters), medical items (e.g. syringes), food packaging, beverage containers, and other material that might have washed down a storm drain. According to one estimate of Karachi Water and Sewage Board, that Lyari is pouring 200 million gallons per day of filthy water near the Karachi Harbor. Seventy –five million gallons per day were treated at the treatment plants and rest went into the marine environment without any check. There are another 13 small drains which also contributing to increase the pollution level of the harbour (Fayyaz Rasool, 2010).

2.3 Quantification (If possible type of litter)

No inventories on the potential sources of marine debris have been compiled. Lake of awareness and poor implementation of the environmental laws and casual attitude towards environmental issues are serious problems in the country. There are over 100 truck/day of all kind of waste collected from Karachi city mainly dumped into the drains near Korangi Creek.

Most Pakistani industries, located around major cities, are increasingly polluting streams, rivers and the Arabian Sea through untreated hazardous waste. In Karachi alone more than 6,000 industrial enterprises, some more than 50 % of the country's industry, are located along the coastal belt (NIO).

It is reported that about 400 million gallons per day (MGD) of untreated industrial effluents (approximately 60 %) and domestic waste (about 40%) is discharged into coastal environment of Karachi (Beg, 1994, Masroor, 2005). These untreated effluents drained into the coastal marine environment via several sources, mainly through Lyari River that is approximately 59% and 25% via Malir River of the total pollution load are being discharges into the coastal area and the rest (15%) of the pollution load is directly introduced into the adjacent open sea coast, Gizri/Korangi and Gharo creeks area (Beg, 1994). The Lyari River carries large quantity of industrial effluents and urban waste into the Karachi harbour. The organic fraction of the waste from domestic sources often contribute more than 50% of the total waste (Ahmed and Zurbrugg *2002*), that have great affinity to absorbed/accumulate almost all kind of pollutants. Thus, the coastal areas, which are the spawning and breading ground of most of the fishes, may have elevated levels of pollution from land based sources.

A study carried out by the Rashida Qari & Moniba Shaffat in 2012 provide some baseline data on density, distribution and composition of manmade debris at different beaches of Karachi. Study also concluded that the management of beaches needs to be focused on reducing the debris or litter especially plastic pollution entering the marine environment from different sources. It is also assumed that plastic is major threat to marine mammals, turtles and birds through entrapment and digestion. Total weight of debris items collected from different beaches of Karachi coast is given in below table:

S.no.	Type of debris	Sampling beach	Total weight (g)	Composition	Use
1	Plastic	Sandspit Buleji Paradise Point Korangi Creek Total:	75.77 836.00 5077.6 80.80 6070.17	Organic polymers (Polystyrene, Polyvinyl Chloride)	Bags for food items and packing
2	Glass	Sandspit Korangi Creek Total:	7.76 1186.4 1194.16	Silica, potassium, alumina, sodium, magnesium, calcium	In building windows and making cutlery
3	Pot pieces	Sandspit Korangi Creek Total:	26.50 1292.8 1319.30	Clay	Decoration purposes
4	Clothing	Sandspit Korangi Creek Total	28.82 20.00 48.82	Cotton	Cloth
5	Paper	Buleji	325.60	Cellulose, hemi	Writing, roofing,

		Paradise Point Total	355.20 680.8	cellulose, lignin	flooring
6	Thermopore	Buleji Paradise Point Total	331.60 20.40 352.00	Polystyrene	For insulation and packing
7	Rubber	Buleji Paradise Point Total	1163.70 155.60 1319.30	Polybutadiene, Polystyrene and Natural rubber	Slippers, rubber band, holding and tighten purpose
8	Fishing nets	Buleji Total	437.60 437.60	(Polyisoprene) thread	for catching fish
9	Cigarette filters	Sandspit Paradise Point Total	1.8 3.8 5.6	Cellulose acetate	Smoking

Source: Pakistan Journal of Scientific and Industrial Research, Vol.58, N0.2 (2015)

WWF-Pakistan studies also reveal that 65 percent of garbage that litter beaches along Pakistan's coast consist of plastics, which includes mineral water bottles, caps, polythene bags, balloons, wrappers, shoes, broken utensils and discarded fishing nets.

Types of Debris found in the Karachi Harbour.

Polyethylene and Wrappers	**Plastic**	**Plastic material and wood**	**Cloth and jute**
Polyethylene sheets & shopping bags. Wrappers of sweets, suparis, etc.	Bottles, Buckets & Utensils, bags Packing materials. Tooth brush, Hair brush & combs, syringes & other surgical equipment. Ropes, Strapping bands, plastic sheeting. Hard hats, Resin pellets. Nets, Buoys, Traps, Fishing lines.	Sticks/twigs Leaves, wooden pieces of all kind. Mangrove parts and Alga Grass and sugarcane Flowers Coconuts and other fruits	Old cloth pieces Holy sheet (cloth) Jute cargo bags Jute ropes and pieces Woollen cloth pieces Fibre ropes etc.
Shoes and Sleepers	**Material made of meta**	**Glass**	**Papers**

Every kind of shoes and sleepers	Vehicle spare parts Juice tin boxes Paint boxes Oil boxes	Medicine bottles Juice bottles Jam bottles Tube lights/bulbs,Glass pieces	Religious material, books, invitation cards Hard paper boxes Books an copies
Food waste	**Animals and their parts**	**Rubber and Leather**	**Thermos pore**
Roti, Nan Fruits Flour bags Rice and pulses bags	Fish and fish offal Meat Parts of the animal bodies Dead animal	Tire &tubes Packing material Balloons/condoms Leather bags and other products	All material made of thermos pore

Source: Fayyaz Rasool, KPT

Different types of wastes and its estimated physical composition in the coastal city of Karachi is given in percentage as below:

Physical Composition of Waste

Cites/ → Waste ↓	2014 Year
	Karachi
Plastic & Rubber	6.40%
Metals	0.75
Paper	4.10
Cardboard	-
Rags	8.40
Glass	1.50
Bones	3.00
Board Papers	-
Food Waste	21.00
Animal Waste	3.40
Leaves Grass etc.	14.00
Wood	2.25
Fines	29.70
Debris	3.50

Stones	-
Others	2.00

Source: - City District Government, Karachi - 2014

2.4 Sources (Through rivers and canals, dumping by ships and boats, surface drainage and other

sources such as tourists, by wind etc.)

In the waters of Pakistan, the majority of marine litters enter from land-based sources through sewerage flow, beach visitors, inadequate waste disposal and management, industrial activities, illegal dumping, monsoon flooding in the Indus and urban runoff. Ocean-based sources principally derive from the fishing and shipping industry.

The source of litter found on the coast can be clearly identified for some litter items. These are mostly items which originate from fisheries, or debris flushed down sewerage systems. Amount and composition of marine litter varies on different beaches due to tides, currents, wave exposure, wind directions and steepness of a shoreline and other characteristics of the coast.

Prominent sources of marine litter in Pakistan, are:

1. Industrial waste (including shipbreaking activities, recycling industries).
2. Untreated sewage disposal.
3. Solid waste disposal.
4. Mangrove forest degradation.
5. Rapid coastal development / urbanization.
6. Coastal tourism.
7. Downstream debris flow by River Indus.
8. Rain feed/seasonal streams.
9. Largescale fishing activities.

Photo by Moazam Khan (WWF-Pakistan)

3. Circulation of Marine litter

Marine litter has now emerged as a serious issue affecting coastal waters and marine environment of Pakistan where the country lacks appropriate waste management infrastructures as a whole because slowly degrading large plastic items generate micro plastic, smaller particles which spread over long distances by wind-driven ocean surface layer circulation.

3.1 Marine litter circulation

By 2050, there will be so much plastic floating in the ocean it will outweigh the fish, according to a study conducted by the World Economic Forum. Scientists estimate that there are at least 5.25 trillion plastic particles — weighing nearly 270,000 tons — floating in the oceans right now. As regards the circulation of marine litters in Pakistani marine areas no such study has been carried out so far by any institution. Further in marine waters of Pakistan with reference to international protocols no maritime system is devised to monitor the marine debris. However, presently NIO at some extent under its ongoing activities is studying this phenomena in Pakistani waters.

The other aspect of marine litter is linked with economy. During the World Economic Forum (WEF) in January, 2018 eleven global companies including Amcor, Ecover, Evian, L'Oréal, Mars, Marks & Spencer, PepsiCo, The Coca-Cola Company, Unilever, Walmart, and Werner & Mertz announced that they will ensure all their packaging is reused, recycled or composted by the year 2025 to accelerate the shift to a circular economy. It estimated that these companies making the pledge are responsible for six million tonnes of plastic packaging every year. Majority of these companies have business in Pakistan as well and in future will help in practicing circular model that emits no waste. Similarly McDonald's announced that all its consumer packaging around the world will come from renewable, recycled or certified sources.

There is an opportunity to transform the way plastic products are designed, produced, used, and recycled and by taking the lead on this front, Pakistan by adopting such new circular approach may provide new jobs. Under this plans the consumption of single-use plastics should need to be reduced. We must stop plastics entering into our coastal waters. The only long-term solution is to reduce plastic waste by recycling and reusing more. This is a real time challenge that people, government and industry join hands together.

We should need to devise a strategy for waste disposal through circular economy this will work to reduce waste including plastic litter at land and in sea and also create space for competitiveness and bring new job opportunities.

3.2 Land based sectors generation (Micro and Macro)

The total solid waste generation as per study of environment ministry in Pakistan is about 20.024 million tons a year, which is approximately 59,000 tons per day. The study also showed that the growth rate of solid waste generation is about 2.4% per annum. At the rate in which our population is increasing, the amount of waste we produce will double in the next ten years. It is estimated to go up to 4.29 kg per house per day from the present 1.896 kg per house per day, thereby overburdening our already poor waste management methods. Despite the racket made by environmentalists, dumping and burning remain the most common methods of solid waste disposal in this country. The concept of recycling is still in its infancy in Pakistan, with most of the work being done by the legion of waste pickers/scavengers (Sadaf Pervaiz, 2013).

With a rise in consumerism and changing lifestyles and production processes, waste generation has become fairly diversified. Proliferating private healthcare facilities generate hazardous medical waste. Growing use of gadgets has given rise to electronic waste. Rubber, plastic, paper, industrial and biological waste of different volumes and characteristic is a natural outcome.

The activities which occur on land with the resulting litter being improperly discarded along roads and waterways. This waste can be blown, washed and discharged into the water from land activities. Sources include fishermen, public littering on the beach, trash from street vendors in coastal cities or urban areas, sewage treatment plants and illegal dumping. Improper waste handling in terrestrial areas can increase the volume of marine litter. The mishandling of wastes, presence of non-biodegradable food wrappers and containers among others are the building blocks of the marine litter issue (UNEP-CEP/RCU, 2008).

The composition of debris along Clifton Beach reveals that plastic items were equal or sometimes greater in number than the combined counts of all other items of the surveyed beach. Debris loads along the beach front of Clifton, Karachi, Pakistan appeared moderate in comparison to similar studies conducted elsewhere. The higher level of debris on Clifton Beach may be due to higher human population in Karachi and greater use of Clifton Beach compared to that of the Gulf of Oman (Ramzan and Zafar Iqbal, 2015).

The shoreline of Karachi has many beaches (Clifton Beach, Paradise Point, Hawksbay, Sandspit and French Beach). Nonetheless, Clifton Beach is the most popular recreational sandy shore since it is easily accessible due to its close proximity to the city Centre. Clifton Beach is about 5 km long. However, the beach is visited every week by thousands of people from Karachi as well as from other parts of the country for recreation and entertainment (Hasan 2012).

A considerable amount of money goes into managing huge volumes of solid waste. Approximately 12,000 tons of solid waste is generated daily in Karachi, excluding industrial and hospital waste. Rapid establishment of new housing sectors, industrial estates and construction activities contribute to waste generation. The amount of solid wastes is expected to substantially increase with the rapid growth of population and economic activity. It is estimated that by the year 2020, solid waste generation in Karachi may approach 16,000 to 18,000 tons each day. The current poor solid waste management practices need to be made more efficient and modernized. Lack of planning, inappropriate technology and poor management are obviously the main areas of concern. This requires serious efforts from government authorities and other agencies for effective solid waste management (MFF Pakistan, 2016).

Due to the lack of adequate sanitation facilities inland, solid waste generated in the small coastal towns and villages, along with a significant portion of the urban waste of Karachi *(municipal /industrial)* is dumped randomly along the coast, which is flushed into the coastal ecosystems at high tide. Urban Karachi generates about 8000–10000 tons/day of solid waste. Due to inadequate hauling /transfer / disposal *(landfill)* facilities, approximately 60% of the waste remains uncollected, is either burnt, or deposited directly into storm drains or coastal rivers *(Lyari / Malir)* which ultimately transport this domestic / commercial / toxic industrial / hospital waste into the coast. This is one of the major causes of the reduced aesthetic and recreational potential of the coast. Components of waste, such as plastic bags, are known to damage the mechanized fishing crafts and harm marine life. This issue has received little attention and significance in pollution debates related to the coast. However, it is a problem, which is growing in magnitude and could pose an even more potent threat to our ecosystem if the coastal lands are developed without giving due consideration and priority to provisions of effective management and disposal of solid waste inland (MFF-National Strategy & Action Plan, 2014)

3.3 Sea based sectors generation (Micro and Macro)

In case of Pakistan lost and discarded fishing nets, fishing lines and gears from fishing boats and trawlers are important contributors to marine debris, especially in heavily fished areas of Karachi and Makran coasts. These vessels also lose plastic floats and other gear. Other sea-based sources of plastic pollution include cargo ships that lose containers to the sea.

The Ocean Based Sources (OBS) of marine debris include the different types of fishing vessels, water sports, cruise and cargo ships, offshore fossil fuel platforms and transportation. Litter can wind up in the water through system or mechanical failure, obsolete waste management practices or through illegal littering and dumping (UNEP-CAR/RCU, 2008).

Fishing activities can also contribute to marine litter where fishermen dump garbage into the sea intentionally or accidentally. Types of debris associated with fishing activities include nets and ropes, fish hooks, bait containers, forgotten or discarded fish, lobster and crab traps, food and beverage containers, cleaning chemicals containers, clothing and pieces of boats if they crash or capsize. These can all pose a serious threat to wildlife if ingested or entangled, to humans themselves through injury and to the marine and coastal ecosystems.

Gadani ship-breaking yard is the world's third largest ship breaking yard. The yard consists of 132 ship-breaking plots located across a 10 km long beachfront at Gadani coast, Pakistan, about 50 km northwest of Karachi. Gadani currently has an annual capacity of breaking up to 125 ships of all sizes, including supertankers, with a combined LDT of 1,000,000 tons (NIO 2016).

The project on environmentally sound management of waste from ship recycling in Pakistan was designed in 2016 to enhance the development of safe and environmentally sound ship recycling in the Gadani-Hub area, with the aim of improving the standards and therefore the sustainability of the industry. This project is being managed by the *Secretariat of the Basel, Rotterdam and Stockholm Conventions* (BRS), the UNEP agency dealing with 'Basel Convention' and the related international conventions; with funding of the EU. This ongoing project particularly focuses on the development of downstream hazardous waste management capacity in the Gadani-Hub area.

Gadani Shipbreaking Industry – Photo by Dr. Zaigham Abbas

Solid waste generated on a ship includes net, cages, glass, paper, aluminum and steel cans, and plastics. It can be either non-hazardous or hazardous in nature. Solid waste that enters the ocean may become marine debris, and can then pose a threat to marine organisms, humans, coastal communities, and industries that utilize marine waters. Marine mammals, fish, sea turtles, and birds can be injured or killed from entanglement with plastics, nets and other solid waste that may be released or disposed off of ships (NIO 2016).

About 2,500 ships and 200 oil tankers visit Karachi harbour through the Manora Channel annually. There is large scale shipping traffic at Port Qasim. The sources of littering and oil pollution in Manora channel are bilges, washings and cleaning from engine rooms/floors of vessels, occurring during loading and unloading at ports.

3.4. National, sub-national and local institutions responsible for solid waste management

The provisions of safe disposal and management of solid waste are being looked after by a number of departments/agencies in one way or the others including:

- Local Government Departments (Sind & Balochistan);
- Public Health Engineering and Rural Development Department;
- Sindh Urban Services Corporation (NUSUC);
- Pakistan Environmental Protection Agency, Ministry of Climate Change
- Provincial Environmental Protection Agencies/Departments
- Sindh Solid Waste Management Board
- Karachi Metropolitan Corporation (KMC)
- Industrial Zone Cites Associations

- Coastal Development Authority of Sindh
- Gwadar Development Authority
- Karachi Port Trust (KPT), Ministry of Maritime Affairs
- Defence Housing Authority (DHA)
- Cantonment Boards
- Gwadar Port Trust (GPT), Ministry of Maritime Affairs
- Port Qasim Authority (PQA), Ministry of Maritime Affairs
- Pakistan Railway, Ministry of Railways
- Civil Aviation Authority, Aviation Division
- Marine Fisheries Department, Ministry of Food Security and Research
- Provincial Fisheries departments of Sindh & Balochistan

Clifton Beach, Karachi – Photo by Dr. Nuzhat Khan, NIO

4. National Impact of Marine Litter

Marine pollution has tremendous economic, health and biodiversity costs. Marine litter resulting from industrial waste, untreated sewage and shipping activities contaminate the sea and pose a great threat to marine life. Marine debris are dangerous to disturb sea animals like marine turtles, dolphins, whales, different species of birds and create hindrances in smooth navigational operations. Another effect of marine litter is that a lot of the dumped waste in the ocean eventually washes up on beaches, and hence ruins beach aesthetic values and tourism. Polluted beaches pose a higher risk of catching diseases.

Plastic pollution has now become a global concern as plastic debris have reached all the oceans of the world with adverse effects on marine organisms and biodiversity as well as on human livelihoods and economy. Marine plastics result from inadequate waste disposal infrastructure and management but also a lack of public knowledge about their environmental impacts.

World Ocean Conference (WOC) held in June, 2017 reconfirms the commitment of UN Member States to the implementation of SDG 14 within the context of the 2030 Agenda. The voluntary commitments cover a wide range of themes, from creation of marine protected areas (MPAs) to action on plastic and other marine debris. Conference also underscored the need for a reduction of single-use plastic, eliminate marine plastics from coast, fisheries industry is set to phase out use of plastics, and collect marine debris throughout its EEZ. Emphasized the importance of the "reduce, reuse and recycle" approach. Outlined its commitment to reduce marine plastic debris by 70% within eight years, and the launch of a US$1 billion waste management strategy. Countries outlined commitments on ocean litter, including a ban on microplastics; reducing use of non-biodegradable plastic bags, announced a new development programme to combat marine litter and microplastics.

4.1 Social

Human health and food safety: Although the human health impacts of marine debris pollution are remain poorly studied in Pakistan and it widely seen as an emerging problem that deserves much more research attention.

Loss of intrinsic value and the moral dimension: Nobody likes to see polluted marine environment. However, no specific information in this context available in Pakistan.

Human and animal health: Marine debris are recognized as harmful to humans and animals by causing direct injuries, damaging boat engines, destroying coral reefs, blocking digestive systems or entangling animals. In recent past when fishermen at sea around 270 km south of Karachi caught a flat needlefish stuck in the handle of a plastic cup in their catch, the World Wide Fund for Nature-Pakistan (WWF-Pakistan, 2017). Continued dumping of plastic products in the marine environment has become a serious threat to marine animals. As per another reports of WWF-Pakistan uncontrolled dumping of plastic products in the marine environment has become a serious threat to the animals and during 2017 several cases of such incidents have been came in notice including marine turtles (*Olive ridly*), whale sharks, dolphins and other species of fishes.

A new global analysis of seafood found that fish populations throughout the world's oceans are contaminated with industrial and agricultural pollutants, collectively known as persistent organic pollutants (POPs).

The coastal and marine biodiversity due to increasing marine litter problem faces numerous threats, some of which require action at national level while the other requires global action. The marine fisheries are a direct source of livelihood for over a million people comprising more than 125,000 households in Pakistan. There are approximately 15,000 fishing vessels of various sizes ranging from small to medium-sized boats, large launches and trawlers engaged in fishing activities.

4.2 Economic

The floating debris in the ports becomes navigational hazard for ships calling at the ports. Vessels during their stay at the ports, take in thousands of gallons of seawater for cooling their machineries in the engine room and other installations. The plastic bags and other rubbish get stuck in the suction hoses thus damaging the machineries. The port authorities have to pay such damages. The floating debris also gives pathetic look if trapped in the enclosed water bodies or washed away on the open coastal areas. The recreational sites lose their values and the economy of the persons depend upon the water recreational activities dropped (Fayyaz Rasool 2010).

Marine litter or debris, which accumulates along the beaches and waterways, disrupts the natural aesthetic beauty of the beaches which diminishes the recreational value and tourism quality of these resources (Liu, Wang, & Chen, 2013). Sustaining the tourism sector will require not only trash removal, but also improving solid waste disposal practices on land, and investment in sustaining coastal and reef ecosystems.

The issue of plastic pollution along Pakistan's coast is a major concern and is worsening due to an inadequate solid waste disposal system along the coastline and in the city. As per the observations and events recorded by the WWF-Pakistan during 2017, the number of incidents of marine animals trapped in plastic products are on increase. The economic impact of marine debris on coastal communities, especially for fisheries and municipalities that regularly need to remove the beach litter to maintain tourism revenues.

All ocean-based economies depend on sustainable, healthy ecosystems to support livelihoods such as fisheries, coastal tourism, aquaculture, seabed resources, oceanic transportation, and export services (SAMOA Pathways, 2014).

Tourism and recreation in the coastal areas of Pakistan is mainly linked to beaches along the Karachi coast and a few places along the Balochistan coast such as Gaddani and Kund Malir. However, tremendous potential for recreation and nature based tourism exists in the Indus Delta, and along the Balochistan coast at Churna and Astola Islands, Jiwani and coastal part of the Hingol national park. However, increased level of beach pollution mainly plastic related material has posed a serious threats to this large scale economic activity.

4.3 Ecological /Environment

Marine animals consume the floating materials by mistake, as it often resembles to their natural prey. Plastic in large quantity or when it entangled is very difficult for the animals to pass down

their gut. It usually lodged permanently in the digestive tracts thus blocking the passage of food causing death due to starvation. The animals that are filter feeder usually intake tiny floating particles resembles to zooplankton thus entering into the marine food chain. In 1999 a study carried out by Marine research Foundation UK revealed that in the gyre of the North-Pacific the plastic material exceeds then the zooplanktons. Plastic material also become the cause of leaching toxicity into the surrounding waters. Water born hydrophobic pollutants collect and magnify on the surface of plastic debris, thus making plastic far more deadly in the ocean than it would be on land. Hydrophobic contaminants are also known to bio-accumulate in fatty tissue, bio-magnifying up the food chain and putting great pressure on ape predators. Some plastic additives are known to disrupt the endocrine system when consumed; others can suppress the immune system or decrease reproductive rates (Fayyaz Rasool, 2010).

The marine species can mistake litter for food and ingest plastics, entangled in nets and bags which can either injure them or permanently damage their ability to fend for themselves. Plastic bags are especially appealing to sea turtles as they masquerade as jellyfish. Abandoned fishing nets and lines may entangle marine wildlife, such as sea turtles, birds and fish, which may hurt or kill them. Many of these animals are threatened or endangered and consequently, the biodiversity of the areas can significantly be impacted.

It is now well recognized that drifting plastic debris has several adverse effects on marine species and ecological systems. However, there is still a lack of precise knowledge about the quantity, sources, transport, accumulation and fate of plastics in the oceans. The most visible and disturbing impact of marine plastic pollution is the ingestion, suffocation and entanglement of hundreds of marine species. Floating plastics, which are presently the most abundant items of marine litter, also contribute considerably to the transport of non-indigenous (alien) marine species thereby threatening marine biodiversity and the food web. (IUCN)

Important Biodiversity Hotspots:

The Arabian Sea, bordering the coast of Pakistan, is known to be rich in marine biodiversity, as a result of prevailing monsoon dynamics leading to strong seasonal upwelling of nutrient rich water from the depths along the narrow continental shelf resulting in high surface productivity and rich plant and animal life. This results in Pakistan's coastal waters having a rich diversity of vertebrates, including cetaceans (dolphins, whales and porpoises), turtles and fishes, as well as invertebrates (MFF, 2016). The important biodiversity hotspots in coastal and marine waters of Pakistan includes:

Ramsar Sites: Ramsar sites are wetland of an international importance with ecological significance. Out of 19 Ramsar sites of Pakistan, eight sites including Rann of Kutch, Nariri Lagoon, Juboh Lagoon, Indus Delta, Miani Hor, Astola Island, Ormara Turtle Beach and Jiwani are located along the coastal areas. They are important sites for roosting and feeding of migratory birds which migrate from Siberia for wintering at various wetlands in Pakistan.

National Park: Hingol National Park along the Makran coast is the only national park bordering the coast in the Lasbela district of Balochistan. It is the largest national park in Pakistan declared for protection of several endangered species of wildlife.

Wildlife Sanctuaries: There are a few wildlife sanctuaries located along the coast of Pakistan which include the Rann of Kutch, Keti Bundar (North) and Keti Bundar (South) Wildlife

Sanctuaries in Sindh. The Kurkhera Wildlife Sanctuary has an area in Miani Hor and the Buzi Makola Wildlife Sanctuary comprises of the entire Kalmat Hor along the Balochistan coast.

Sea Turtle Nesting Beaches: Of the seven species of Sea Turtles, five species are reported from Pakistani waters. All the Sea Turtle species are listed on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES. The Most common marine turtle found in Pakistani waters is the Green Turtle. The important sea turtle nesting sites along Pakistan coast include Sandspit and Hawksbay beaches near Karachi, and Ormara-Taq Beach, Astola Island and Daran beaches along the Makran coast. These beaches are nesting sites of marine turtles which lay their eggs on these beaches during July to December. Famous Sandspit and Hawksbay beaches are two of the eleven globally most important beaches where thousands of Green turtles (*Chelonia mydas*) use them their nesting grounds.

Marine turtle hatchling entangled in fishing net- Photo by Naeemullah Kazi (SWD)

Churna Island: Churna Island is a small uninhabited island located in the Arabian Sea, about 9 km (5.6 mi) west of the mouth of the Hub River, at the boundary between the provinces of Balochistan and Sindh. Churna is approximately 1.2 km (0.75 mi) long and 0.5 km (0.31 mi) wide. Amateur diving, snorkeling and jet skiing are popular water sports in the area. The area is known for its high value biodiversity with variety of habitats, such as, its diversified coral assemblage around Churna and Kaio Islands and the rich mudflats and oyster reefs. Churna–Kaio Islands Complex is known to be an important basking and feeding area for marine mega fauna including baleen whales, whale shark, mobulids and sunfishes.

Astola Island Marine Protected Area: Astola Island is locally known as 'Haft Talar', or the island of seven hills is first marine protected area of Pakistan. The island is a part of Pasni sub-district of Gwadar District and located in the sea 39 km away from Pasni. The island is about 4 km in length, and 1.5 km wide at its maximum width point. The Island is an ecologically important site, as it inhabits colonies of corals and its sandy beach provides nesting ground for the globally threatened green turtle (*Chelonia mydas*). The Astola saw-scaled viper (*Echis carinatus astolae*) is endemic to the island. This is a small, uninhabited island in the Arabian Sea in Pakistan's territorial waters along the Balochistan Coast. On 15th June, 2017 under the provisions of Balochistan Wildlife (Protection, Preservation, Conservation and Management) Act, 2014 Astola Island Marine Protected Area has been notified as first marine protected area of Pakistan.

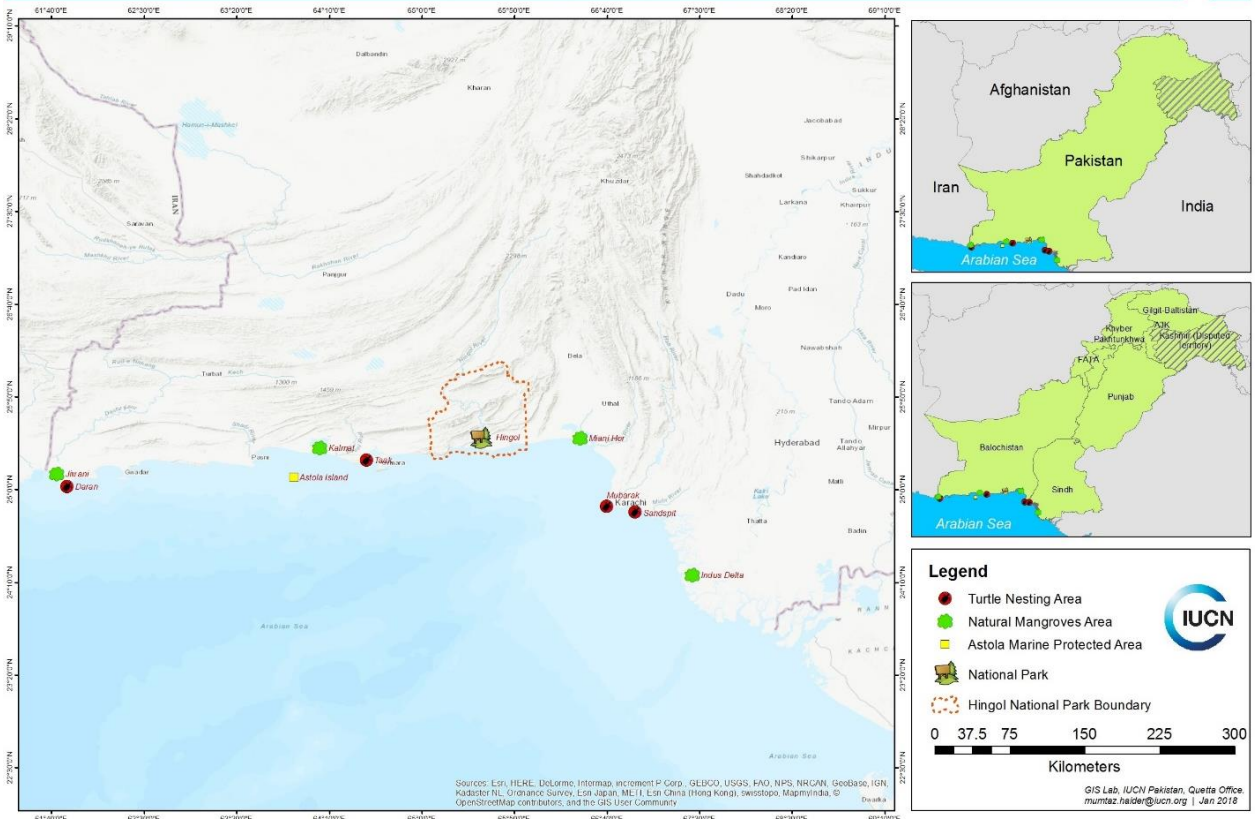
Astola Island Marine Protected Area – Photo by Shamim Fakhry (MBRL)

Mangroves: Mangroves make up one of the world's most unique ecosystems because they thrive where no other trees can survive – in the transition zone between the ocean and land. They are also among the world's most productive ecosystems. Mangroves are an important feature of the coastal areas of Pakistan. They are most abundant in the Indus Delta which constitutes 97% of the total mangrove cover found in Pakistan; whereas the rest 3% mangroves are found at three locations along the Balochistan coast, at Miani Hor, Kalmat Hor and Jiwani. Mangroves provides breeding grounds for fish and shrimps but is also home to resident and migratory birds.

Indus Delta Mangroves – Photo by Dr. Nuzhat Khan (NIO)

Among all above indicated biodiversity hotspots and ecologically significant sites few such as Turtle beaches of Karachi, Churna Island, Indus delta mangroves and Miani Hor are facing potential threats from ever increasing marine litter pollution.

Biodiversity Hotspots along the Coast of Pakistan



5. Management agencies, policies, Strategies and activities taken to minimize the marine litter

The Karachi Port Trust (KPT) is spending huge extra money on maintenance of its ships due to increasing pollution in the sea. In the process they regularly dock their boats and tugs to clean the propellers and the shafts of plastic and polythene bags. Pakistan Navy is also facing same problem for maintenance of its ships. Increasing sea water pollution had created an emergency situation and demand immediate action. Marine litter is not only polluting coastal and sea waters but also become fatal for marine life, poisoning seafood and degrading overall ocean ecosystem.

The severity of inflow of solid waste and slurry material into the navigational channel was so high that KPT need extra effort and resources to dredge the harbor. In this regard KPT has hires four boats which scoop the inorganic waste and floating debris including polythene bags and plastic material from the port vicinity on daily basis. Approximately five to ten tons of debris is collected from the navigational channels daily.

In various countries better waste management techniques used right at one's door step which is the key to reducing the accumulated filth and controlling its spread in cities. In this regard they normally use four different colour-coded wrappers to separate plastic, tin, glass and food waste, respectively. This practice makes for easy and quicker disposal of waste. A country like South Korea is generating sizeable revenues from efficient waste management.

5.1 Management agencies and their responsibilities

Karachi Port the only port of Pakistan with a modest Marine Pollution Control Unit (MPC) to look after the pollution problems including small oil-spills. The efforts of MPC have resulted in some reduction of pollution from the sources within KPT area. However, the pollution from land based sources outside the limits of KPT has remained unabated.

Karachi Port is one the poorly managed ports from pollution standpoint. Improvements and strict Pollution Control Management is required to control pollution. There is need to revise the SOPs at the port for strict compliance of pollution control measures including efforts to stop the inflow of untreated sewage, industrial waste and marine debris. There is even greater need to upgrade and strengthen the present Marine Pollution Control Unit at KPT to monitor and control pollution within the jurisdiction of KPT. Similar efforts and institutional arrangements would be required for the Gwadar Sea Port as well to cope with the issue of marine pollution including emerging threat of marine litter management. Since this new port facility is emerging as a trade hub in the region rapidly.

The situation of solid waste management is grave. The Karachi Metropolitan Corporation (KMC) is assigned to look after the garbage disposal sites. Household garbage collection, street cleaning and transferring waste to secondary collection points is assigned to union council administrations. But these organizations possess negligible capacity and financial strength.

The Sindh Solid Waste Management Board (SSWMB) has been created in 2014 to address issues of Solid Waste in Karachi and other parts of the province. The SSWMB is responsible for collection and disposal of solid waste and other waste including Municipal Solid Waste, Industrial Solid Waste and Medical / Hospital Waste in the entire Province of Sindh including Karachi and other areas of coastline. However, the Board is required to take over solid waste management

functions gradually from the Councils and other bodies and till such time they will continue to manage the solid waste in their respective areas. It is only when Local Government will notify transfer of the functions from the Councils to the Board through official notification; the Board will take up the task of solid waste management. Only in Karachi more than 12000 tons garbage is being generated per day but unfortunately Karachi has no Garbage Transfer Stations (GTS) due to which problem of solid waste has further aggravated. The Board is in the process of initiating many schemes to deal with the solid waste, which includes front-end-services (taking garbage from front of the premises etc.) to establishing GTS and landfill sites. However, so far only District Municipal Council (DMC) South and DMC East Karachi have been transferred to the Board for the purpose of solid waste management through notification; and in these two DMCs the work of solid waste disposal has been awarded to "M/s. Changyi Kangjie Sanitation Engineer Company Limited of China". Similarly in entire Karachi only one incinerator installed in Government Hospital and couple of others in private hospitals, in the rest of Sindh province including coastal areas the incinerators are either not installed or they are non-functional. The hospitals all over the province are disposing of their waste either through burning or by washing it off in Municipal Draining System. There was no separate budget for management of solid waste of hospitals.

5.2 Management policies and Strategies and their effectiveness

Over the coming decades, the volume of plastic waste moving from the land into the sea is expected to increase if the many coastal economies and populations around the world continue to expand without taking steps to manage their municipal solid waste. Marine plastic pollution will remain a difficult problem to solve because it represents a "fundamental market failure" on a worldwide scale (Ocean Conservancy, 2017).

In Pakistan at country level following policies and acts are formulated to address coastal and marine pollution but not exclusively included marine debris issue:

- National Environment Policy 2005
- National Climate Change Policy 2012
- Pakistan Environment Protection Act, 1997
- The Sindh Local Government Act, 2013
- The Sindh Environmental Protection Act, 2014
- Balochistan Environmental Protection Act, 2012
- Hospital Waste Management Rules, 2014
- Maritime Security Agency Act, 1995 (revised 2016)
- The Sindh Industries Registration Act, 2017 (un-approved)
- Sindh solid Waste Management Board Act, 2014
- National Institute of Oceanography Act, 2007
- Karachi Port Trust Act, 1886
- Ports Act, 1908

Under Pakistan Environmental Protection Act, 1997 (revised in 2013), imposed ban on manufacturing, sale and use of non-degradable scheduled plastic products. Further as per order issued by the Pak EPA in February, 2005 the powers related to monitoring and pollution control in the areas of Pakistan's Maritime Zones has been delegated to the Maritime Security Agency.

5.3 Management activities done for Land base, Beach base and marine base litter

Few times a year, students, maritime guards and volunteers along the coast line particularly at the beaches of Karachi in collaboration of NGOs like WWF and IUCN and with the financial

support of ICI, Engro, MacDonald, Nestle, etc. take part in the beach cleanup campaigns, where in they remove plastic bottles, straws, bags, and other debris from the road and coastal tourist spots. However, KPT marine pollution department at small scale engage itself in the marine base debris removal activities.

Like previous years on September 16th, 2017, Pakistan has celebrated the International Coastal Cleanup Day campaign at Seaview Beach, Karachi in collaboration and support of SACEP in a big way with the involvement of different stakeholders under the banner of Mangrove for the Future (MFF). At this occasion with the help of SACEP under the theme of **"Let's Join Hands to Clean Our Seas"** campaign was launched to create awareness about marine litter with particular emphasis on plastic debris and its impact on our ocean life. A poster containing information on plastic litter and its menace was also published to sensitize the beach visitors, students and solid waste managers. The other partners in organizing of this impressive event were UNEP, Engro Foundation, Nestle, Shehri-CBE, IUCN, WWF, KPT, NIO, eVOLVe-Act to impaACT, Provincial and Federal Ministries.

In fact marine debris is not yet emerge as a serious environmental issue in Pakistan and very limited awareness exists even in many relevant institutions about this potential threat to the marine life.

Dr. Moazam Khan, WWF

6. National Marine Litter monitoring programme.

The Government of Pakistan enacted the Pakistan Environmental Protection Act (PEPA) in 1997 which provides a framework for establishing federal and provincial Environmental Protection Agencies (EPAs). One of the functions of EPA is to ensure implementation of different provisions of the legal instrument including monitoring of marine pollution / marine litter. However, there is no monitoring mechanism in place to check transboundary shipments of waste and dumping of plastic at sea under the international convention for the Prevention of Pollution from Ships (Annex-V).

In future the implementation of Marine litter Action Plan will requires a well-established monitoring programme, which includes setting up of monitoring strategy to be used for monitoring planning, monitoring tools and costs effectiveness of monitoring.

6.1 Monitoring

By realizing the extent of the problem and translating this concern the Karachi Port Trust (KPT) established Marine Pollution Control Department. In 1996 the department contracts a private company to remove the debris from the port waters. However later on by increasing quantities of marine debris in the waters and shorelines it took it upon them to remove the debris and develop Marine Management Programme for KPT waters. Under this programme following activities are being held.

- Assessing and monitoring of the floating debris
- Removal of debris
- Publishing the data so that people become aware about the situation
- Liaison with other Government and Non-Government agencies to stop the pollution from the source.

The Maritime Security Agency, Ministry of Defence is empowered under its own Act, 1994 and Pakistan Environment Protection Act, 1997 to monitor marine pollution including marine debris in open waters of Pakistan.

6.2 Baseline and targets in the context of monitoring marine litter in the sea

Presently no formulized baseline data exists about marine debris. However, some of the national as well as sub-national institutions have started taking interests in this issue particularly Karachi Port Trust. Further on the notice of Supreme Court recently Karachi City District Government and Sindh Solid Waste Management Board has started streamlining the issue of proper disposal of marine pollution including marine litter. The ongoing efforts need to be streamlined with robust and integrated monitoring programme in coordinated, compatible, coherent, consistent and comparable to monitor marine debris. In addition NIO under its different studies occasionally collects information on marine debris and associated impact.

7. Gaps, Research, Analysis Knowledge needs, and proposal as basic for setting priorities

Prevention is the best way to safeguard marine ecosystem from marine debris. The second line of action could be to develop tools and policies to track, capture, and recycle plastic waste before it reaches the ocean.

The importance of the world's oceans cannot be overstated. They supply 50 percent of the oxygen we breath, feed billions of people and provide livelihoods for millions more. They are the great biological pump of global atmospheric and thermal regulation and the driver of the water and nutrient cycles. And, they are among the most powerful tools for mitigating the effects of climate change.

We continue to degrade our oceans through the relentless destruction of habitats and biodiversity, including overfishing and pollution. Disturbingly, recent reports indicated that the oceans may contain 1kg of plastics for every 3kg of fish by 2025. These actions are facilitated by chronic failures of global governance; for example, one-fifth of all fish taken from the oceans are caught illegally. To rid the coastal and marine waters of a plague of debris particularly from plastic waste is quite challenging task for the responsible authorities. We should need to start anti-plastic campaign to avert deposition of marine litter and save our environment.

Specifically, **SDG 14** commits to end overfishing, eliminate illegal fishing, establish more marine protected areas, reduce plastic litter and other sources of marine pollution and increase ocean resilience to acidification. We should need to develop strategy to phase out single-use plastics and convert them into a reusable or recyclable plastic by 20130 (SDGs). Further in this regard we should need effective marine governance to ensure implementation of SDG 14 through integrated approach and shared cooperation between SAS countries. In this regard environmentally sound waste management action against both land based and sea based marine litter is required by adopting strategy to address synergies among SDG 14, SDG 6 (clean water and sanitation) and SDG 12 (responsible consumption and production).

To scale up capacity building efforts for sound waste management domestically and regionally we must focus to launch campaigns and encourage a circular economy, plastic deposit schemes and public awareness.

Pakistan has established its SDGs Support Unit in Ministry of Planning, Development and Reform in 2016. However, as per "Data Reporting Gap" draft report 2017, the situation does not bode well for goals relating to clean water and sanitation; reduced inequalities; sustainable cities and communities; responsible consumption and production; life on land; life below water, and peace and justice. The reporting of indicators in these ranges between 0 percent and 38 percent, thus leaving a large reporting gap.

Pertinent ministries and institutions, based on their functional responsibilities and mandates, are assigned relevant tasks related with the demand and supply of data for SDG indicators. After the 2010 devolution, most sectors have been transferred to provincial governments, bringing the policy and planning of these sectors under the purview of provinces.

In addition NIO has designed and proposed a study in line with UN-SDG-14 and UNEP Resolution 1/6 Marine Plastic Debris and Global Programme of Action (GPA), intergovernmental programme to prevent the degradation of the marine environment from land-based activities and Global

Partnership on Marine Litter (GPML) to protect human health and the environment by the reduction and management of marine litter. (NIO, 2017).

A brief description of policy gaps and research needs are given as below:

- The national marine resource policy along with other sectoral support policies at national and sub-national levels are required to meet the future challenges related to sustainability of ocean resources
- No specific laws related to marine pollution including marine litter and plastic debris exists at national level to address the emerging threat
- Private sectors role and involvement in waste management is very confined which need to be strengthen
- The budgetary allocation for marine pollution control and management are not always based on national/provincial targets set for sustainable development of marine resources
- No large scale programme is in place on waste management and effluent treatment before release into the sea
- The coastal communities, industries and federal as well as provincial departments related to marine resource management lack capacities to tackle the issues like marine debris
- No satellite based monitoring system is yet developed to monitor the marine litter issue at national level

The options requires to strengthen management capabilities of coastal & marine agencies to conduct studies and carry out research on emerging issues like marine litter and its impact on marine resources. The implementation of these activities need to be supported by several actions to produce the enabling conditions for effective implementation of the strategy options. The inclusion of marine litter issue and its management in the policies and plans will help in building of more healthy and resilient marine ecosystem.

8. Way forward

The waste recycling is an established enterprise, organized and managed at informal scale in Pakistan. Street scavenger, waste pickers, collectors/ contractors, recycling plant operators and recycled goods buyers are key actors in this process. Paper, glass, metal, rubber, clothing, dried bread, bones and used cans are the main articles that feed into the recycling stream, generating livelihoods for an estimated 65,000 households. It also help to reduce unremoved waste in neighborhoods. But due to its informal nature, limits on expansion and threats from state institutions, this enterprise is operating below its potential.

The causes of water pollution are discharge of untreated sewerage, municipal and industrial wastes. The discharge of solid and industrial waste into the coasts of Pakistan contains chemical pollutants and non-degradable plastic materials. Many of these pollutants reach the sea, mainly through different drains and pose direct threat to coastal and marine ecosystems.

The issue of marine litter is threatening marine and aquatic life. Pakistan is also facing the hazard of plastic debris being dumped and floated in the marine waters. This is primarily happening due to inadequate and ineffective collection and disposal of municipal/industrial solid waste. The following short and long term essential steps must be taken to overcome this issue of safe waste disposal along the coastal areas of Pakistan, such as:

- The provincial administrations of Sindh and Balochistan must evolve a working relationship with municipalities, take stock of the situation, set priorities and devise a monitoring mechanism.

- Public-private partnership options can be explored for specialized domains such as hospital waste management.

- Research institutions, NGOs, and International agencies should need to support in dissemination of best practices;

- Promote an integrated approach in dealing with different types of waste with particular focus on wastes affecting marine ecosystem such as plastic debris;

- Launch marine pollution control programmes with adequate legal cover and policies, and governmental and private enforcement mechanism as building blocks for a successful implementation;

- Need long term and consistent education and awareness programmes/campaigns for the public, government, NGOs and community groups regarding safe disposal of waste and address the issues of illegal dumping;

- Develop strong and robust monitoring mechanism to deal with marine plastics debris;

- Recycling programmes should be encouraged to reduce the pressure of plastic debris releases into water bodies;

Marine Litter Specific Recommendations:

- Government should establish national taskforce to formulate integrated national plan for marine litter monitoring with particular emphasis on sources, types and pathways of debris; geographic distribution, impacts on biodiversity, presence and effects of micro plastics in sea waters;

- Establish mechanism to address the issue of abandoned, lost, or otherwise discarded fishing gear in collaboration with fisheries sector organizations/agencies;

- Develop and implement policies, regulatory frameworks and measures consistent with the waste management best practices to achieve prevention and environmentally sound management of waste;

- Improve already established national infrastructures for waste disposal, management and recycling for land and sea based sources of marine litter;

- Establish marine litter monitoring and removal programmes, particularly in areas known to hot spots for marine debris in line with environmental best practices; coupled with setup of marine animals (birds, mammals, reptiles, etc.) rescue centers and build capacity for marine animal disentanglement;

- Improve and expand waste management standard operating procedures (SOPs) for the public at famous beaches and coastal sporting events. Also establish efficient waste removal emergency response facilities that deal with debris produced during natural disasters. Furthermore, launch periodic awareness campaigns on medical waste management issues for public health and safety;

- Existing legislations need to be strengthened and revamped by incorporating provisions of anti-litter regulations for coastal and marine areas with effective enforcement, monitoring and education programme;

- Reduce the input of plastic in marine ecosystem needs to involve different stakeholders from the plastic, tourism and fishing industries and governmental organizations in order to effectively address environmental issues related to plastic pollution;

- Introduce new rules and regulations at sea port facilities to tackle sea-based marine litter, with measures to ensure that waste generated on ships or gathered at sea is not left behind but returned to land and adequately disposed off there;

- Long-term solutions requires improved governance at all levels as well as change in lifestyle and system changes, such as a more circular economy and more sustainable production and consumption patterns;

- Review existing regulatory frameworks, institutional arrangements and other instruments related to marine litter and their enforcement to identify synergies and gaps as well as potential solutions to address gaps nationally, sub-nationally and regionally;

- Stakeholders engagement including involvement of private sector, the use of best environmental practices and best available technology may be instrumental in marine plastic pollution mitigation;

Better liaison and strengthened cooperation between different stakeholders at all levels will improve marine litter avoidance and control in Pakistan.

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Annex-1: Stakeholders Consultation

In pursuance to the preparation of country status report on Marine Litters, the concerned organizations and experts have been contacted for their views and feedback. During the process of consultation important information have been gathered regarding marine debris and its impact on marine ecosystem.

#	Dates	Names whom consulted	Designation and Organizations
1	24-10-2017	Syed Ghulam Qadir Shah	MFF Pakistan Coordinator/IUCN
2	25-10-2017	Dr. Asif Inam	Director General, NIO
3	25-10-2017	Dr. Hina Baig	Senior Research Officer, NIO
4	26-10-2017	Muhammad Irfan Tariq	Director General (ENV.), Ministry of Climate Change
5	27-10-2017	Muhammad Azeem Khoso	Director (UA), Ministry of Climate Change
6	27-10-2017	Ms. Farzana Altaf Shah	Director General, Pak EPA
7	27-10-2017	Mr. Asad Rafi Chandana	Director General, Ports & Shipping Wing, Ministry of Ports & Shipping
8	28-11-2017	Abraul Hassan	In-charge MBRL, Ministry of Ports & Shipping
9	27-11-2017	Muhammad Tahir Qureshi	Advisor IUCN-Pakistan
10	28-11-2017	Taj Muhammad Sheikh	Conservator Wildlife, Sindh Wildlife Department
11	29-11-2017	Fayyaz Rasool	Manager Pollution, Karachi Port Trust
12	29-11-2017	Dr. Shahid Amjad	Ex-DG, NIO/IOBM, Karachi
13	29-11-2017	Muhammad Aslam Jarwar	Deputy Director, Sindh Fisheries Department
14	30-11-2017	Dr. Moazam Khan	Advisor Marine, WWF-Pakistan
15	30-11-2017	Waqar Phulphoto	Director Solid Waste, Sindh EPA
16	13-12-2017	Umair Shahid	Manager Marine, WWF-Pakistan, Karachi
17	13-12-2017	Muhammad Shoaib	Senior Conservation Officer, WWF-Pakistan, Karachi

18	13-12-2017	Syed Ali Imran	Conservator Forest (Planning), Balochistan Forest & Wildlife Department, Quetta
19	13-12-2017	Muhammad Noor	DG Fisheries, Fisheries Department Balochistan, Quetta
20	13-12-2017	Ajaz Mohsin, Lt. CDR-PN	Staff Officer, Horticulture & Environment Planning, Pakistan Navy
21	13-12-2017	Ms. Amra Javed	Executive Member, Shehri-CBE, Karachi
22	11-01-2018	Ghulam Muhammad Mahr	Director General, Sindh Fisheries Department (Coastal)
23	15-01-2018	Zafar ul Hassan	Chief (Poverty Alleviation & SDGs Section), Ministry of Planning, Development and Reform. Government of Pakistan, Islamabad.

After preparation of initial draft report on marine litter, the same has been shared with the representatives of federal as well as provincial institutions responsible for marine litter management, control and monitoring in the national consultative workshop held on 9th January, 2018 at NIO, Karachi. In the consultative workshop on "Marine Litter Status and Issues" a draft report was reviewed critically and participants offered valuable comments and provided new information, references, photos and recommendations for way forward. The list of participants is as under:-

#	Name & Designation	Organizations	Contact details
1	Dr. Asif Inam, Director General	National Institute of Oceanography (NIO)	Niopk.gov.pk@gmail.com
2	Dr. S.H. Niaz Rizvi, Ex-DG	National Institute of Oceanography (NIO)	niazri@gmail.com
3	Cdr Ali Abbas, Director NCMPR (Rep. DG IMA)	National Center for Maritime Policy & Research (NCMPR)	Aliabbas2963@gmail.com
4	Iqbal Nafees Khan, DG	Sindh Coastal Development Authority	Inkhan2008@hotmail.com
5	Lt. Col. Zulfiqar Abbasi	Defence Housing Authority (DHA), Karachi	zaabbasi@yahoo.com
6	S. M. Zafar Imam	Marine Fisheries Department (MFD)	Zafarimam2001@yahoo.com
7	Naghmana Zafar	National Center for Maritime Policy & Research (NCMPR)	Naghmana.ncmpr@bahria.edu.pk
8	Waris Ali Gabol, Deputy Director	Sindh Environmental Protection Agency	warisgabol@gmail.com
9	Fayyaz Rasool, Manager	Marine Pollution Control Department, Karachi Port Trust (KPT)	Fayyaz19us@yahoo.com

10	Muhammad Moazzam Khan, Technical Advisor	WWF-Pakistan	mmoazzamkhan@gmail.com
11	Syed Ali Raza, Director (Buss. Dev./GTS)	Sindh Solid Waste Management Board	alirazakazmislgb@gmail.com
12	Dr. Nuzhat Khan, Principal Scientific Officer (PSO)	National Institute of Oceanography	nuzhatk@gmail.com
13	Cdr. Ghazi Salahuddin	Pakistan Maritime Security Agency	ghazi.salahuddin72@gmail.com
14	Naeemullah Kazi, Deputy Director-KPC	Sindh Wildlife Department, Karachi	Qazimbrl67@gmail.com
15	Naveed Ali Soomro	IUCN-Pakistan	Naveed.soomro@iucn.org
16	Abdul Munaf Qaimkhani	National Consultant	amqaimkhani@yahoo.com

National Consultative Workshop Participants at NIO, Karachi on 9th January, 2018

Annex-2: Different Types of Pollutants on the Coast of Pakistan, 2010 to 2014

Area	Oil Sliks	Tar on Beaches	Tar Balls	Industrial Waste	Domestic Wastes	Heavy Metal	Thermal Pollution
Jiwani	+	+	+	-	+	-	-
Gwadar	++	+	++	-	+	-	-
East Bay	+	+	++	-	+	-	-
West Bay	-	-	+	-	+	-	-
Pasni	+	-	+	-	+	-	-
Ormara	-	-	+	-	-	-	-
Sonmiani Bay	-	-	+	+	+	++	-
Gadani	+	-	+	++	+	++	-
Cape Monze	+	+	+	-	-	+	-
Paradise Point	+	-	+	-	+	+	+
Buleji	-	-	+	-	+	-	-
Hawksbay	+	-	+	-	+	+	-
Sanspit	+	-	+	-	+	+	-
Manora Channel	+	+	++	-	+	+	-
Clifton	+	+	++	+	+	+	-
Korangi Creek	-	-	+	++	++	++	+
Port Qasim	-	-	+	+	+	+	+
Indus Delta	-	-	-	-	+	+	-

Source: - National Institute of Oceanography, Karachi.

Note: -
+ = Low
++ = Medium
+++ = High
++++ = Highest