



# **Marine Litter in the South Asian Seas (SAS) Region**

## **PREPARATION OF REGIONAL MARINE LITTER ACTION PLAN IN THE SOUTH ASIAN SEAS (SAS) REGION**

### **COUNTRY REPORT - BANGLADESH**

**United Nations Environment Programme (UNEP)  
SOUTH ASIA CO-OPERATIVE ENVIRONMENT PROGRAMME (SACEP)  
Ministry of Environment, Forest and Climate Change (MoEFCC)  
Government of the People's Republic of Bangladesh**

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# Foreword

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Bangladesh, a beautiful country with numerous resources, has made impressive gains in key human development indicators in the recent years. It has taken considerable steps towards poverty alleviation, economic and social change providing better social services especially in health and education to tackle environmental pressures exacerbated for example by climate change.

Marine waste, debris or litter whatever it is called, has got the attraction of all over the world among scientist, researchers, national, international or regional organizations and institutes because of its impact on the marine environment, ecosystem and biodiversity. The amount of marine litter is increasing day by day with the increase of population around the world. Plastic, metal, wood, rubber, foam, are the main marine litter found all over the ocean, even where there is no human present. It has a great impact on the environment, economic, human health, biodiversity, society, food safety and wildlife.

The United Nations, European Commission and other organizations come forward to tackle down the marine litter issue. In our region, the South Asia Co-operative Environment Programme, also known as SACEP, is an inter-governmental organization established in 1982 by the South Asian governments to promote and support protection, management and enhancement of the environment in this region. SACEP is also hosting the secretariat of the South Asian Seas Programme (SASP) which is one of the 18 Regional Seas of the United Nations Environment Programme (UN Environment). The SASP was adopted in March 1995 and today enjoys the unqualified support of the region's five countries (Bangladesh, India, Maldives, Pakistan and Sri Lanka). For monitoring marine litter in the SAS region, a marine litter programme has been introduced into the SAS region called the International Coastal Cleanup (ICC), which is coordinated globally by Ocean Conservancy, a US NGO.

This report is an important synthesis of the best available knowledge on marine litter and the tools and approaches available to tackle the issue in Bangladesh. Importantly, however, it also highlights many gaps in knowledge, policies and management issues. I hope that this report will provide governments and other stakeholders with the information needed to take urgent actions to address marine debris, one of the most prominent threats to marine

ecosystems, and support healthy and resilient oceans as a critical aspect of achieving sustainable development.

Secretary  
Ministry of Environment, Forest and Climate Change  
Government of the People's Republic of Bangladesh

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# Acronyms and abbreviations

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3R	Reduce, Reuse and Recycle
APEC	Asia-Pacific Economic Cooperation
BEMP	Bangladesh Environmental Management Project
BIWTA	Bangladesh Inland Water Transportation Authority
CARDMA	Coastal Area Resource Development & Management Association
CCAMLR	Commission for the Conservation of Antarctic Marine Resources
CDS	Coastal Development Strategy
DCC	Dhaka City Corporation
DoE	Department of Environment
FAO	Food Agriculture Organization
GBM	Ganges, Brahmaputra and Meghna river systems
GoB	Government of Bangladesh
GPA	Global Program of Action
GPML	Global Partnership of Marine Litter
ICC	International Coastal Cleanup
IOC	Intergovernmental Oceanographic Commission
MARPOL	Marine pollution
MoEFCC	Ministry of Environment, Forest and Climate Change
MPO	Marine Pollution Ordinance
MSFD	Marine Strategy Framework Directive
NGO	Non-government Organization
NOAA	National Oceanic and Atmospheric Administration
NPA	National Program of Action
NTO	National Tourism Organization
OSPAR	Oslo and Paris Conventions
PRF	Port Reception Facility
SACEP	South Asia Co-operative Environment Programme
SAS	South Asian Seas
SASP	South Asian Seas Programme
SEMP	Sustainable Environment Management Programme
UNCLOS	United Nations Convention on the Law of the Sea
UNEP	United Nations Environment Programme
WARPO	Water Resources Planning Organization

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# Executive Summary

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Marine litter or debris are the persistent, manufactured, processed solid material found in the marine and coastal areas. It is a fundamental ubiquitous problem due to its harmful effect on the environment, wildlife and human health. Debris washing up on beaches not only creates negative impact on esthetics but may also have considerable economic impacts, such as less number of tourists which diminishes the recreation potential. It reaches the ocean from the land from various sources through river runoff, drainage system, wind action and intentional or unintentional discharge of materials in the sea by human activities. It is gradually becoming a serious concern for the world as well as for the South Asian Seas (SAS) region including Bangladesh. Actions must be taken to prevent and reduce the impacts of the marine litter on ecosystem, economy and society. However, data on marine litter is limited in the entire SAS region. The South Asia Co-operative Environment Programme (SACEP) has attempted to develop a data base to generate required data on marine litter along with microplastic, and prepare a regional action plan for the SAS region. As part of this, the Ministry of Environment, Forest and Climate Change (MoEFCC) of the People's Republic of Bangladesh through its Department of Environment (DoE) has been assigned to prepare a Country Report on Marine Litter in Bangladesh highlighting the national status including database, proposed recycling enterprise and interventions. This country report is mainly based on the reviews of scientific and policy documents together with a preliminary survey on marine litter along the four beaches of Bangladesh.

This report has been compiled based on the primary and secondary data available and could serve as a baseline information on the status of marine litter in Bangladesh. In Bangladesh, marine litter's origin, pathway, type and trends are not given full concern yet and no comprehensive study has been done yet. A very few studies on marine litter in Bangladesh reveals that the industries such as food industries, garments, bricks, wood, metal, glass, paper mills, plastic factories, medical industries, paint factories and fish processing centers are mainly originating marine litter. The most concerned debris are plastic (including polythene), metal, wood, paper, glass, ceramic, cloth etc. According to the SACEP/UNEP (2007) report, a total of 528.12 kg marine litter was estimated within 98.01 km (5.39 kg/km) of the Bay of Bengal coast of Bangladesh. To know the present situation, a preliminary marine litter survey was carried out on the four beaches of Cox's Bazar and Chattogram Districts using the counting method. In Cox's Bazar District, Laboni beach and Inani beach area and in

Chattogram District, Ananda Bazar beach and Patenga beach area were surveyed. A total of 18.5 Kilometers beach areas was investigated from where a total of 6,705 items of marine litter was recorded. The percentage compositions of recorded marine litter were approximately 63% of plastic, 13% of foamed plastic, 2% of cloth, 1% of glass and ceramic, 1% of metal, 9% of paper and cardboard, 3% of rubber, 1% of wood and 7% other materials. It reveals that plastic is the most abundant litter type in the Bay of Bengal coast of Bangladesh. The source of marine litter can be grouped into two categories: land-based and sea-based sources. Most of the debris come from land-based sources in different ways. Some of the major land-based sources of marine litter are sewage, municipal waste, industrial waste etc. whereas, the sea-based sources are merchant shipping, ferries and cruise liners, fishing vessels, offshore oil and gas platforms, fish farming installations etc. Sea-based debris can come from commercial fishing and boating activities (fishing gear, foam plastic (insulation), rope, fishing nets, traps and buoys; tied bottles and cans) shipping activities in the Bay of Bengal. Of all the debris items found on the Bangladeshi coast, 90% was land-based. Sea-originated debris was 10%. The overall dominance of land-based items is consistent with the land-based origin of the top debris items found on the beaches.

In Bangladesh, some government agencies and to a lesser extent some NGOs and private companies are involved in marine litter monitoring and management. The MoEFCC is the apex body for managing, monitoring and controlling pollution including marine litter. Especially the Department of Environment (DoE) under the MoEFCC together with other agencies has taken many policies and strategies to control, preserve and protect the environments in many aspects. Coastal Zone Policy (2005), Coastal Development Strategy (2006), National Environmental Policy (2013) are important initiatives taken by the government to combat the marine pollution issues in Bangladesh. Banning of plastic (polythene bag) in 2002, is the most remarkable step to control pollution and debris in Bangladesh. In fact, the local government and administration bodies are responsible for cleaning the coastal areas and/or beaches in Bangladesh. However, there are gaps in monitoring, management and control of marine litter in Bangladesh which might be due to the lack of capacity, awareness and appropriate legal and institutional mechanisms.

The 3R – Reduce, Reuse and Recycle – strategy has achieved much attention by many countries to solve the great problem of Marine Litter. Two other ‘Rs’ are also added recently – Refuse and Redesign. In Bangladesh, the National 3R Strategy for waste management was launched in 2010. The City Corporations and Municipalities are making efforts to incorporate

the concepts and guidance of this strategy in their solid waste management activities. Similar strategy should be initiated and implemented on an urgent basis for better management of marine litter in Bangladesh.

The existing policies and regulations to tackle the marine pollution in Bangladesh should be reviewed and a specific and effective marine litter policy should be formulated to combat the marine litter issue in the country. Nonetheless, a continuous review of the monitoring, innovation and improvement of the activities needs to be addressed in a timely manner.

# Key messages

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1. Marine litter is predominantly the result of poor waste management. Improving waste management will help to prevent such waste from reaching the marine environment. Government needs to integrate the issue of marine littering into their national waste management strategies.
2. Enhance coordination between the responsible waste management agencies may have effective impacts on reducing the marine littering in the Bay of Bengal.
3. To minimize the impact of marine litter, different strategies (e.g. 3R-reduce, reuse and recycle), and action plans are needed at theregional, national and local levels.
4. Raising awareness about littering through educational activities and information campaigns are crucial in order for society to understand the effect of littering and to lead to long-term behavioural change. Antilitter legislations and policies should be introduced and/or reinforced at the national level.

## 1. Introduction and Background

Bangladesh shares large borders with India and a small southern strip with Myanmar. It extends from 20°34'N to 26°38'N latitude from 88°01'E to 92°41'E longitude. The Indian State of West Bengal, Assam, Meghalaya and Tripura border Bangladesh in the west, north and east, respectively. Myanmar forms the southern part of the eastern frontier. Along the border, Bangladesh shares 93.9% with India and 6.1% with Myanmar. Nepal, Bhutan, Pakistan and China are near the country though these countries are not sharing the border with Bangladesh. It is one of the most densely populated countries in the world. Dhaka is the capital and largest city after Chattogram. After the maritime dispute with Myanmar and India, country's maritime area in the Bay of Bengal is roughly equal to the area of its main land. Most of its area is covered by the Bengal Delta. It is the largest delta of the world and that's why it is also known as the deltaic country, a delta in South Asia.



Figure 1.1 Map of Bangladesh (source: [www.maps.com](http://www.maps.com)).

The country has low lying riverine area and many inland waterways with a 580 km coastline area along the Bay of Bengal. Bangladesh is the home to the Ganges, the Brahmaputra and the Meghna rivers (GBM), and networks of smaller rivers and canals. The delta plain of the GBM river systems and their tributaries occupy about 79 percent of the country's area. Most of the land area is fertile and dominated by the delta that is formed by the confluence of the GBM rivers and their tributaries, where the Ganges meets with the Brahmaputra and later joins the Meghna rivers and fall into the Bay of Bengal. Most of its area is less than 12 m above the sea level. Therefore, a major portion of the country would be flooded in case of sea level rise.

The country has many small and medium islands and a coral reef (St. Martin's Island). The longest unbroken sea beach, Cox's Bazar Beach is located here. Highlands with evergreen forests are found in the northeastern and southeastern regions of the country. It is home to the Sundarbans, the largest mangrove forest in the world. The country's biodiversity includes a vast array of flora and fauna, including endangered Bengal tigers, the national animal. The country is divided into eight administrative divisions: Dhaka, Chattogram, Rajshahi, Khulna, Barisal, Sylhet, Rangpur and Mymensingh. Divisions are subdivided into districts. There are a total of 64 districts. Each district is subdivided into Upazilas (Thana).

Coastal zones play a significant role as a place for human settlement and tourism. Bangladesh is one of the marginal coastal countries of the Bay of Bengal of the Indian Ocean. It is known that coastal areas are among the most sensitive zones around the world. The coast of Bangladesh is known as a zone of multiple vulnerabilities due to problems that include, among others, marine litter, which made the whole coastal and marine environment vulnerable. Marine litter also known as the marine debris, is a fundamental ubiquitous problem which arises from human activity, either intentional or unintentional (Slavin et al., 2012; Williams et al., 2016). It is generally defined as "any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment" (Galgani et al., 2010). It reaches the oceans through deliberate disposal or unintentional discharge, either at sea or from land by way of rivers, drainage systems, flooding and wind action (UNEP/MAP, 2012). Therefore, marine litter includes all items that do not naturally occur in the marine and coastal environment but are, nevertheless, found there and has harmful effects on the environment. Most of the marine litter consists of slowly degradable waste items that made of persistent materials such as plastic, polystyrene, metals and glass from a large number of different sources. Marine litter can blow around, remain floating on the water surface; drift in the water column; get entangled on shallow, tidal

bottoms; or sink to the deeper seabed. These are items and material that are either discarded directly (thrown or lost directly into the sea); brought indirectly to the sea through rivers, sewage systems, storm water or winds; or left by people on beaches and shores, that's why these are found everywhere in the marine and coastal environment. Approximately 10 million tons of litter end up in the world's oceans and seas each year. According to the OSPAR, it is estimated that about 70% of marine litter is on the seabed, 15% is floating in the water column and 15% is found on shores (Clean Coasts, 2016).

Marine litter has already been recognized as an emerging threat to the seas globally (Bouwman et al., 2016; Deudero and Alomar, 2015; Gall and Thompson, 2015; Poeta et al., 2015). In recent years, it has become a significant environmental concern for governments, scientists, and stakeholders (Seltenrich, 2015). The amount of marine litter increasing day by day due to the increasing population and development of their livelihoods.

Marine litter issue has long been on the political and public agenda. It is recognized as a worldwide rising pollution problem affecting all the oceans and coastal areas of the world (Galgani et al., 2015; Ryan, 2015; Thompson, 2006). Generally, the problem of marine litter is rooted in the prevailing production and consumption pattern and the way we dispose and manage waste. To minimize the negative impacts, a plethora of instruments has been developed at international, regional and national levels that can be broadly divided into four categories: preventive, mitigating, removing and behavior-changing. The preventive and behavior-changing measures are particularly important in addressing marine litter at its origin. The former schemes include source reduction, waste reuse and recycling, containing debris at points of entry into receiving waters and land-based management initiatives (e.g. restriction of the use of plastic bags, establishment of extended producer responsibility). They represent a wide range of international, regional and national efforts devoted to combat marine litter. As it is not possible to include all the relevant instruments in details, we briefly discuss some of the important measurement of the marine litter action plans.

### **Regulation and Management of Marine Litter**

A large number of instruments at international, regional and national levels have been adopted to tackle marine litter problems. These instruments comprise conventions, agreements, regulations, strategies, action plans, programs and guidelines. They contain specific management measures that are either compulsory or voluntary. These instruments can be divided into two broad categories, international and regional or national.

## *International Instruments to Tackle Marine Litter*

### **A. United Nations Convention on the Law of the Sea (UNCLOS)**

The UNCLOS is one of the most important agreements related to the use of the oceans and entered into force in 1994 and comprises 320 articles and nine annexes. It established a comprehensive regime for the law of the sea by governing all aspects of the oceans from geopolitical delimitations to environmental control, scientific research, economic and commercial activities, technology and the settlement of disputes relating to ocean matters (Roberts, 2010). In particular, articles 192–237 of Part XII are dedicated to the protection and preservation of the marine environment. While the provisions do not explicitly refer to marine litter, they place a general obligation on states to protect and preserve the marine environment, which can be used in the context of marine litter regulation.

### **B. Annex V of MARPOL 73/78**

Annex V of MARPOL 73/78 is the major international instrument addressing ocean-based litter pollution from ships and was developed under the auspices of the International Maritime Organization (IMO). Annex V was recently revised in 2011 and came into force in 2013. It has an updated framework for the control of garbage generated by ships. It imposes a general ban on discharges of all garbage from ships at sea, except for a few clearly defined circumstances (Revised Annex V, reg. 3). These circumstances are associated with the types of garbage that can be disposed of, specifications of the distances from the coast, discharge of garbage within or outside special areas (Revised Annex V, reg. 1), the manner in which they may be disposed of, and route requirements for allowable discharge (Revised Annex V, reg. 1a). Other major changes include expanding the requirements for placards and garbage management plans to fixed and floating platforms (Revised Annex V, reg. 10.1), and reduction of the minimum tonnage limit for garbage management plans from 400 gross tonnage (GT) to 100 GT (Revised Annex V, reg. 10.2). Major provisions remaining unchanged include: the obligation to provide a Garbage Record Book (GRB) for ships  $\geq 400$  GT or ships certified to carry  $\geq 15$  persons (Revised Annex V, reg. 10.3), and the provision of adequate reception facilities at ports without causing undue delay to ships (Revised Annex V, reg. 8.1). A GRB is to record each discharge made at sea or a reception facility, or a completed incineration, including date, time, ship position, category of the garbage and the estimated amount discharged or incinerated (Revised Annex V, reg. 10.3.1 and 10.3.2). The GRB is subject to inspection by the competent authority of a party to MARPOL 73/78 when the ship is in port (Revised Annex V, reg. 10.5).

### **C. London Protocol**

The London Protocol (LP) is a major instrument dealing with the dumping of wastes and other matter at sea. The discharge of garbage during normal operations as regulated in Annex V of MARPOL 73/78 is not considered as dumping (LP, reg. art. 1.4.2). In 1996, the protocol was adopted to further modernize the 1972 London Convention (Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter) and eventually replace it. The protocol entered into force in 2006. While the goal of the 1972 convention is to regulate pollution by dumping, the goal of the Protocol is to stop waste dumping at sea (Louka 2006). Namely, the protocol is more restrictive in regulating wastes dumping than the 1972 convention by introducing a reverse listing approach. This approach is, in essence, to prohibit the dumping of any wastes or other matter except for the materials listed in Annex I (London Protocol, art. 4.1.1). Dumping of these materials (such as dredged material, sewage sludge, fishing wastes, vessels and platforms, inert, inorganic geological material) requires a permit and parties shall adopt measures to ensure that the issuance of permits and permit conditions to comply with Annex II (London Protocol, art. 4.1.2). In addition, the protocol prohibits incineration of wastes at sea and the export of wastes to countries for dumping or incineration at sea (London Protocol, art. 5 and 6). The protocol is to supersede the convention for the state parties that ratified it and will eventually replace the convention as more and more parties ratify.

### **D. UNEP Regional Sea Program**

The UNEP Regional Sea Program and Global Program of Action (GPA) embarked in 2003 on the development of a Global Initiative on Marine Litter. This initiative has succeeded in organizing and implementing regional activities on marine litter around the world. Activities focusing on managing marine litter were arranged through individual agreements in 12 Regional Seas. The main activities include: a review and assessment of the status of marine litter in the region, organization of a regional meeting of national authorities and experts on marine litter, preparation of a regional action plan for the management of marine litter, and participation in a regional cleanup day within the framework of the International Coastal Cleanup Campaign. This regional initiative also provides a platform for the establishment of partnerships, cooperation and coordination of activities for the control and sustainable management of marine litter. The main partners include Regional Sea Conventions and Action Plans, government representatives, UN agencies, relevant bodies, donor agencies, the private sector and NGOs (UNEP, 2009).

### **E. UNEP/IOC Guidelines on Surveying and Monitoring of Marine Litter**

The UNEP developed, in cooperation with the Intergovernmental Oceanographic Commission (IOC), guidelines on surveying and monitoring of marine litter in order to provide a long-term platform for scientific monitoring. Four sets of operational guidelines were developed: comprehensive assessments of beach, benthic and floating litter, and rapid assessments of beach litter. The first three sets target the collection of highly resolved data to support the development and/or evaluation of mitigation strategies, while the last aims to raise public awareness of and educate about marine litter issues (Cheshire et al., 2009).

### **F. UNEP/FAO Abandoned, Lost or Otherwise Discarded Fishing Gear**

A report commissioned by the UNEP and Food Agriculture Organization (FAO) identified reasons for fishing gear being abandoned, lost or otherwise discarded, reviewed existing measures to reduce derelict fishing gear, and proposed recommendations for future action (Macfadyen et al., 2009). A variety of existing measures have been presented, including gear marking, port-state measures, onshore collection, payment for retrieved gear, better locating and reporting lost gear, disposal and recycling, and awareness raising schemes.

### **G. Honolulu Strategy**

The UNEP and the US National Oceanic and Atmospheric Administration (NOAA) co-organized the Fifth International Marine Debris Conference in 2011, where the Honolulu Strategy was formulated. This strategy can be regarded as a global framework on possible actions to combat marine litter. It contains three goals, 19 strategies and numerous specific actions, serving as a useful and practical reference for concerned parties to take actions at national levels (UNEP/NOAA 2011).

### **H. UNEP Global Partnership of Marine Litter**

The most recent initiative was to establish a Global Partnership of Marine Litter (GPML) in June 2012 by the UNEP. The GPML builds on the Honolulu Strategy. It is a global partnership, acting as a “coordinating forum” for all stakeholders (international, regional, national and local organizations) working in the area of marine litter prevention and management. The forum assists stakeholders to complement each other’s efforts, to avoid duplication and to optimize the efficiency and efficacy of their resources.

### ***Regional Instruments to Tackle Marine Litter***

#### **A. EU PRF Directive**

In response to MARPOL 73/78, which requires party states to ensure the provision of adequate PRFs, the EU adopted the Port Reception Facility (PRF) Directive aimed at reducing the input of ship-generated waste to the sea. The directive came into force in 2002 and key requirements include: member states are obliged to ensure the availability of PRFs to meet the needs of ships, ports to develop and implement a waste reception and handling plan, a reporting requirement for the master of a ship regarding the delivery of waste, implementation of a cost-recovery system, and establishment of an enforcement scheme (EU, 2000).

### **B. EU Marine Strategy Framework Directive**

The most relevant way to tackle the marine litter is the Marine Strategy Framework Directive (MSFD) (EU 2008), the environmental pillar of the EU Integrated Maritime Policy. This directive is an integral policy instrument for the protection of the marine environment for the European Community, following an ecosystem-based, adaptive and integrated approach to the management of human activities, which have an impact on the marine environment. The directive establishes a framework, within which member states shall take necessary measures to achieve or maintain good environmental status (GES) in the marine environment by 2020 (The MSFD, art. 1). Marine litter is listed as the tenth of 11 qualitative descriptors for determining GES, which states that the properties and quantities of marine litter do not cause harm to the coastal and marine environment.

### **C. Helsinki Convention**

The 1992 Helsinki Convention (Convention on the Protection of the Marine Environment of the Baltic Sea Area, known as Helsinki Convention) is a regional instrument aimed at protecting the marine environment of the whole Baltic Sea area, including inland waters as well as the seawater itself and the seabed. Its Annex IV (Prevention of Pollution from Ships) contains Regulation 4 (Application of the Annexes of MARPOL 73/78) and Regulation 6 (Mandatory discharge of all wastes to a port reception facility), which can be used in the context of marine litter. According to Regulation 4, contracting parties shall apply the provisions of Annexes I–V of MARPOL 73/78. According to Regulation 6, ships shall discharge all ship-generated wastes before leaving port, which are not allowed to be discharged into the sea in the Baltic Sea in accordance with MARPOL 73/78 and the convention. In relation to this, the Commission (HELCOM is the governing body of the Helsinki Convention) has approved the strategy for PRFs for ship-generated wastes (also known as the Baltic Strategy). This strategy comprises a set of measures and regulations with

the main goals to ensure ships' compliance with global and regional discharge regulations and to eliminate illegal discharges of all wastes from all ships. Over 210 PRFs are provided in ports located around the Baltic Sea. To encourage their use, a "no-special-fee" system has been designed, by which disposal fees are included in port charges (HELCOM, 2012). In addition, the Baltic Sea Action Plan adopted by the HELCOM includes an agreement to raise awareness of the negative environmental and economic effects of marine litter in the marine environment, including effects of "ghost fishing" of derelict fishing gear (BSAP, 2007).

#### **D. OSPAR Initiatives on Monitoring Marine Litter**

Since 1998, OSPAR has monitored levels of beach litter (OSPAR, 2010a). A pilot project (2000–2006) on monitoring marine beach litter in the OSPAR region using the standardized method was conducted (OSPAR, 2007). The guideline for monitoring marine litter on the beaches in the OSPAR Maritime Area was further adopted in 2010, providing practical advice, especially with standardized methodology and a photographic guide, for determining the nature and amount of litter (OSPAR, 2010b).

#### **E. Barcelona Convention**

The Barcelona Convention (Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean) is a regional instrument aimed at protecting and promoting sustainable development of the Mediterranean marine and coastal environment. It was adopted in 1976 and amended in 1995 by the parties to the Mediterranean Action Plan (MAP). Seven protocols to the convention establish the MAP legal framework and address specific aspects of conservation. The most relevant to marine litter is the Land-based Sources and Activities Protocol (LBS Protocol). It states that parties undertake to eliminate pollution deriving from land-based sources and activities, in particular, to phase out inputs of the substances that are toxic, persistent and liable to bio-accumulate listed in its Annex I (The LBS Protocol, art. 5.1), including litter. In addition, the Dumping Protocol has relevance to marine litter. It states that dumping of wastes and other matter is prohibited, except for dredged material, food waste, platforms and other man-made structures, and inert geological materials.

#### **F. CCAMLR Marine Debris Program**

The Commission for the Conservation of Antarctic Marine Resources (CCAMLR) has initiated the Marine Debris Program in its convention area. Specific measures were employed

to reduce the amount of debris entering the marine system and to mitigate its impacts. The measures include monitoring marine debris, addressing the risk associated with the entanglement of marine mammals in plastic packaging bands and the injury to seabirds caused by the discharge of hooks in offal, and educating fishers and fishing vessel operators about the potential impact of marine debris on marine wildlife. Members annually submit information on marine debris beach surveys, debris associated with seabird colonies, entanglements of marine mammals, and seabirds and marine mammals soiled with oil.

### **Regulation and Management of Marine Litter in South Asian Seas (SAS) Region**

The SAS Region includes the seas bordering Bangladesh, India, Maldives, Pakistan, and Sri Lanka and comprises the Northern part of the Indian Ocean, along with parts of the Bay of Bengal and the Arabian Sea. Bangladesh, India, and Pakistan are parts of the Indian subcontinent, while the island of Sri Lanka shares a part of the continental shelf with India. Maldives is a group of coral atoll islands. The countries constituting the SAS Region have almost a fifth of the world's total population. High population density, low income, low development indicators, and high dependence upon natural resources for livelihood characterize all these countries. The SAS region has some of the largest biologically rich marine ecosystems, like the Gulf of Mannar, coral atolls of the Maldives, coastal lagoons like Chilika and Puttalam, vast mudflats of the Gulf of Kutch and Jaffna, and the mangroves of the Sundarbans.

### **Bangladesh**

With the commitment to promote integrated coastal management and contribute to reduce the pressure on marine environments, Bangladesh initiated a process to develop National Program of Action (NPA) under the Global Program of Action (GPA) for the Protection of the Marine Environment from Land-based Activities in 1999. NPA in Bangladesh integrates the existing challenges and integrated coastal zone management, taking into account the coastal management background of the past and adopts the methodological framework suggested by the UNEP under GPA and the actions thereon. A marine litter program has been introduced in the SAS region by the International Coastal Cleanup (ICC), which was coordinated globally by Ocean Conservancy, a U.S. NGO. According to UNEP Regional Seas participation in ICC events (2007), a total 528.12 kg marine litter recorded within 98.01 km (5.39 kg/km) area in Bangladesh (2007).

According to UNEP/SACEP (2007) report, the quantity of marine litter and their categories are listed in the following table-

SL. No.	Sources /Activities	Types and Number (Items)
1	Shoreline and Recreational Activities	Bags 7121, Balloons 32, Beverage Bottles (Plastic) 2 litre or less 180, Beverage Bottles (Glass) 155, Beverage Cans 389, Caps/Lids 215, Clothing/Shoes 205, Cups/Plates/Forks/Knives/Spoons 224, Food Wrappers 2982, Shotgun Shells 345, Straws/Stirrers 87 and Toys.
2	Ocean/Waterway Activities	Fishing Lines 13, Fishing Lures/Light Sticks, Light Bulbs 34, Oil/Lube Bottles 20, Pallets 3, Plastic Sheeting 2, Rope 1, Strapping Bands 59.
3	Smoking-Related Activities	Cigarettes/Cigarette Filters 5152, Cigarette Lighters 413, Cigar Tips 104, Tobacco Packaging 1475.
4	Dumping Activities	Appliances 5, Batteries 152, Tires 3.
5	Medical/Personal Hygiene	Condoms 34, Syringes 8.

## India

The status of marine debris in India varies from place to place. The information collected from different sources explains the diversity of the problem. There appears to be no focus to address this problem in the country as a whole, except for a small but significant effort taken by a NGO—EXNORA in Elliotts (Besant Nagar) beach in Chennai. In India, organized efforts were initiated since 1986 to assess the state and trend of marine coastal pollution in the seas around the country up to 5 km offshore through systematic monitoring network of 173 selected stations under a project "Monitoring of Indian Coastal Waters" which was continued up to March 1992. The project was administered jointly by the Department of Ocean Development (DOD) (presently the Ministry of Earth Sciences) and the Central Pollution Control Board (CPCB) with the National Institute of Oceanography (NIO) as Nodal Agency

shouldering the responsibility for training of manpower and establishing monitoring methodology. Subsequently, the DOD launched a project entitled—Coastal Ocean Monitoring and Prediction System (COMAPS), in almost a similar manner in 1992 extending the study area up to 25 km offshore through a number of executing agencies in the country which is still continued.

Constant monitoring of the health of the seas and taking up remedial measures for preventing and controlling pollution from land-based activities is another activity, for ensuring sustainable development of the seas around India. The various measures taken up by India for regulating the activities along the coastal zone, fishing and fisheries, etc., have a definite role to play in sustainable development and utilization of the ocean and its resources.

### **Maldives**

Two national action plans have been formulated and implemented. The first being in 1989, which emphasized the need for institutional and capacity building through human resource development and training, together with information collection about the status of the environment. The second action plan was implemented in 1999, with emphasis on approaches to issues and threats faced by the country, from local and global causes. Consequently, some legal mechanism entry into force in the Maldives.

Law No: 4/93: Environmental Protection and Preservation Act made the Ministry of Planning, Human Resources and Environment responsible for formulating policies, rules and regulations regarding the environment in areas that do not already have a designated government authority to carry out such functions. Law prohibiting Disposal of Waste into Northern harbor/lagoon area of Malé, Law No. 33/78: It is prohibited to dispose waste into the northern harbor/lagoon area of Malé.

### **Pakistan**

Pakistan has developed a National Action Plan (NAP) on Environment for the protection of Marine environment from land-based sources of pollution. NAP recognizes the important role of environmental assessment in integrated coastal zone management. In 1994 the Pakistan government set up the Marine Pollution Control Board (MPCB) to supervise and implement pollution control and prevention measures along Pakistan's coastline. Considering that Pakistan's maritime sector is a vital component of her national economic and military power, a National Maritime Policy of Pakistan has been approved.

## **Status of Marine Litter in South Asian Seas (SAS) Region**

In the entire SAS Region, data/information of some utility is available only from India and Sri Lanka and in the other three countries, the information is either unavailable or even if available it is scanty. There are also no accepted or standard uniform methodologies being followed in the Region for collecting, analyzing and interpreting the marine litter data.

The main objectives of this report are to prepare a documentation on the status of marine litters in Bangladesh which could serve as a baseline information in the formulation of marine litter action plan in future. To meet up the necessary requirements several specific objectives have been taken into account, which are as follows:

- To explore the abundance, composition, sources, and management of marine litter along the Bay of Bengal coast of Bangladesh
- To find out the present practices for the marine litters' management in Bangladesh.
- To propose recommendations for addressing the problems associated with marine litter. Although this document is not a comprehensive study of marine litter, but it does provide current information on the marine litter issues in Bangladesh.

## **2. Marine Litter Status at National Level**

### **2.1. Origin, Typology, Pathway and Trends**

As marine litter is a complex threat to the environment and human health, it is important to point out the origin, typology, pathway and trends of marine litter and to know the various categories of marine litter that is more prominent.

The 'origin' can be defined by the geographic location of the source and where the release took place. This origin can be, and often is, distant from the sea or the site where litter item is recorded. Being able to distinguish between the wastes that is generated locally, regionally and globally, is important when deciding on appropriate measures to prevent littering in a certain area.

Litter pollution in a given area can be of local origin – directly discarded on the beach or in the sea in that area – or can be transported from inland via rivers and runoff or

transported from distant regions via ocean currents and the prevailing wind. Sometimes river or ocean currents are described as sources. However, these are actually pathways and/or transport mechanisms, which move litter into and within the marine environment from various land- and sea-based sources. The pathways can be considered the physical and/or technical means by which litter enters the marine environment

The type of marine litter can be varied from the nation to nation. However, there are some common marine litter that found all over the world and have the great impact on the environment as well as human health. From the origin of marine litter, it is easy and clear to say the typology of litter in our nation. From the different origin and study, the main litter in our nation are two types solid and liquid. Mostly, the solid waste is important to study and constitute the major parts of the marine litter. The major litter are plastic (including polythene), metal, wood, paper, glass, ceramic, cloth etc. Though, a proper study will be needed to accept the proposed type of litters.

Marine litter means litter found in the marine environment, it does not mean it will originate from the marine environment. Litter can be originated from any source, it may land or sea (hydrocarbon production in deep sea). Wherever it is originated, it will come to the sea in some pathways such as rivers, stream, flood, rain, wind, storms (for land-based source) and currents.

## **2.2. Source and Kinds of Marine Litter**

The source of marine litter can be grouped into two; one of them is sea or ocean-based source and another is land-based source. Though debris can originate from land or sea sources, but most researchers postulate that the dominant input comes from land (Coe and Rogers, 1997), although Sheavly and Register (2007) argued that some 50% is of marine origin. Merchant shipping, ferries and cruise liners, fishing vessels, Military fleets and research vessels, pleasure craft, offshore oil and gas platforms, fish farming installations etc are the great sources of ocean-based marine litters.

Global studies of marine litter over the past two decades have shown that plastic - synthetic organic polymers derived from polymerization of monomers obtained from oil or gas - is the modal litter type, with more being found in the northern than southern hemisphere (Moore et al., 2001; Ivar do Sul and Costa, 2007; Thompson et al., 2009; Corcoran et al., 2009; Williams et al., 2014; Erikssen et al., 2014; Poeta et al., 2016). The land-based sources of marine litters are municipal landfills (waste dumps) located on the coast, riverine transport of

waste from landfills or other sources along rivers and other inland waterways, discharge of untreated municipal sewage, including storm water (including occasional overflows), industrial facilities, solid waste from landfills, and untreated wastewater, tourism (recreational visitors to the coast). However, it is clear that a significant amount of marine litter comes from land-based sources (Thiel et al., 2013).

Marine litter comprises of various material types including plastics, metals, glasses, timber, rubber, cloth, etc. According to Galgani et al. (2010) marine litter can be classified into the following distinct categories:

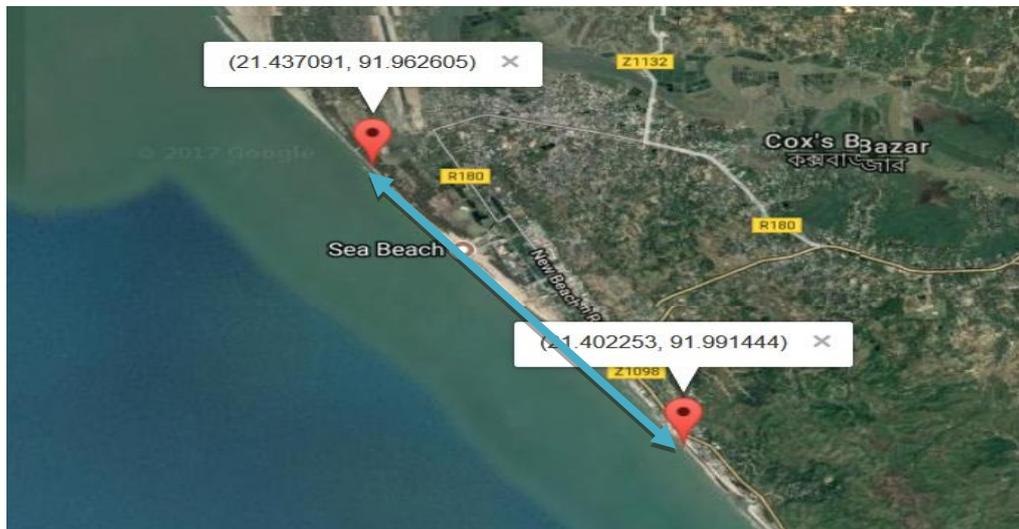
- (1) Plastics, covering a wide range of synthetic polymeric materials, including fishing nets, ropes, buoys and other fisheries- related equipment; consumer goods, such as plastic bags, plastic packaging, plastic toys; tampon applicators; nappies; smoking related items, such as cigarette butts, lighters and cigar tips; microplastic particles.
- (2) Metal, including drink cans, aerosol cans, foil wrappers and disposable barbecues.
- (3) Glass, including bottles, bulbs
- (4) Processed timber, including pallets, crates and particle boards.
- (5) Paper and cardboard, including cartons, cups and bags
- (6) Rubber, including tyres, balloons and gloves.
- (7) Clothing and textiles, including shoes, furnishings and towels
- (8) Tar balls, including oil residues

Similar categorization of marine litter was also found in other studies (Ribicet al., 1992, ANZECC 1996a, Kiessling 2003, Otley and Ingham 2003, Edyvane et al., 2004). Furthermore, some other materials are also found in the marine environments which can be categorized as a marine litter. Additionally, organic material (e.g. faeces or food waste) are also included as litter. Conversely, materials of natural origin, including seagrass or algal wrack and other vegetation (straw), are explicitly excluded. Above these categories, the plastic is the most dominated marine litter due to its extremely durable characteristics and are likely to persist in the marine environment for a considerable period, possibly as much as hundreds of years. Many studies have shown that the observed marine litter consists primarily of plastics with a continuously increasing global annual production of 299 million tons (Plastics Europe 2013). It has been estimated that 10% of all plastic debris ends up in the oceans (Thompson 2006). Plastics constitute 40 to 80% of all the recorded marine litters (Kuase and Noda, 2003; Barnes et al., 2009). Barnes (2005) reported that about 8 million litter items enter the oceans every day. Moreover, plastics can also be degraded and fragmented in the environment as a

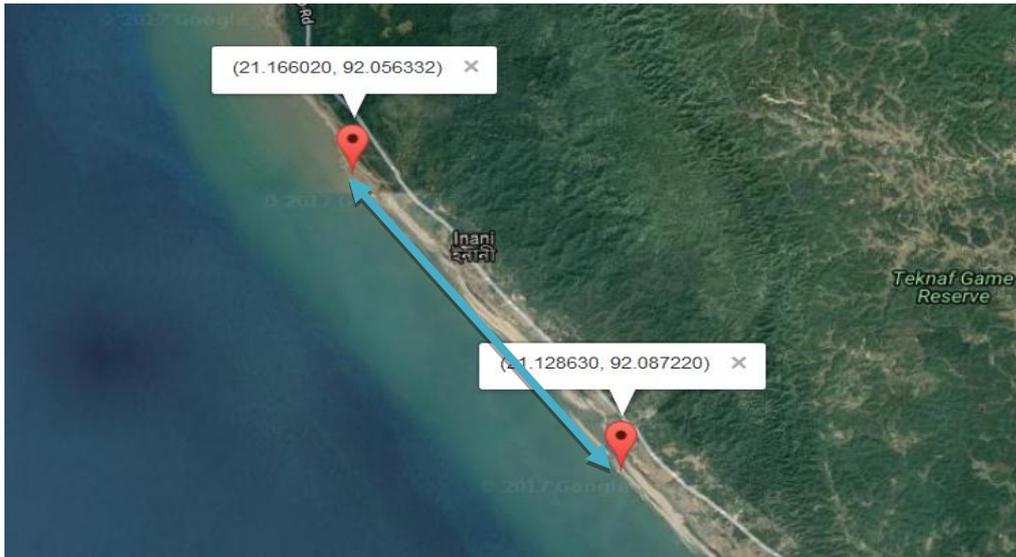
consequence of exposure to sunlight (photo-degradation) in addition to physical and chemical deterioration, which is likely to result in numerous tiny plastic fragments called microplastics (EUC, 2012).

### 2.3. Quantification

The quantification of marine debris received increasing attention in recent studies due to the high accumulation rates of anthropogenic items in this ecosystem. However, there has been no empirical study of the status of marine litter in Bangladesh to date. Thus, a preliminary case study was conducted at four beaches (Laboni sea beach, Inani sea beach, Ananda Bazar sea beach and Patenga sea beach) on the coast of two coastal districts (Cox's Bazar and Chattogram) in November 2017. Laboni sea beach and Inani sea beach are located in Cox's Bazar (parts of the longest, about 120 km, and most visited tourist sea beach in the world). Ananda Bazar sea beach and Patenga sea beach are located in Chattogram district, known as coastal capital of Bangladesh. The selected locations of the study area are shown in Figure 2.1.



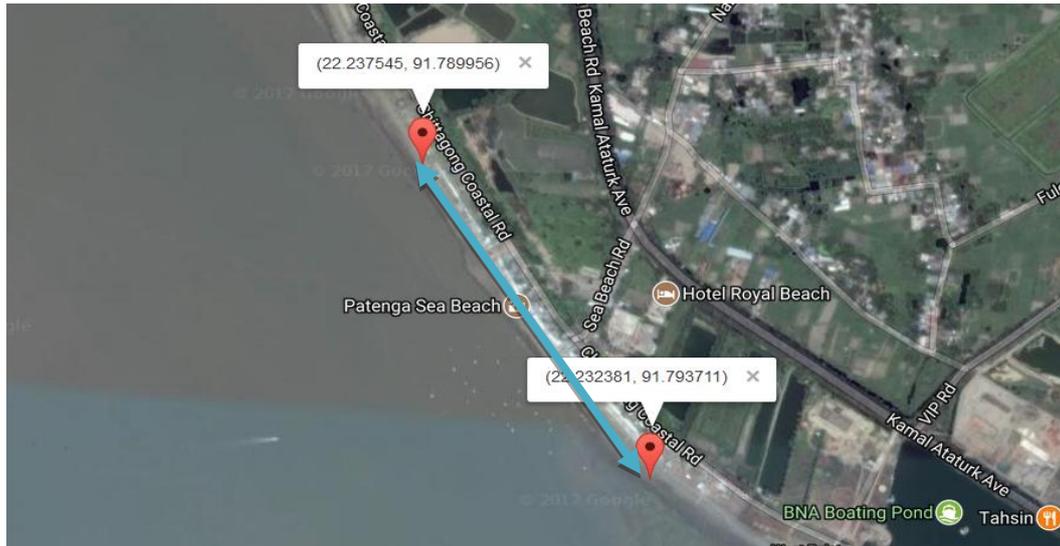
(a)



(b)



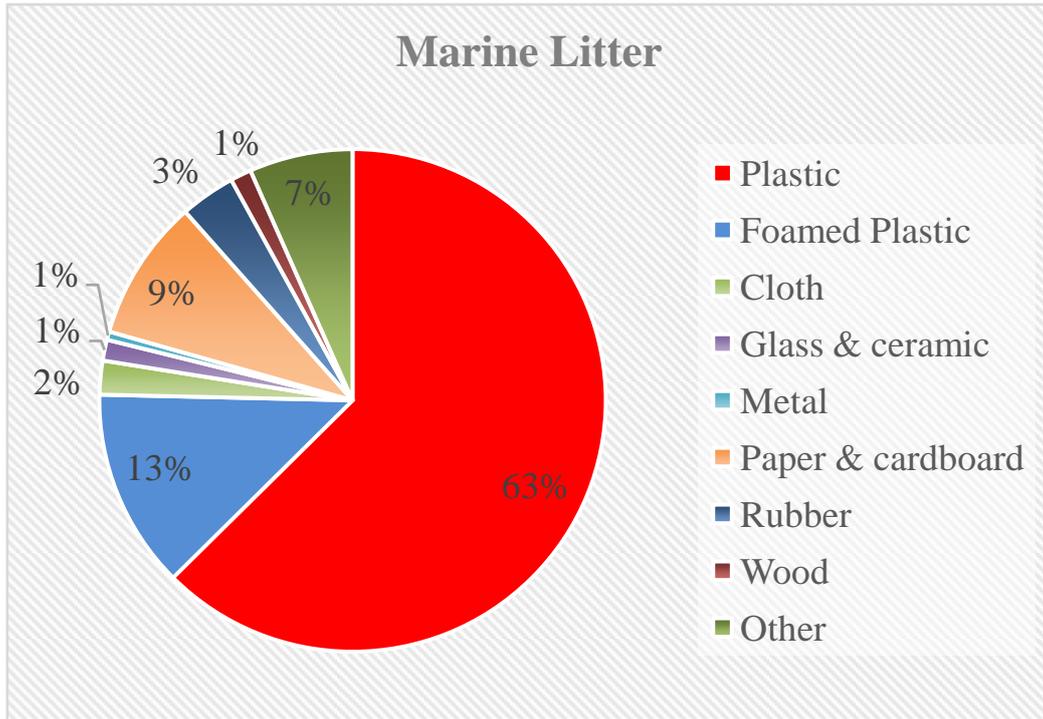
(c)



(d)

**Figure 2.1:** Location of the surveyed areas of (a) Laboni sea beach, (b) Inani sea beach,(c) Ananda Bazar sea beach and (d)Patenga sea beach.

Sampling was done during low tide along the mid-tide zone of the beaches covering approximately 5.5 km for each beaches. A total of 6705 items marine litters was recorded from the four surveyed beaches. Among them approximately 63% of plastic, 13% of foamed plastic, 2% of cloth, 1% of glass and ceramic, 1% of metal, 9% of paper and cardboard, 3% of rubber, 1% of wood and 7% of other materials (Figure 2.2).



**Figure 2.2:** Marine litter types and quantities recorded from the four sea beaches in Cox’s Bazar and Chattogram Districts of Bangladesh in November 2017.

From the percentages data, plastic was the most dominating marine litter along the Bangladesh coast. It is not only dominating the marine litter list of Bangladesh but also all over the world. Barnes *et. al.* 2009; Ryan *et. al.* 2009; Browne *et. al.* 2011 confirmed that plastic materials represent the major constituents of this debris, and there is no doubt about the ubiquity of such debris on a truly global scale. It has also been stated that the majority of plastic including microplastics are the product of the land-based human activity, with as much as 80% moving from land to ocean (Andrady 2011, Newman *et. al.* 2015).

**Table-1:** Type of marine litter's category and their total quantity (items) that observed in Cox's Bazar and Chattogram districts in Bangladesh in November 2017.

Serial	Type	Items
1	Plastic	4193
2	Foamed Plastic	860
3	Cloth	146
4	Glass & ceramic	90
5	Metal	36
6	Paper & cardboard	610
7	Rubber	237
8	Wood	90
9	Other	443

Table 1 indicates the total number of marine litter and categories found in the Cox's Bazar and Chattogram Districts during the investigation. Table 2 indicates the quantity of marine litter based on its specific types. The UNEP/IOC Guidelines on Survey and Monitoring of Marine Litter (2009) was followed for the specification of sampled marine litters.

**Table-2:**Sub category of marine litter and their quantity that found along the beach of Cox's Bazar and Chattogram in Bangladesh in November 2017.

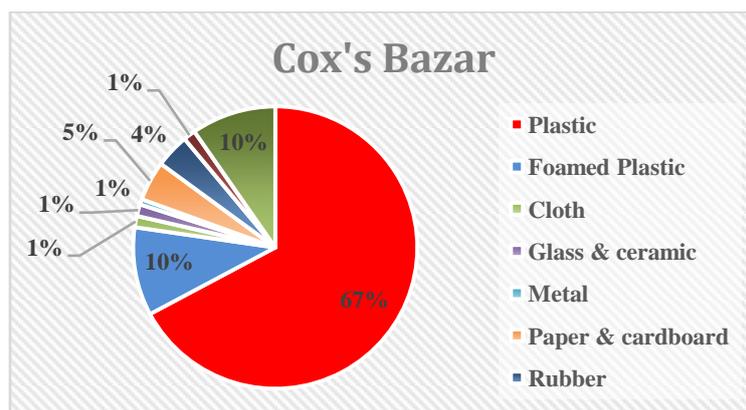
Serial	Material	Code	Litter type	Number
1	Plastic	PL01	Bottle caps & lids	242
2	Plastic	PL02	Bottles < 2 L	300
3	Plastic	PL03	Bottles, drums, jerry cans& buckets > 2 L	18
4	Plastic	PL04	Knives, forks, spoons, straws, stirrers, (cutlery)	12
5	Plastic	PL05	Drink package rings, six-pack rings, ring carriers	74
6	Plastic	PL06	Food containers (fast food, cups, lunch boxes & similar)	127
7	Plastic	PL07	Plastic bags (opaque & clear)	2182
8	Plastic	PL08	Toys & party poppers	8
9	Plastic	PL09	Gloves	0
10	Plastic	PL10	Cigarette lighters	12
11	Plastic	PL11	Cigarettes, butts & filters	470
12	Plastic	PL12	Syringes	6
13	Plastic	PL13	Baskets, crates & trays	5
14	Plastic	PL14	Plastic buoys	25
15	Plastic	PL15	Mesh bags (vegetable, oyster nets & mussel bags)	6
16	Plastic	PL16	Sheeting (tarpaulin or other woven plastic bags, palette wrap)	19
17	Plastic	PL17	Fishing gear (lures, traps & pots)	22

18	Plastic	PL18	Monofilament line	0
19	Plastic	PL19	Rope	267
20	Plastic	PL20	Fishing net	147
21	Plastic	PL21	Strapping	0
22	Plastic	PL22	Fibreglass fragments	0
23	Plastic	PL23	Resin pellets	0
24	Plastic	PL24	Other (specify)	251
25	Foamed Plastic	FP01	Foam sponge	225
26	Foamed Plastic	FP02	Cups & food packs	22
27	Foamed Plastic	FP03	Foam buys	20
28	Foamed Plastic	FP04	Foam (insulation & packaging)	589
29	Foamed Plastic	FP05	Other (specify)	4
30	Cloth	CL01	Clothing, shoes, hats & towels	99
31	Cloth	CL02	Backpacks & bags	10
32	Cloth	CL03	Canvas, sailcloth & sacking (hessian)	2
33	Cloth	CL04	Rope & string	8
34	Cloth	CL05	Carpet & furnishing	0
35	Cloth	CL06	Other cloth (including rags)	27
36	Glass & ceramic	GC01	Construction material (brick, cement, pipes)	0
37	Glass & ceramic	GC02	Bottles & jars	67
38	Glass & ceramic	GC03	Tableware (plates & cups)	16
39	Glass & ceramic	GC04	Light globes/bulbs	5
40	Glass & ceramic	GC05	Fluorescent light tubes	0
41	Glass & ceramic	GC06	Glass buoys	0
42	Glass & ceramic	GC07	Glass or ceramic fragments	2
43	Glass & ceramic	GC08	Other (specify)	0
44	Metal	ME01	Tableware (plates, cups & cutlery)	0
45	Metal	ME02	Bottle caps, lids & pull tabs	11
46	Metal	ME03	Aluminium drink cans	16
47	Metal	ME04	Other cans (< 4 L)	6
48	Metal	ME05	Gas bottles, drums & buckets (> 4 L)	0
49	Metal	ME06	Foil wrappers	0
50	Metal	ME07	Fishing related (sinkers, lures, hooks, traps & pots)	0
51	Metal	ME08	Fragments	3
52	Metal	ME09	Wire, wire mesh & barbed wire	0
53	Metal	ME10	Other (specify), including appliances	0
54	Paper & cardboard	PC01	Paper (including newspapers & magazines)	323
55	Paper & cardboard	PC02	Cardboard boxes & fragments	2
56	Paper & cardboard	PC03	Cups, food trays, food wrappers, cigarette packs, drink containers	150
57	Paper & cardboard	PC04	Tubes for fireworks	1
58	Paper & cardboard	PC05	Other (specify)	133
59	Rubber	RB01	Balloons, balls & toys	5
60	Rubber	RB02	Footwear (flip-flops)	149

61	Rubber	RB03	Gloves	0
62	Rubber	RB04	Tyres	8
63	Rubber	RB05	Inner-tubes and rubber sheet	7
64	Rubber	RB06	Rubber bands	6
65	Rubber	RB07	Condoms	2
66	Rubber	RB08	Other (specify)	61
67	Wood	WD01	Corks	0
68	Wood	WD02	Fishing traps and pots	0
69	Wood	WD03	Ice-cream sticks, chip forks, chopsticks & toothpicks	23
70	Wood	WD04	Processed timber and pallet crates	42
71	Wood	WD05	Matches & fireworks	18
72	Wood	WD06	Other (specify)	7
73	Other	OT01	Paraffin or wax	0
74	Other	OT02	Sanitary (nappies, cotton buds, tampon applicators, toothbrushes)	0
75	Other	OT03	Appliances & Electronics	2
76	Other	OT04	Batteries (torch type)	0
77	Other	OT05	Other (specify)	441

### Cox's Bazar District

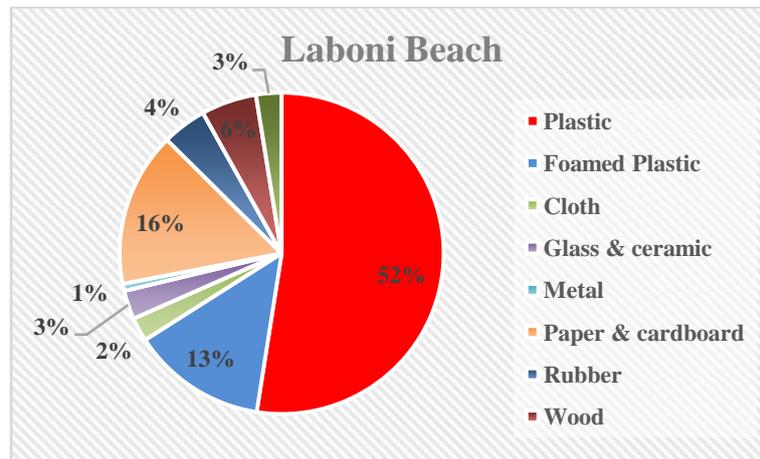
Cox's Bazar is the most popular tourist spot in Bangladesh. Total amount of marine litters recorded from the two beaches in Cox's Bazar district was 4573 items. The identified litter types and their quantities are given in Figure 2.3. It implies that the plastic litters are in the top position (67%) compared to other types of litter followed by cloths and paper based products.



**Figure 2.3:** Total marine litter recorded from Cox's Bazar in November 2017.

### ***Laboni Beach (Cox's Bazar)***

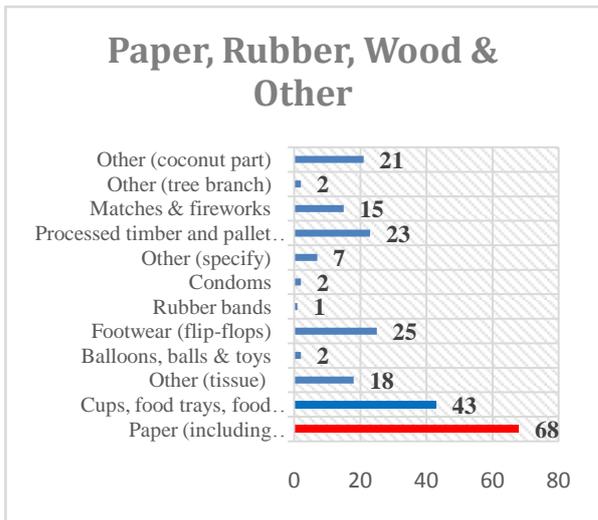
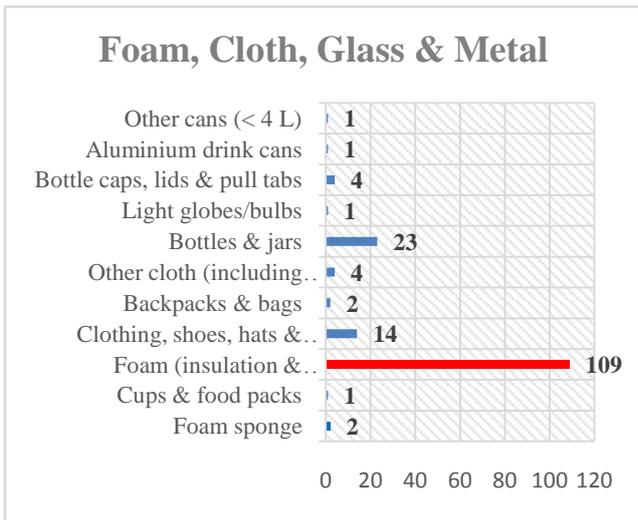
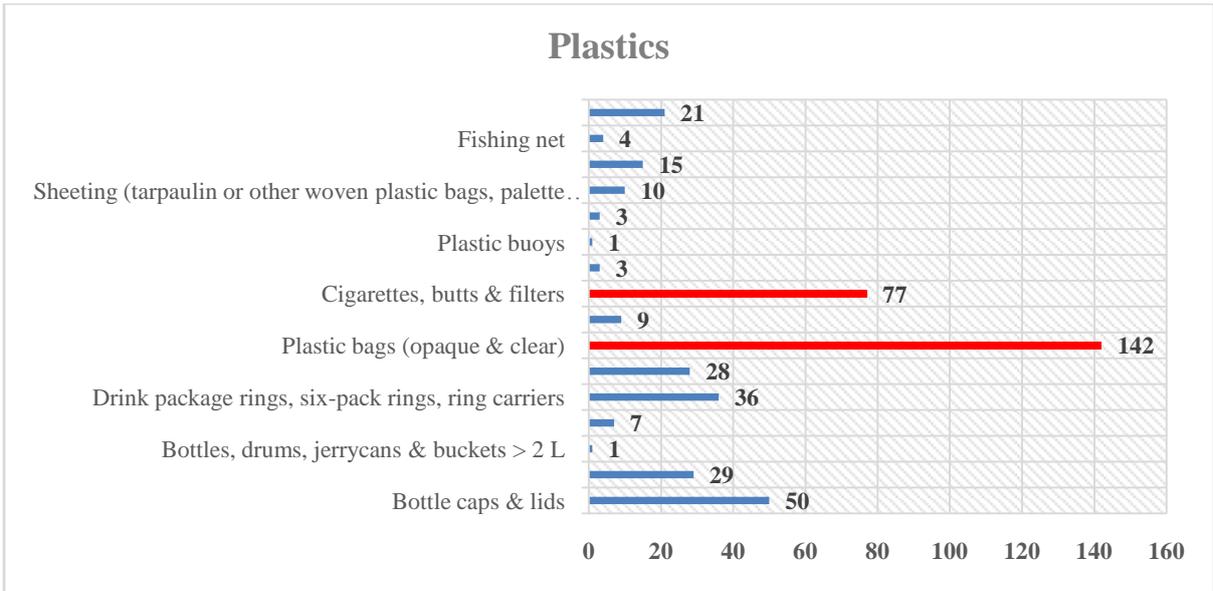
Laboni beach is the most popular and crowded sea beach in Cox's Bazar. A total of 831 items of marine litters was recorded and their categories and sub-categories are shown in Figure 2.4 and Figure 2.5.



**Figure 2.4:** Marine litter observed in Laboni Beach, Cox's Bazar in November 2017.

Plastics were the most prevalent form of marine litters recorded from the beach. Plastics are mostly used material as a carrying bag, food package, carrying footwear, mobile, cloth etc. In fact, plastics seem to be the most common type of marine litter worldwide as similar results were also found in the Caribbean region, USA, Brazil, Israel and sub-Antarctic island beaches (Golik and Gertner, 1992; Moore *et. al.*, 2001; Ivar do Suland Costa, 2007; Oigman-Pszczol and Creed, 2007; Eriksson *et. al.*, 2013).

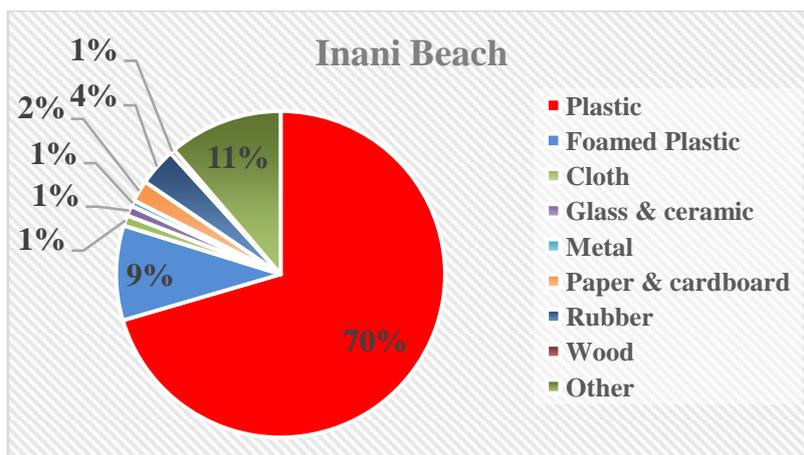
Among the plastic categories, plastic bags (opaque & clear) are dominant followed by the cigarettes, butts & filters. Within the categories of foam, cloth, glass and metal, foam (insulation & packaging) is the most dominating materials (red color) that is used for icebox and preserving fish in the fishing vessel. In the paper, rubber, wood and other categories, paper (including newspapers & magazines) is the most abundant (red color) which might be due to the fact that most of the beach hawkers used various forms of papers (including newspapers & magazines) as their packaging materials.



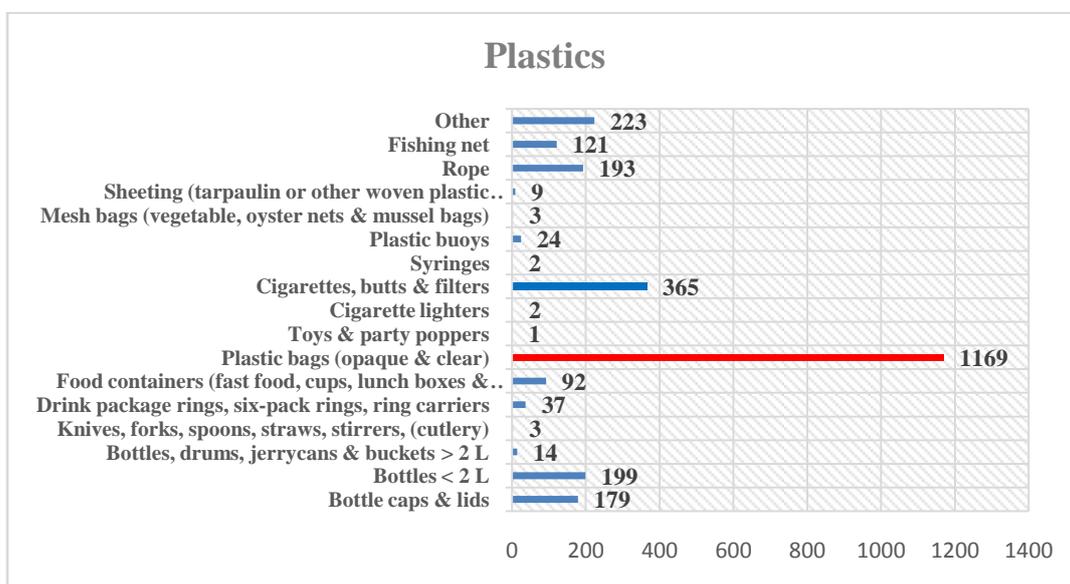
**Figure 2.5:** Types of marine litters found in Laboni Beach, Cox's Bazar in November 2017.

### ***Inani Beach (Cox's Bazar)***

Inani beach is located near Himchari Hill which is little bit far from the Cox's Bazar main city. A total of 3742 items of marine litter was recorded and their categories and sub-categories are shown in Figure 2.6, 2.7 & 2.8.

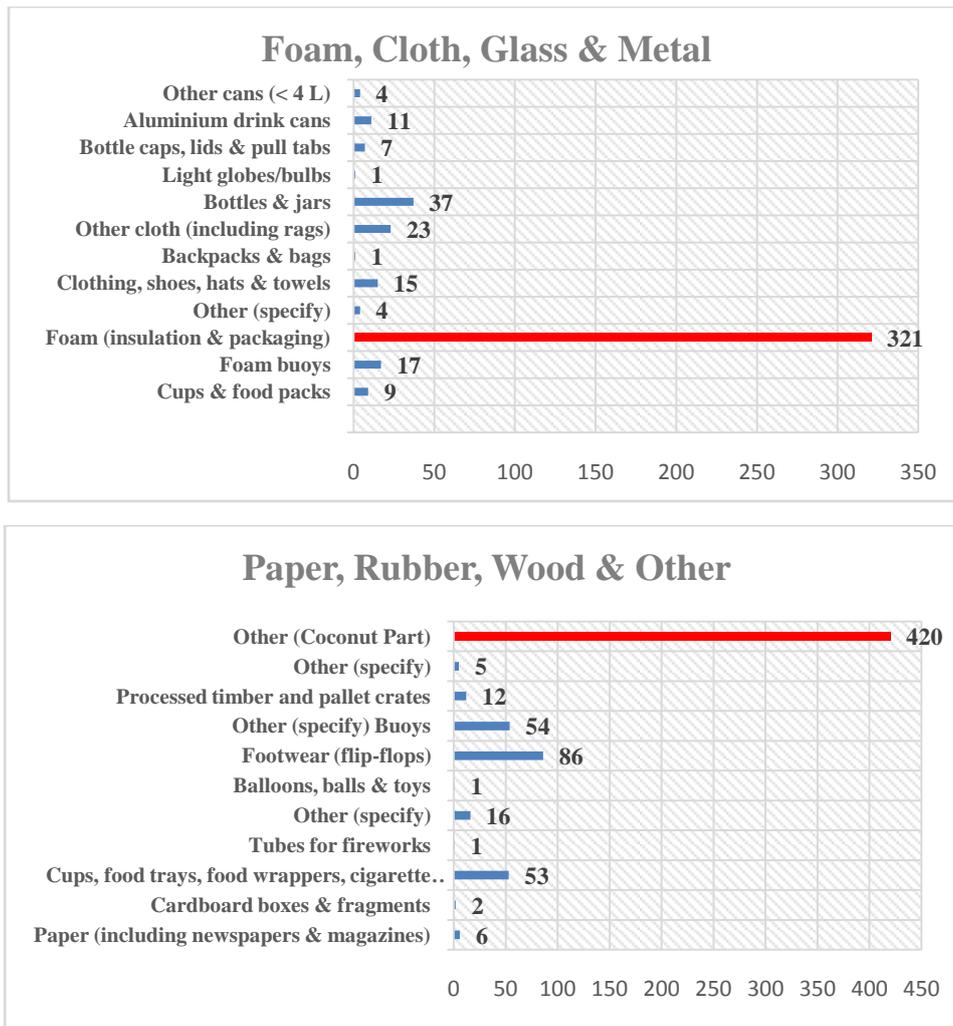


**Figure 2.6:** Marine Litter observed in Inani Beach, Cox's Bazar.



**Figure 2.7:** Quantity of plastic litter in Inani Beach area, Cox's Bazar.

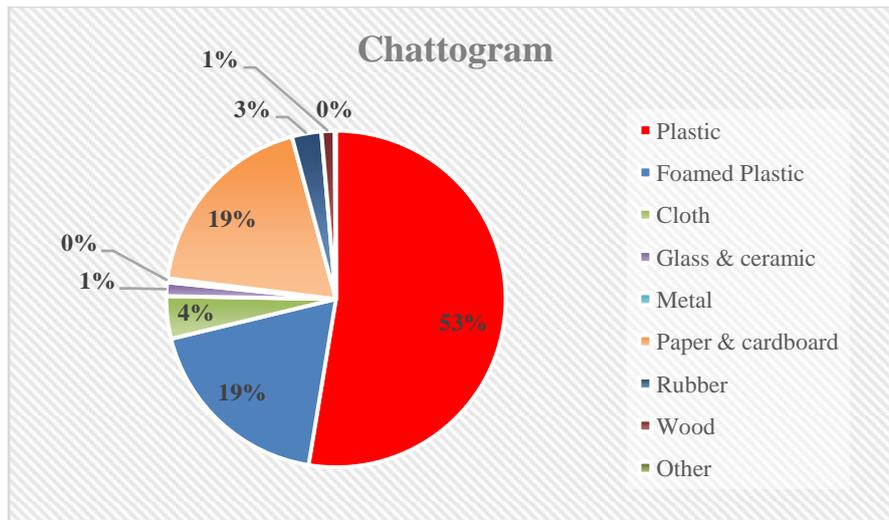
In the Inani Beach, the abundance of plastic bags (opaque & clear) is higher than the other type of plastic materials. In the foam, cloth, glass and metal categories, foam (insulation & packaging) is the most dominating item that is used for icebox and preserving fish in the fishing vessel. In the paper, rubber, wood and other categories, coconut based litter is the most abundant. In the Inani Beach, the coconut is available with its cheaper price and tourists throw coconut waste onto the beach after drinking its water.



**Figure 2.8:** Foam, Cloth, Glass & Metal and Paper, Rubber, Wood & Other types of marine litters found in Inani Beach area, Cox’s Bazar in November 2017.

### Chattogram District

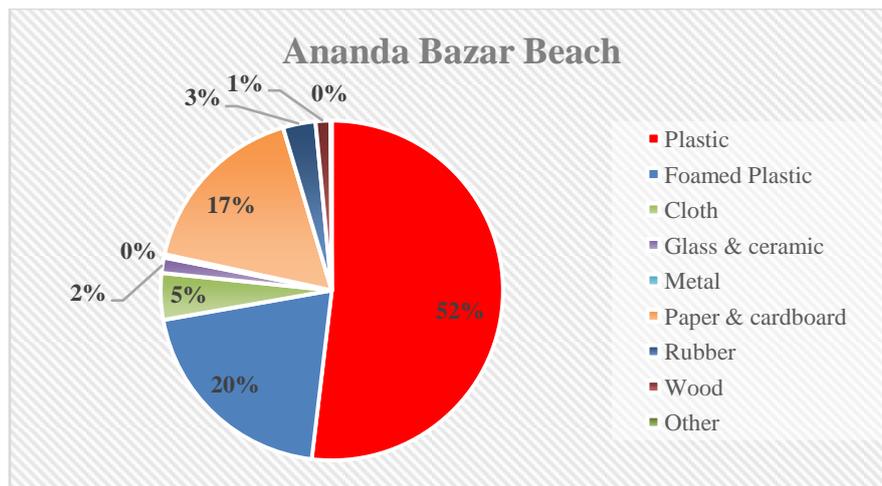
Chattogram is a district located in the south-eastern region of Bangladesh. It is a port city and second largest city in Bangladesh (Wikipedia, 2017). Total amount of marine litter observed in Chattogram district was 2132 items. The categories and their percentages are given in Figure 2.9. Similar results were found from the beaches in Chattogram as from the beaches in Cox’s Bazar where the plastics litters were the most abundant category.



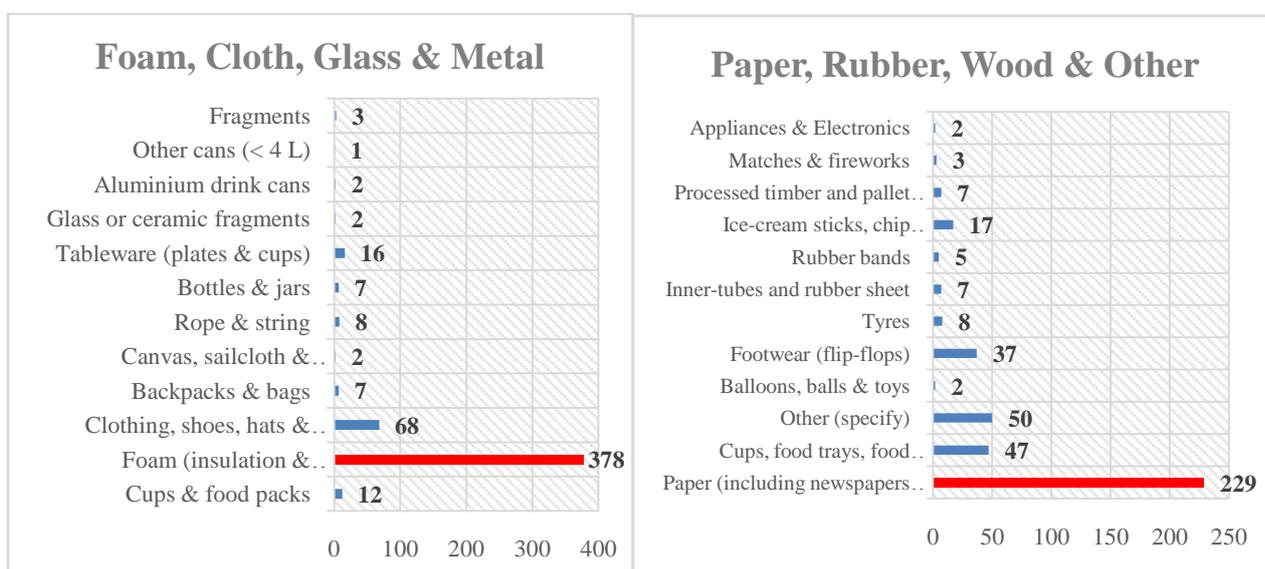
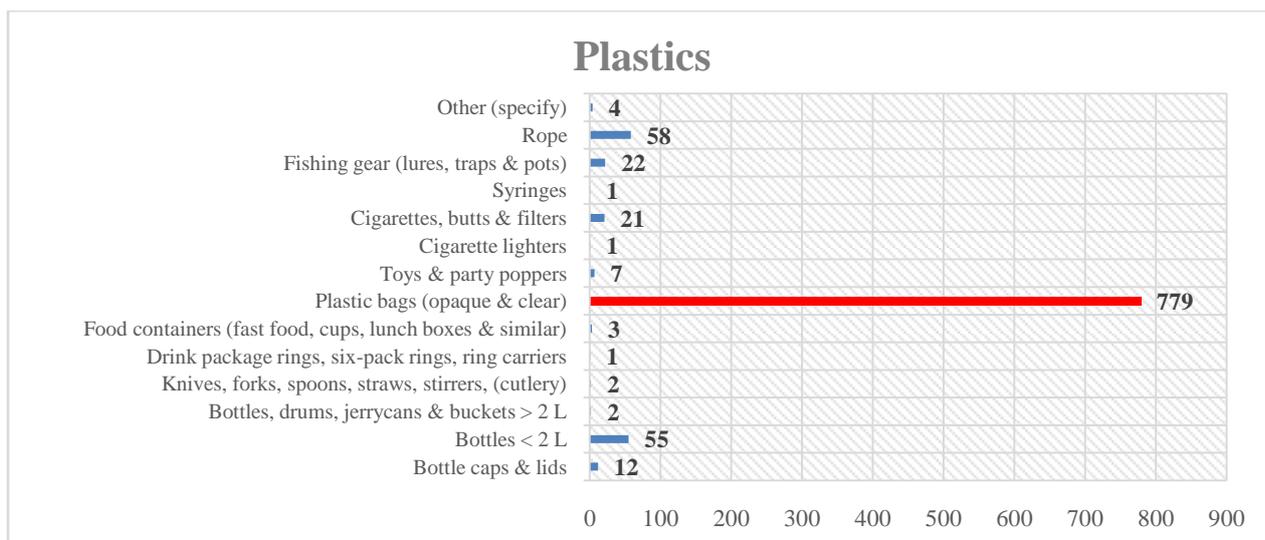
**Figure 2.9:** Marine litters recorded from the two beaches in Chattogram in November 2017.

***Ananda Bazar Beach (Chattogram)***

Ananda Bazar Beach is very beautiful and an attractive to the tourists. It is situated near the municipal waste dumping zone of Chattogram city. A total of 1918 items of marine litters was recorded and their categories and sub-categories are shown in Figure 2.10&2.11. The most abundant marine litter in this beach was plastic materials.



**Figure 2.10:** Marine litters observed in Ananda Bazar Beach, Chattogram.

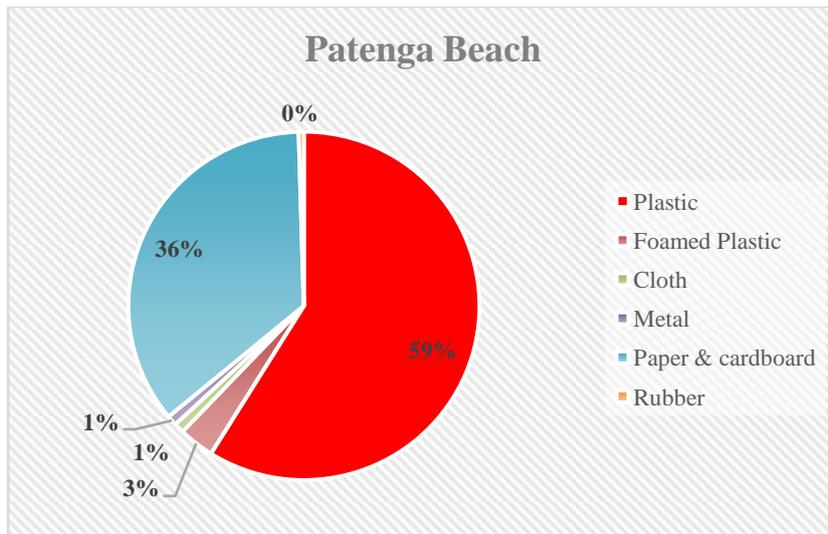


**Figure 2.11:** Quantity of marine litter according to their types in Ananda Bazar Beach, Chattogram District.

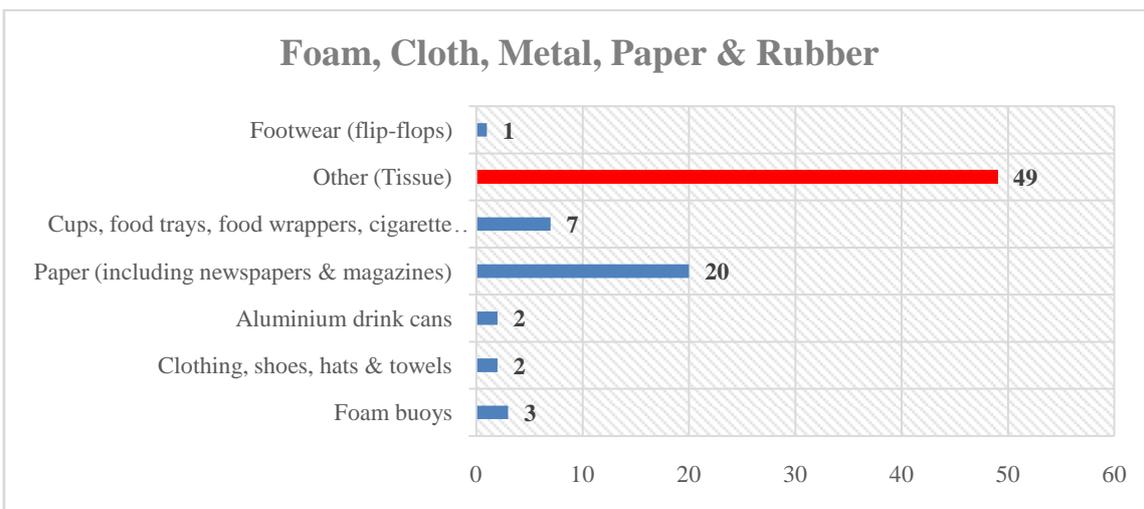
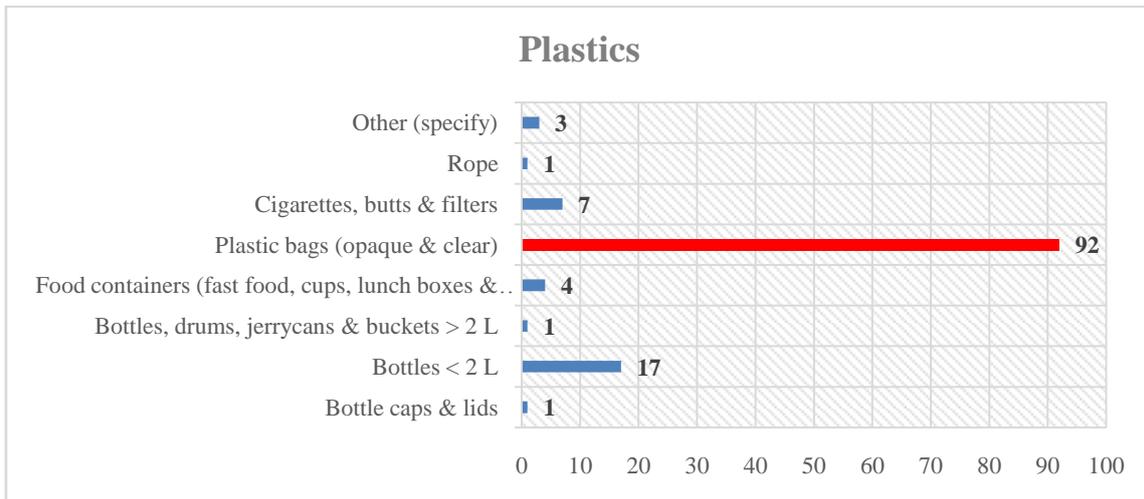
From the above figures, it is evident that the plastic bags (opaque and clear) were the dominant types of litters. However, due to intensive fishing activities, the large amount of foam (insulation and packaging) were found in this site. In the paper, rubber, wood and others categories, paper (including newspapers and magazines) contributed the highest observation.

### ***Patenga Beach (Chattogram)***

Patenga is a popular tourist spot. Patenga is a sea beach located 14 kilometers south of the port city of Chattogram. It is located near the mouth of the Karnaphuli River. A total of 214 items of marine litters was recorded and their category is shown in Figure 2.12 & 2.13.



**Figure 2.12:** Marine litter observed in Patenga Beach, Chattogramin November 2017.

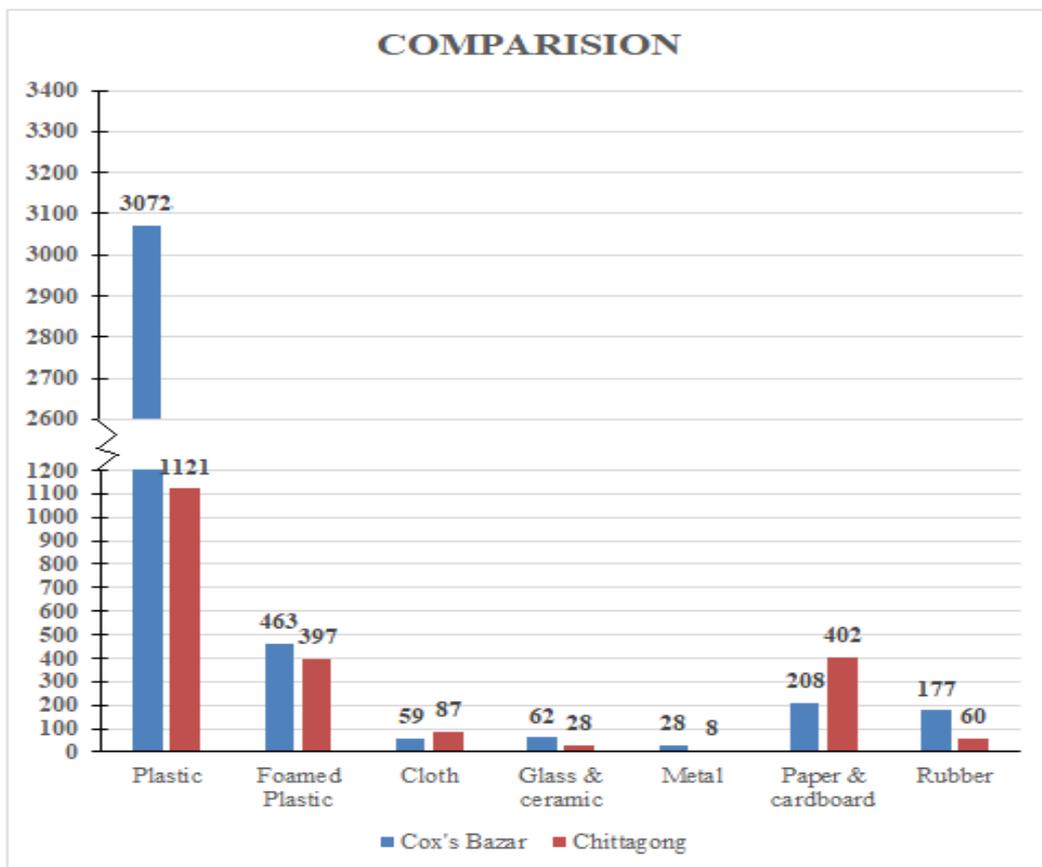


**Figure 2.12:** Types of marinelitter in Patenga Beach, Chattogram.

Plastics are the most abundant litter(59%) followed by the paper and cardboard (36%). Among the plastic category, the larger quantity of plastic bags (opaque and clear)was recorded. Interestingly, higher amount of tissue papers found in this beach was probably due to the influence of heavily crowded tourists in the beach.

### Comparison between the two districts

Figure 2.13 represent a rough comparison between marine litters recorded from the four beaches in the two coastal districts (Cox’s Bazar and Chattogram).Almost similar composition of marine litters was found from both the areas.



**Figure 2.13:** Comparison between marine litters recorded fromCox’s Bazar and Chattogram in November 2017.

In Figure 2.13, the total quantity of cloth, glass and ceramic, metal, rubber and wood almost same. The amount of plasticswas comparatively higher in Cox’s Bazar. On the other hand, the amount of paper and card boardwasslightly higher in Chattogram.

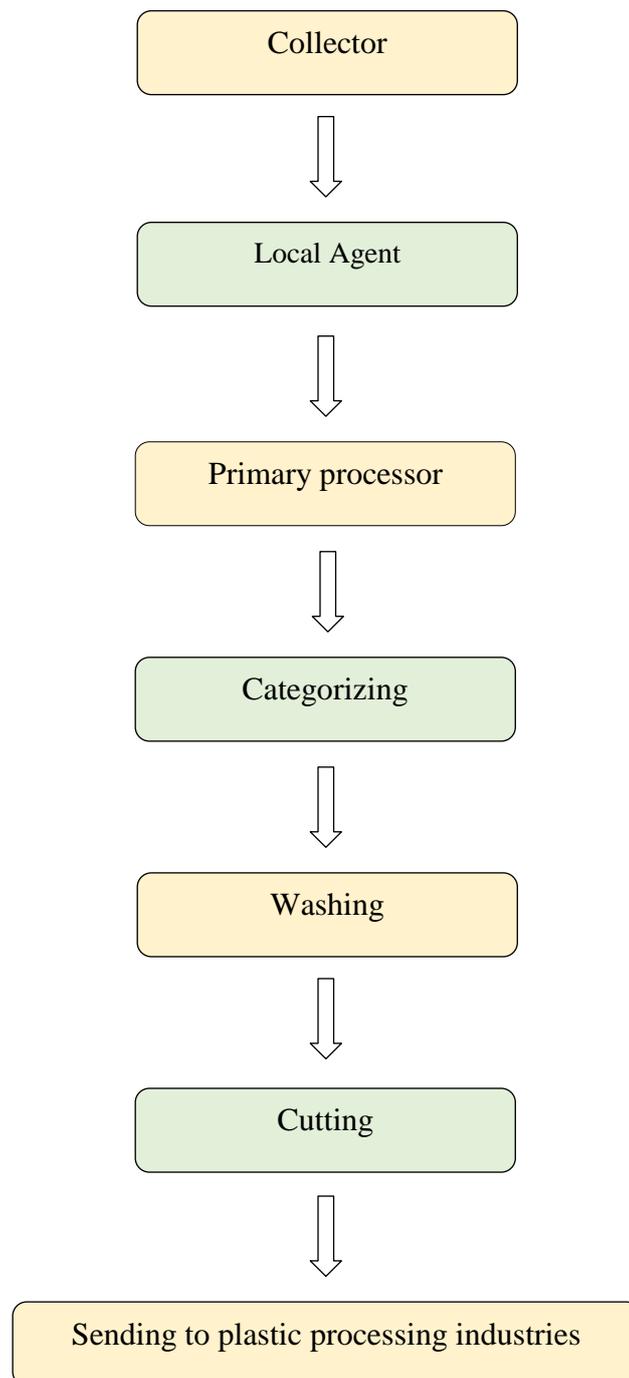
### **Fate of marine litter in the surveyed beaches**

Due to the tourist friendly environment and favorable weather, these beaches are very attractive to the tourists from inland and abroad. The economy of these districts are largely depending on the tourism sector. So, the government authorities are now getting aware of the environmental conditions of the beaches, because a dirty beach could discourage the tourist to visit the places. They have taken some steps to make the beach clean and healthy for the tourist. Due to the financial constraints, massive and continuous cleaning of the beaches is sometimes difficult for the concerned authorities. Some local add media have shown their interests and made some arrangements for beach cleaning. The telecommunication companies like Robi, Banglalink and others like Berger Paints also took parts in activities for beach cleaning. Thirty women clean the Cox's Bazar beach (Laboni Point to Kolatoli Point) twice a day (at 8.00 am and 3.00 pm). They collect the debris in a bin and finally burn the burnable waste or buried in the nearest tamarisk forest. There are debris bins at many places in the beach and some billboards indicating to use these bins to make aware the tourists to keep clean the beach.

The tourist police also try to help the tourism authority to keep clean the beaches. The authority expect more support from the government to make the beach clean. The Department of Environment (DoE) have taken some initiatives for cleaning the sea beaches, e.g. they celebrated the world beach cleaning day in Cox's Bazar this year. Some non-government organizations (NGOs) sometimes arranged awareness campaigns in the beaches to make the tourists and the local people be aware of the clean beaches

As plastic is a recyclable element, some peoples collect the plastic bottle and metallic can form the beaches. The children of 10-15 years of ages are usually found to collect the plastic materials from the beaches. Generally, they sell these at a very cheap rate to the local agent or they deliver the product to the primary processor. In Cox's Bazar two industries are found who collect the plastic bottle and metallic can for recycling. They collect and separate the plastic material on the basis of the color. The plastic bottles are then washed with detergent. The final step for the local industry is to make it in small pieces and ready for sale. They supply these processed plastic material to the plastic processing industries. These industries finally recycle the plastic materials and make the recycled products to be used and sold in the markets.

*Flowchart for the fate of Plastic Bottle*



#### **2.4. Sources (Through rivers and canals, dumping by ships and boats, surface drainage and other sources such as tourists, by wind etc.)**

Marine debris researchers traditionally classify debris sources into two categories: land- or sea-based, depending on where the debris enters the water. Ocean current patterns, climate, tides, and proximity to urban centers, industrial and recreational areas, shipping lanes, and commercial fishing grounds influence the type and amount of debris that is found on the open ocean or collected along beaches and waterways or under water.

Land-based debris starts on streets, parks, parking lots, and other surfaces. The debris then is washed, blown or discharged into nearby waterways (e.g. rivers and canals). Sources include inappropriate or illegal dumping of domestic and industrial garbage; public littering; poorly covered dumpsters and dump trucks; manufacturing sites, processors, and transporters; sewage treatment and combined sewer overflows; beachgoers; fishermen; shore-based solid waste disposal and processing facilities. Both legal and illegal waste handling practices contribute to marine debris. These include the inadvertent release of debris from landfills and garbage from water transports. Littering packaging from convenience items, food wrappings, beverage containers, and a host of other materials creates the foundation for the marine debris problem. Approximately 4.8 to 12.7 million tons of land-based plastic waste ends up in the ocean every year of which about 1.15 to 2.41 million tons of plastic waste currently enters the ocean from rivers.

Marine debris is also generated by people's actions and activities at sea. Sea-based debris can come from commercial fishing vessels; merchant, military, and research vessels; recreational boats and cruise ships; and offshore petroleum platforms and associated supply vessels. Some debris enters the water from accidental loss or system failure, while other debris comes from poor waste management practices, and illegal disposal. Commercial and recreational fishermen create marine debris when they discard ship-generated trash overboard or fail to retrieve nets, ropes, trawl floats and other fishing related gear.

Of all the debris items found on the Bangladeshi coast, 90% was land-based. Sea-originated debris was 10%. The overall dominance of land-based items is consistent with the land-based origin of the top debris items found on the beaches.

### **3. Circulation of Marine Litter**

#### **3.1 Marine Litter Circulation**

Marine litter circulation means the distribution, transportation and accumulation of marine litter in the ocean, specific region or all over the world. The distribution of plastic marine litter is patchy, and it is often very difficult to trace the circulation pattern that is how litter back to its source. Correlation between human population density and the amount of beached litter is usually high, and likewise in active fishing areas fishing related litter accounts for a large fraction of litter found the seafloor. Similarly, also marine litter particularly plastic materials have been found to be more abundant in the shoreline in densely populated areas. This is not, however, always the case since the litter distribution and accumulation can also be affected by prevailing winds, hydrodynamics and geomorphology. Closed and/or partially closed seas, such as the Bay of Bengal, might have high densities of marine litter partly due to densely populated coastline, but also because of limited water exchange.

Buoyant plastic litter can be transported considerable distances via winds and sea currents. The circulation patterns on the surface waters transport marine litter even to the remotest places of the globe including polar areas and isolated islands. The converging surface currents also trap and retain buoyant marine litter in the five subtropical gyres, which are located in the northern and southern Atlantic Ocean, northern and southern Pacific Ocean and in the Indian Ocean. Plastics can also be transported between these oceanic gyres; a travel time between southern and northern Atlantic gyres is only couple of years.

In addition to surface currents, the oceans exhibit also deep water circulation patterns that redistribute cooled water towards the seafloor. Deep water circulation works in connection with surface circulation: when surface waters enter polar regions, they start to cool down and sink. It has been suggested, that sinking water could transport marine litter to the underlying water column and ocean floors, but more research is needed to confirm this.

Even though large-scale trends in marine litter accumulation have been detected, the role of ocean dynamics and wind patterns on litter distribution on a smaller scale are not yet fully understood due to their complexity. Tides, winds, local currents, storm events and river outflows all transport and redistribute litter on a local scale. For example rivers with high flow rate may transport litter far from the shore, whereas in small, slowly running rivers and estuaries litter may more easily accumulate on the riverbanks or next to salinity fronts.

From the surface waters winds can mix floating items into the underlying water column, where they can continue sinking. When entering seafloor, bottom currents and topography may further influence where litter is distributed. It has been observed that microplastics tend to accumulate where the currents are weakest. The geometry of the site may have an effect on accumulation: high concentrations of microplastics have been found from harbour areas that are partially enclosed and have a low flushing rate.

Despite of the properties of plastic litter and physical forces affecting their distribution in the marine environment, also biological factors can have their effect on the circulation of marine litters between different compartments. For example seabirds that catch litter from the sea surface may transport these items to the shore. The sinking phytoplankton aggregates are able to trap microplastics and increase their sinking rate. Sinking phytoplankton might thus affect the vertical distribution of microplastics in the water column transferring them quicker towards the benthos. When on the seafloor, the distribution of microplastics can further be affected by benthic animals. The benthic invertebrates are able to transfer microplastics from the sediment surface deeper into the sediment when they move around on the seafloor. This mixing of sediments, termed bioturbation, is an important process affecting the vertical distribution of particles and solutes in soft bottom environments and can thus have an influence also on the distribution of microplastics.

### **3.2 Land Based Sectors Generation (Micro and Macro)**

Land-based beach debris were items which originated in Bangladesh: I. Debris from tourists/vacationers - items which appeared to be left on the beach (such as piles of cutlery and food containers, intact cigarette filters and cardboard boxes), items which are usually related to beach activities (toys, plastic and metal-fabric chairs, tent and parasol parts, sunscreen and bathing clothes), shore fishing related (thin monofilament line, bait boxes - cardboard and foam - and related packages, tuna cans); II. Debris from inland-construction materials, pots, sanitary-related items, items which arrived from streams after floods;

Items with labels indicating “Made in Bangladesh”, which are very easy to distinguish. Although there is a possibility of items arriving from sailing activities, it is much lower compared to shore activities. However, if we found items that appeared to arrive from the sea, they were counted as sea originated, even when they had labels indication made in other countries.

### **3.3 Sea-Based Sectors Generation (Micro and Macro)**

Sea-based or sea-originated debris were items that drifted on the coast from the sea, including: I. Debris from fishing and boating activities (fishing gear, foam plastic (insulation), rope, fishing nets, traps and buoys; tied bottles and cans); shipping (oil drum or container), light bulbs and fluorescent light tubes; items with fouling that were not in the other groups; II. Debris from other countries according to barcode, telephone number or “Made in...”.

### **3.4. National, Sub-national and Local Institutions Responsible for Solid Waste Management**

1. Local Government Division
2. Ministry of Environment, Forest and Climate Change
3. Ministry of Water Resources
4. Ministry of Industry
5. Ministry of Energy and Mineral Resources
6. Bangladesh Inland Water Transportation Authority (BIWTA)
7. Coastal Area Resource Development & Management Association (CARDMA)
8. Department of Environment
9. Ministry of Shipping
10. Ministry of Industry
11. Ministry of Fisheries and Livestock
12. Water Resources Planning Organization (WARPO)
13. City Corporations (Dhaka, Chattogram, Khulna)
14. Waste Concern

## **4. Impact of Marine Litter at National Level**

Marine litter has a significant environmental impact in spoiling marine ecosystem services, and it can consequently damage all the industries based on the use of marine resources. It also has an important social and economic impact by reducing the aesthetic value of the environment and public use, subsequently creating a reduction in the value of the land, tourism, and the local economy.

### **4.1. Social**

The social impacts of marine debris are a difficult problem to quantify, because many pollution problems and biological and environmental effects have taken a long time to

identify and quantify, partly because of the diverse sources (lack of awareness, inadequate waste management, etc.), and because data on volume/mass, occurrence and distribution are seldom recorded. However, social impacts of marine litter should not be underestimated. These include for example: i) Reduction of recreational activities and tourism; ii) Loss of fishing opportunities; iii) Blockage of turbines. Social impacts of marine litter include reduced recreational opportunities and loss of aesthetical value. For instance, polluted beaches are unattractive for tourists, often resulting in lost revenues for the tourism industry and for people who generate their income through tourism-related activities. In the APEC region, marine debris is estimated to cost the tourism sector USD 622 million per year. Public authorities or private companies are often faced with considerable clean-up costs. Another indirect impact consists in the loss of fishing opportunities and thus presents important impacts on livelihoods: due to the time spent cleaning nets, propellers and blocked water intakes from entangled plastic bags and other debris, catch rates of Bangladeshi subsistence fishermen have reduced and led to lost revenues. In Scotland, these costs have been calculated to add up to USD 17 million per year.

Litter at the sea may cause serious damage to water vessels and adversely affect fishing catch and fishing gear (Mouat et al., 2010). Discarded fishing line, rope and plastic trash or food bags can damage boats and ships by wrapping around boat propellers or being sucked into outboard boat engines. Visitors to a beach can be harmed from broken glass, medical waste, fishing line, and discarded syringes; swimmers, divers and snorkelers can become entangled in submerged or floating debris. Medical and personal hygiene debris (including condoms and tampon applicators) that enters waterways through direct sewage outflow or inadequate sewage treatment systems also presents serious water quality concerns that affect human health and safety. The presence of these items indicates that bacterial contamination, including *E. coli*, other harmful bacteria, and viruses, may be found in these waters. Consumption or contact with water polluted with these contaminants and pathogens can result in infectious hepatitis, diarrhea, bacillary dysentery, skin rashes, and even typhoid and cholera.

## **4.2. Economic**

Debris makes shorelines unattractive and potentially hazardous, and forces communities and governments to spend funds for beach maintenance. Many coastal communities rely on the income generated by seaside businesses, so the indirect costs of a littered beach can be great. Marine debris discourages people from fishing, boating, swimming, and visiting coastal

areas. In Bangladesh, Cox's Bazar, Chattogram, Saints Martins, Sundarban, NijhumDwip (Island) etc are the main tourist spots. People of this area largely depend on tourism activities. However, occurrences of marine litter along the beautiful beaches and waterways destroy the beauty and enjoyment of those areas, and hence, negatively affect tourism and the economic benefits. To improve the tourism sectors, the beach cleaning activities are needed and maintaining the beauty of beaches are money and time consuming. Economic sectors are hampered by marine pollution particularly marine littering. Again, marine litter affect the ecosystem and biodiversity that hampers the fisheries and aquaculture sectors in the economy. It causes economic loss in fisheries and aquaculture operations due to damage or entanglements and cost to vessel operators (downtime and damage due to entanglements). Derelict fishing gear has been found to be lethal to ocean life for years after fishermen no longer use it. In a process called ghost fishing, an abandoned fishing net will continue to catch and kill ocean life [4]. There is increasing recognition of the worldwide ghost fishing problem and the impact it is having on the viability of already stressed fisheries which can also lead to economic losses for fisheries.

### **4.3. Ecological/Environmental**

Generally, marine litter has a great impact on the environment and marine ecosystem. The impact on the environment, has the impacts on economic and others. Wildlife entangles with marine litter such as rope, net, poly bag, sac etc. and ingestion of micro-marine litter as a food is directly damaging wildlife and the environment in which they live. Marine litter damage habitat of marine wildlife and fish species by destruction including smothering of the seabed, entangled litter on coral reefs and deposition on seagrass beds. Many species loss due to habitat destruction by marine litter and consequently it affects the ecosystem and biodiversity. Many species have migrated to another environment and some alien species may use the transport mechanism of marine debris in the ocean to migrate into new areas and disturb the ecosystem. Marine flora and fauna face problem due to marine debris and the number of depending species loss due to lack of food supply. Marine debris also causes diseases and illness to the wildlife. Sometimes, marine species ingest marine litter thought as food and it causes intestinal blockage, malnutrition and poisoning. Another important impact is ghost fishing, it a fishing without any human activities. The part of fishing gear such as net and other, float or sink in the sea as a marine litter and later many species entangle by it and died. It causes the loss of species reduction and as well biodiversity.

While research has been done on the harm marine debris can cause to humans, wildlife, habitat and vessels, there are many environmental impacts that are less well understood. These include: i) Source and fate of microscopic fragments/plastic fibers, ii) Accumulation and dispersion of toxic substances found in or on plastic, iii) Disturbance from mechanical beach cleaning has been shown to interfere with sea turtle nesting, iv) What other impacts does beach cleaning have? v) Impact of marine debris on the species at the base of the food chain, vi) Bio-transfer of pollutants.

## **5. Management Agencies, Policies, Strategies and Activities Taken to Minimize the Marine Litter**

### **5.1. Management Agencies and Their Responsibilities**

As Bangladesh has no marine policy, so that no specific department/organization is dedicated for controlling marine pollution. In Bangladesh, the waste management is governed by the environmental sector vested with the MoEFCC. However, many other institutions, directly and indirectly, are involved in managing or shaping the environment sector. These embrace public sector, private sector and civil society institutions. Major institutions/agencies involved in the environmental waste management are the Department of Environment, Department of Forest, Department of Fisheries, Ministry of Agriculture, Ministry of Fisheries and Livestock, Ministry of Water Resources, Ministry of Shipping, Ministry of Energy, Ministry of Health and Family Welfare, Ministry of Education, Ministry of Housing and Public Works, Bangladesh Coast Guard, Bangladesh National Tourism Organization (NTO) etc.

At the higher level, National Environment Council (NEC) headed by the Prime Minister and Executive Committee of National Environment Council (ECNEC) headed by the Minister for Ministry of Environment and Forest provide guidance to the sectoral Ministries/Agencies on matters of national environmental management. At the Divisional level, Divisional Environment Committee chaired by the Commissioner with representation from all other government (local) are supposed to deal with environmental issues at the local level. However, these institutional arrangements are yet to be fully functional.

The MoEFCC bears the responsibility for working with other ministries to ensure that environmental concerns are given due recognition in their development program. The Ministry has an active role to play in policy advice and coordination of the implementation of

action plans across all sectors. MoEFCC is also responsible for reviewing and monitoring the impact of development initiatives on the environment across all sectors.

Each of the Ministries has their own policy and program frameworks which provide a basis for addressing fundamental issues of environmental management and protection in Bangladesh. Institutional capacity of all the concerned ministries for implementing the various action measures identified still remains weak. It was acknowledged in the GoB document that neither the fledgling MoEFCC nor its Department of Environment has developed the institutional capacity to substantially tackle problems of environmental management and protection.

The Department of Environment (DoE), as the technical arm of the Ministry, is responsible for environmental planning, management, monitoring and enforcement. The mandate of the Department includes: assessment and monitoring of tasks such as on-site surveillance of environmental improvement components of development projects; promoting environmental awareness through public information program; and controlling and monitoring industrial pollution; environmental impact assessment, and in formulating guidelines for line agencies involved in activities affecting air quality, soil and water conservation, afforestation, wildlife, critical habitats, fisheries and other natural resources issues. Although, the DoE is directly responsible for coastal and marine pollution control, marine litter has not been identified as a separate entity for exclusive monitoring and management in the National Plan of Action for Environmental Protection. However, aiming to control and minimize the marine pollution the DoE has-

- A. Established or improved upon, as necessary, regulatory and monitoring programs to control emissions, including recycling technologies.
- B. Promoted risk and environmental impact assessments to help ensure an acceptable level of environmental quality.
- C. Promoted assessment and cooperation at the regional level, where appropriate, with respect to the input of point source pollutants from the marine environment.
- D. Taken steps to eliminate emissions or discharges of organo-halogen compounds from the marine environment.
- E. Taken steps to eliminate/reduce emissions or discharges or other synthetic organic compounds from the marine environment.
- F. Promoted controls over anthropogenic inputs of nitrogen and phosphorous that enter coastal waters where such problems as eutrophication threaten the marine environment or its resources.
- G. Taken steps to develop and implement environmentally sound land-use techniques and practices to reduce run-off to water courses and estuaries which would cause pollution or degradation of the marine environment.
- H. Promoted the use of environmentally less harmful pesticides and fertilizers

and alternative methods for pest control, and considered the prohibition of those found to be environmentally unsound. I. Adopted new initiatives at national, sub-regional and regional levels for controlling the input of non-point source pollutants which require broad changes in sewage and waste management, agricultural practices, mining, construction and transportation. J. Taken steps to control and prevent coastal erosion and siltation due to anthropogenic factors related to, inter alia, land-use and construction techniques and practices.

Additionally, Coastal Area Resource Development & Management Association (CARDMA) has a mission on protecting natural and human resources of the coastal area of Bangladesh: education and awareness creation of people and policymakers towards the importance of conservation and sustainable development, strengthening strategy, planning and legal framework for environmental protection and Ecosystem and natural resource management.

Furthermore, management of solid waste which is the prime source of marine litter, is the responsibility of Local Government Division (LGD) under which City Corporations and municipalities are working. A number of cities and towns in the Coastal region of Bangladesh may have solid wastemanagement service through municipal or City Corporation (e.g. Dhaka, Chattogram, Khulna).

The City Corporations and Municipalities are making efforts to incorporate the concepts and guidance of the 3R (Reduce, Reuse, Recycle) strategy in their solid waste management activities. City Corporations and municipalities are responsible for removal, collection and garbage management. The corporation is taking appropriate measures to collect and remove the waste from all the public roads, general latrines, beauties, sewage, buildings and places under its control. Under the general control and supervision of the corporation, all the buildings and occupiers of the premises in the corporation area are responsible for the removal of garbage from it.

## **5.2. Management Policies and Strategies and Their Effectiveness**

Bangladesh has been able to create an enabling policy regime for better management of its environment and natural resources. The policies have adopted in principle the concept of sustainable development and it has also recognized the importance of economic development that goes hand in hand with the control of environmental pollution and maintaining ecological balance. The formulated Environment Policy although fairly rich in content is not supported by necessary actions of implementation. As Bangladesh does not have

National Marine Litter policy, it is the right time to have the same. However, to control the environmental pollution created by solid waste disposal, ship-breaking and lube oil discharge at sea, different policies and strategies indirectly related to marine litter are adopted by different organizations/department. The related Policies, Acts, Rules and Strategies are as follows:

1. National Environment Policy 2018

It states that one have to take necessary steps for the protection of marine and coastal environment from land based activities.

2. National Shipping Policy 2000

Marine pollution Ordinance has been passed in the parliament which is mainly effective to prevent pollution of coastal and seaports. But no organisation has been set up for implementation of rules and regulation regarding this. In order to full up this vacuum Department of Shipping will be authorised to prepare rule to prevent environment pollution by inland marine vessel in the inland river way, outlet of the river and in coastal water boundary. Pollution from marine vessel (control of contaminating materials, garbage management and disaster management), pollution from facilities of marine vessel (control of contamination materials and garbage management), and work relating to marine vessel (dredging, ship maintenance and repair and dismantling of ships).

3. Bangladesh Environment Conservation Act 1995 (Lastly Amended 2010)

4. Hazardous Material and Ship breaking waste management rules 2011

5. Territorial Water and Maritime Zones Act 1974 (Draft Maritime Zones Act 2018 proposed)

6. Coast Guard Act 2016

It states that identifying environment polluting activities and take necessary steps to prevent environmental pollution.

7. Environment Court Act 2010

8. National River Protection Commission Act 2013

9. Territorial Waters and Maritime Zones Rules 1977

10. Environment Conservation Rules 1997

11. National 3-R Strategy for Waste Management, 2010

However, the implementation of the Environmental policy and the Environmental Protection Act have been bogged down due to some institutional and functional limitations.

- Various operational rules for effective implementation of the Policy and Act would require complementary and detailed operational rules, many of which have not yet been formulated. Furthermore, floods and cyclones are major concerns for environmental management in Bangladesh but the Environmental Protection Act still have limited concern and intervention for such disasters.
- Implementation of the Policy and Act demands a significant amount of funding and investment, which is hardly placed in the revenue and or development budget of Bangladesh.
- The DoE, the principal implementing agency severely lacks human and physical resources to respond to the demanding tasks and responsibilities of both the Policy and the Act.
- Lack of Inter-agency coordination is one of the major causes of poor and inefficient use of the existing policy outline and rules on environmental protection and management. Neither the policy nor the law presents clear operational guidelines for such inter-agency coordination and synchronization of approaches.
- Empirical studies also noted that involvement of the effective engagement and participation of the community in various environment management and operational interventions have narrowed down the functional effectiveness of the policy and the Act.
- Some of the other constraints in terms of institutional, legal, policy framework for an effective implementation of environmental policy are, for example, inconsistency with other policies, lack of inter-sectoral coordination, lack of regulatory and institutional capacity, limitations of the environment laws, outdated environmental laws as well as ignorance about these laws, non-punitive approach of laws, politician-polluter nexus, etc.

In addition, major international conventions/ protocols related to environmental protection and conservation signed and ratified by Bangladesh are as follows:

- (1) International Convention for the Prevention of Pollution of the Sea by Oil, 1981.
- (2) Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989.
- (3) Plant Protection Agreement for the South East Asia and Pacific Region, 1974.
- (4) Treaty banning nuclear weapon tests in the atmosphere, in outer space and under water, 1985.
- (5) Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973.

- (6) Vienna Convention for the Protection of the Ozone Layer, 1985.
- (7) Montreal Protocol on Substances that Deplete the Ozone Layer, 1987.
- (8) The London Amendment to the Montreal Protocol, 1990.
- (9) Convention on Wetlands of International Importance Specially Waterfowl Habitats (the Ramsar Convention).
- (10) International Framework Convention on Climate Change, 1992.
- (11) Convention on Biological Diversity, 1992.
- (12) Convention to Combat Desertification.

### 5.3. Management Activities Done for Land Base, Beach Base and Marine Base Litter

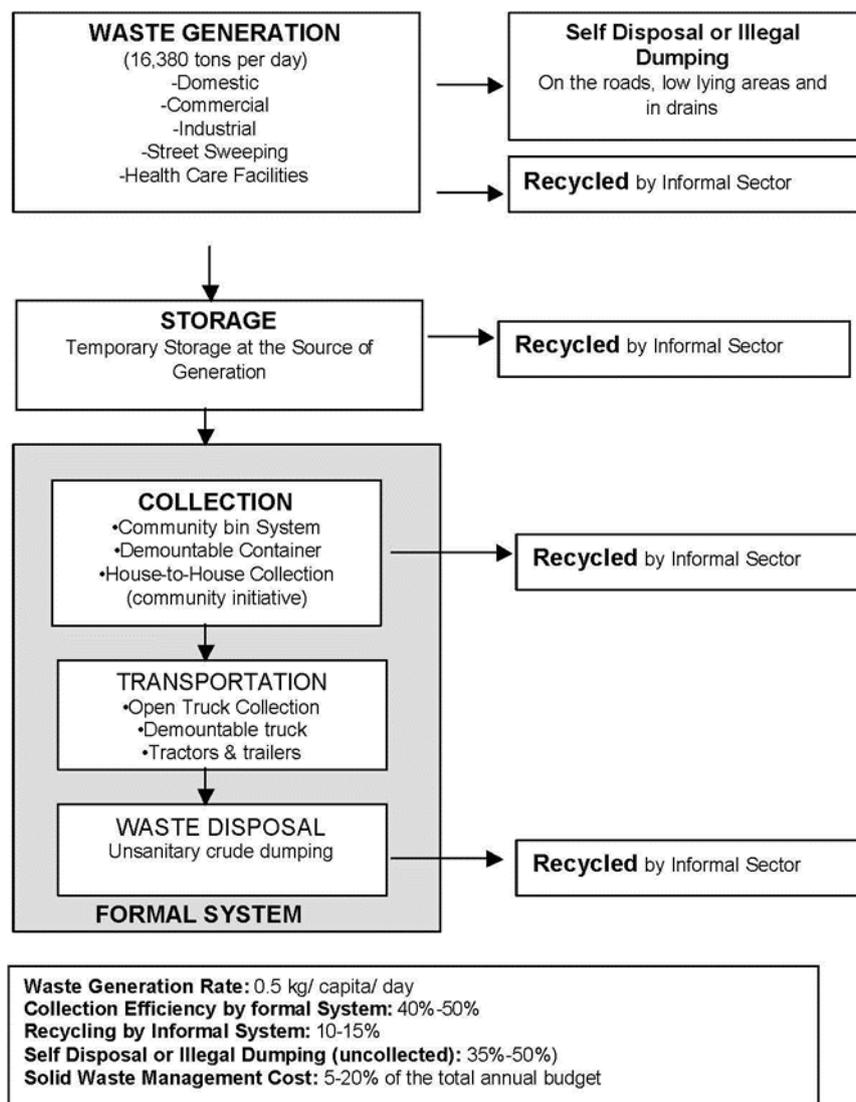


Figure 5.1. Solid waste management process in Bangladesh (DoE, 2004).

Although Bangladesh does not have specific marine litter management activities, there are several activities related to the land-based waste management in the country. However, the waste management system in Bangladesh is not well organized. Figure 5.1 illustrates the existing waste management process in Bangladesh. There are three systems of waste management in Bangladesh (DoE, 2004).

Table 5.1. Technology/ method used to manage urban solid waste (DOE, 2004).

Activity	Status in Bangladesh
Source Reduction	Limited official initiatives from the government; Reuse and recycling is done informally by informal sectors; Segregation of recyclable waste with economic value (such as newspaper, bottles, cans, glass, plastic, metal, rubber and different container; Soiled recyclables materials from the source of waste, dustbins and dumpsites are retrieved by waste pickers for their survival.
Collection	No provision storage exists at or near the point of sour; Waste is collected in the following ways: Community bin System (brick, concrete or corrugated iron sheets), Demountable containers, House-to-House Collection, Designated Open Spaces.
Transportation	Conventional open trucks, demountable containers and tractors and trailers for the collection of waste; No provision of transfer stations to transfer waste from the smaller collection vehicle to larger transport; Multiple handling of waste exists. Waste mixed with contaminated substances; Transportation does not synchronize with the capacity of collection points.
Recycling	Most recycling is done through the informal sector and waste picking. Presently local government bodies are replicating Waste Concern's model of community based composting in a number of cities; Recently using Clean Development Mechanism (CDM) under the Kyoto Protocol Waste Concern along with WWR (a Dutch company) took an initiative for a 700 tons/ day capacity composting plant and land fill gas recovery project at the Matuail landfill site of Dhaka city.
Incineration	Not common or successful because of high capital and operation costs, high moisture content and low calorific value of waste makes waste not viable for incineration; At present few incinerators are used to manage health care related waste in a number of town and cities.
Land filling	Usually open crude dumping is adopted. This system is most unhygienic and inefficient; Hospital waste, toxic waste and untreated industrial waste are also disposed of at the municipal landfill.
Costs	5-20% of annual municipal budget is used for Solid Waste Management

One is the 'Formal System', where municipalities/city corporations are responsible for Solid Waste Management (SWM). 'Formal system' is based on the conventional system of collection-transportation- disposal of waste carried out by the local authorities. In this system

the concept of recycling is absent. Next is the ‘Community Initiative’ that is based on primary solid waste collection by CBOs and NGOs, Finally, ‘Informal System’ represented by the large informal labor force involved in the solid waste recycling trade chain. Partnership between these three systems is needed to promote effective solid waste management system in the country. Table 5.1 explains the technology and methods used to manage municipal solid waste.

There are several activities done for land-based waste management in Bangladesh. However, there are no certain beach base and marine base litter management activities done. Bangladesh is implementing its National 3R Strategy for the solid waste management.

There have been dedicated pilot initiatives in line with 3R Strategy through different programs and projects being implemented by various Ministries/Divisions/Agencies. Major initiatives are as follows:

- I. Programmatic CDM Using Organic Wastes of Urban Centres (City Corporations/ Municipalities/Districts) throughout Bangladesh: Key objectives- 1. Reduction of Green House Gas (GHG) from the municipal organic waste by converting waste to compost fertilizer; 2. Introduction of 3R (Reduce, Reuse and Recycle) concept; 3. Awareness building among the city dwellers about 3R concept; 4. Providing additional financial assistance for waste management through selling CER in the international CDM Market;
- II. Implementation of 3R Pilot Initiative in Dhaka and Chattogram Cities: Key objectives- 1. To promote 3R initiative throughout Bangladesh; 2. To raise public awareness about the benefit of waste segregation at source and recycling of waste; 3. To reduce the amount of waste in land filling areas; 4. To take initiative for the management and recycling of waste by using public-private partnership; 5. To introduce the 3R strategy in corresponding project areas through exhibition and pilot programs;
- III. Urban Public and Environmental Health Sector Development Program in 6 City Corporations: The investments under the project loan include, among others, the following: (i) integrated waste management facilities (sanitary landfills, medical waste treatment, and composting); (ii) modern slaughterhouses; and (iii) food laboratories.

- IV. Promoting Low Carbon Urban Development in Bangladesh: Waste related activities include i) Implementing solutions for solid waste management including Integrated Resource Recovery Centre (IRRC); ii) waste to energy and 4R where in some projects development in PPP modality.
- V. IDCOL Biogas and Bio-fertilizer Program: IDCOL has been implementing domestic biogas program in Bangladesh since 2006 with support from SNV Netherlands, KfW and the World Bank. Till April 2016, IDCOL has financed construction of over 42,800 biogas plants all over the country through its 43 partner organizations.
- VI. Safe and Environmentally Sound Ship Recycling in Bangladesh – Phase I: The project, aimed at improving standards and sustainability within the industry, will consist of five work packages, covering studies on economic and environmental impacts of ship recycling industry and on the management of hazardous materials and wastes, recommendations on strengthening the Government’s One-Stop Service (in which all the various ministries with a responsibility for ship recycling – e.g. Industries, Environment, Labour, Shipping – offer a single point of contact for related matters), a review and upgrade of existing training courses for health, safety and environmental compliance, and the development of a detailed project document for a possible follow-up project to implement the recommendations of phase I.
1. Environmentally Sound Development of the Power Sector with the Final Disposal of Polychlorinated Biphenyl (PCB)
  2. Co-composting Project based on Faecal Sludge and Organic Waste
  3. CDM Based Composting Project (capacity 130 tons/day) Project in Dhaka
  4. Purbachal New Town Project by RAJUK (Capital Development Authority of Dhaka) incorporated the National 3R Strategy in their master plan. They kept the provision of source separation of waste and earmarked land for waste recycling projects.
  5. UNICEF initiated Composting Initiative and Promoting 3Rs in 19 towns of Bangladesh
  6. Feasibility Study on Conversion of Multi-technology Poa-dd on Solid Waste Management into NAMA (Nationally Appropriate Mitigation Actions) in Bangladesh.

Due to the geographical setup of Bangladesh, Bay of Bengal is the ultimate destination of all the wastes originated from inland land-based sources. Therefore, the activities undertaken by the GoB to combat the problem of land-based solid and liquid waste are ultimately preventing marine pollution and that obviously reduce the marine litter pollution in the Bay. Furthermore,

the DoE is going to establish new offices in 11 coastal districts. These offices will work in the management of marine litters.

There are many problems and drawbacks of solid waste management in the urban areas of Bangladesh. The major ones are as follows:

- Absence of national policy to encourage recycling practice;
- Lack of proper handling rules and standard;
- Lack of finance, and inefficient tax collection;
- Inefficient practice of waste collection;
- Shortage of suitable lands for final disposal of solid waste;
- Lack of awareness about environmental problems associated with solid wastes;
- Lack of partnership between public sector, private sectors and community groups;

#### **5.4. Legal and Regulatory Measure Taken at the National Level**

*The Banning of Polythene:* The major and remarkable regulatory measure taken in Bangladesh was banning of polyethylene bags in 2003. Most of the sewage lines of Dhaka city had been blocked by indiscriminate dumping of polyethylene bags over the years. The government (GoB) has banned the production, marketing, import, stock, distribution, carrying and use of polyethylene bags up to 20 microns thick or less from 01 March 2002. The Punishment for disordering the law-

a. For manufacture, import and marketing tie punishment is imprisonment not exceeding 10 years or fine not exceeding 10 lac Taka or both.

b. For sale, exhibition for sale, stock, distribution or commercial transportation or commercially use the punishment is imprisonment not exceeding 6 months or fine not exceeding ten thousand Taka or both.

*National Environmental Management Action Plan (NEMAP):* The government has taken a project named NEMAP to integrate environment with the development in a policy framework. It provides a guideline for promoting effective management of resources, raising awareness among the people and improvement of environmental degradation.

*Local Level Legal Framework:* There is no adequate legislation in the country to address the growing problems of solid waste. The responsibility of removal and disposal of municipal solid waste lies with the City Corporations and municipalities. The six City Corporation

Ordinances and Pourshava Ordinance 1977 are the only local law that gives some idea about disposal of municipal waste.

*Knowledge Enrichment Programme:* Environmental education program has been incorporated in primary and higher education. Many universities have introduced various curriculum and projects on environmental issue. Government organizations as well as NGOs present meetings and seminars to raise public awareness on the environmental issue.

## **6. National Marine Litter Monitoring Programme**

There is no specific Marine Litter Policy in Bangladesh. That's why no Ministry/department is exclusively responsible for marine litter monitoring. At present, no fixed marine litter monitoring program is available in Bangladesh. Bangladesh celebrated the International Coastal Cleanup Day at the 19<sup>th</sup> September in 2017 at the longest sea beach, Cox's Bazar. The day was celebrated making awareness about the impact of marine litter among the mass people.

## **7. Gaps, Research, Analysis, Knowledge, Need and Proposal as Basic for Setting Priorities**

Marine litter issue has gain scientific interest globally that produced a vast knowledge on its sources and impacts particularly for plastic debris among which microplastic is the most concerned type. Marine debris is a complex cultural and multi-sectoral problem that imposes tremendous ecological, economic, and social costs around the world. One of the substantial barriers to addressing marine debris is the absence of adequate scientific research, assessment, and monitoring. There is a gap in scientific research to better understand the sources, fates, and impacts of marine debris. Scalable, statistically rigorous and, where possible, standardized monitoring protocols are needed to monitor changes in conditions as a result of efforts to prevent and reduce the impacts of marine debris. Although monitoring of marine litter is currently carried out within several countries around the world including Bangladesh (often on the basis of voluntary efforts by non-governmental organizations), the protocols used tend to be very different, preventing comparisons and harmonization of data across regions or timescales.

There is a gap in information needed to evaluate impacts of marine debris on coastal and marine species, habitats, economic health, human health and safety, and social values. There is a lack of adequate knowledge amongst public on the deleterious effects of the marine

litter on the health and economy. More information is also needed to understand the status and trends in amounts, distribution and types of marine debris. There is also a gap in capacity in the form of new technologies and methods to detect and remove accumulations of marine debris including microplastics, as well as in means of bringing home to the public in all countries the significance of marine debris and the important part that the public can play in combating it.

Besides, the ways in which waste management is conducted are often a barrier. There is a lack of proper coordination among the responsible institutions, stakeholders, and provision of adequate financing for recycling of wastes. This is not a problem in Bangladesh but also a global problem, however, waste is managed on a very local level. Truly biodegradable, naturally occurring, biopolymers are becoming more widespread and commercially available. There is a need to pursue truly biodegradable biopolymer alternatives to plastic.

The Government of Bangladesh is working actively on various aspects of pollution under the aegis of the Global Programme of Action (GPA) of the UNEP. The concerned authorities have been working for the implementation of individual as well as joint action plans both at the policy level and resource utilization plans, affected by marine pollution and degradation caused by land-based activities. The activities on the monitoring of marine litter and microplastics are meagre and have been initiated recently along the Bangladeshi coastline and coastal waters to have a scientific understanding on the type, source, process and distribution of marine litter that would be supportive to frame a "Marine Litter Policy" for Bangladesh.

The Government of Bangladesh has already phased out single use plastic shopping bags and has been promoting the usage of biodegradable jute bag. Beach cleaning is an effective way to reduce and prevent litter from being washed into the seas. As part of the clean coast program, beach cleaning activities, educating school kids, raising awareness among public are being actively pursued. Bangladesh being a member country of the UNEP, and South Asia Cooperative Environment Program (SACEP) is responsible for clean seas of South Asia Seas (SAS). In this regard, our efforts are being directed towards transforming from the traditional waste management practices to more sustainable waste management practices following 3R strategy- Reduce, Reuse and Recycle strategy. Since Bangladesh does not have a National Marine Litter policy, it is highly recommended to formulate/develop a specific policy aiming of controlling the marine littering in the environment of the Bay of Bengal.

## **8. Way forward**

Marine litter is a burning issue at this moment, but Bangladesh is not well aware to work on Marine litter pollution. As Bangladesh has no policy on marine litter, Bangladesh needs to give emphasis on developing policy and research. Bangladesh has identified the following fields for controlling Marine litter:

- Development of Policy and planning
- Mass awareness
- Source control of litters
- Research and development of data base
- Institutional Capacity development
- International negotiation
- Monitoring and evaluation

## **9. Conclusions**

Marine litter is a global concern, affecting all the oceans of the world. Every year, millions of tonnes of litter end up in the ocean worldwide, posing environmental, economic, health and aesthetic problems.

Poor practices of solid waste management, waste water (including storm water) collection and treatment, lack of infrastructure and awareness of the public at large about the consequences of their actions aggravate the situations substantially.

Cleaning up the oceans is certainly could be one of the options but it is however not the most efficient method to cope up the marine litter problem. The better solution is to tackle the problem at its source. Collaboration with industries, non-governmental organizations and other development partners might be effective.

Marine litter is also one of the clearest symbols of a resource inefficient economy. Valuable materials are polluting our beaches and damaging our environment instead of being pumped back into our economy. Therefore, a circular economy approach which puts the emphasis on preventing waste and on recycling and reuse of materials and products in the first place, is the best solution to the marine litter problem.

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## Appendix I

### Photo Gallery: Different kinds of Marine Litter found in the coast of Bangladesh



Food Container



Fishing Line Buoys



Cloth and Leather Belt



Cigarette Lighter



Plastic (Picture)



Glass Bottle



Process Timber



Condom



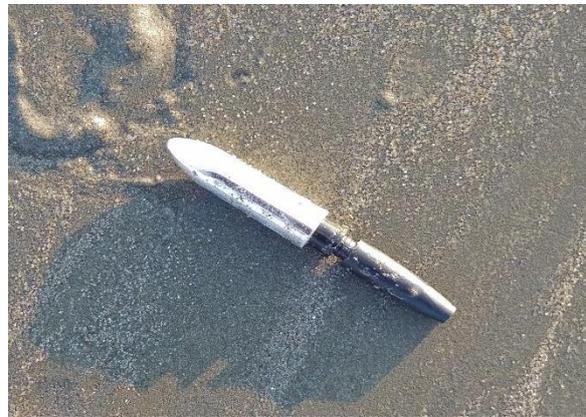
Foamed, Footwear, Bottle Cap



Glass Bottle, Plastic Bag, Plastic



Plastic Comb, Cap



Plastic (Cosmetic)



Diaper, Poly Bag



Plastic Glass, Cap



Metal Cap



Plastic (Inhaler)



Plastic Spoon, Syringes, Glass Bottle



Hard Plastic



Plastic Bottle



Fishing Nets



Bottle (>2 Liter)



Party Toy



Cloth (Shoe)



Cigarette pack



Paper



Perfume bottle (Glass)



Matches



Polythene



Football (Rubber)



Fishing Net (Plastic)



Plastic and Glass Bottle



Fishing Gear



Bulb (Glass)



Aluminum Foil Pack



Chips Pack (Plastic)



Rope (Plastic)



Glass Bottle



Cigarette Butt



Medicine (Plastic)



Variety of Can, Metal and Plastic



Straw (Plastic)



Buoys (Plastic)



Life Vest



Footwear (Rubber), Bulb

## **Appendix II**

### **Minutes of the National Consultation Workshop on 'Status of Marine litters in Bangladesh' held on 28 March 2018 at the Department of Environment, Agargaon, Dhaka, Bangladesh.**

A national consultation workshop was held on the 'Status of the Marine Litters in Bangladesh'. The workshop was chaired by the Director General, Department of Environment and key-note paper was presented by Dr. Md. Kawser Ahmed, Professor & Chairman, Department of Oceanography, University of Dhaka. The Secretary, Ministry of Environment and Forest Mr. Abdullah Al Mohsin Chowdhury was present as the chief guest. Representatives from relevant Government institutions, Universities and Non-Government organizations attended the meeting. A list of participants is attached in Annex A.

The programme started with the introductory remarks from the Director (Natural Resource Management-NRM) on the structure of the consultation meeting. Dr. Md. Kawser Ahmed, Professor & Chairman, Department of Oceanography, University of Dhaka presented on the status of marine litter in Bangladesh. His presentation covered the definition of marine litter, world status, importance of managing marine litter, methodology of the study, and the results (attachment A: the presentation). After the key-note paper, a detail discussion/consultation was held on the status of marine litter in Bangladesh, its causes, steps taken by the government and opportunities for reducing the litter. Suggestions and comments from various stakeholders were recorded and was included in the report for further actions.

#### **Discussion on the category of litters in the Bay of Bengal:**

During the presentation Dr. Kawser Ahmed informed that the major categories of litters along the Chattagram and Coxes Bazar beach are plastics, foamed plastics, cloth, glass materials and ceramics, metals, paper and cardboards, wastes of rubber, wood etc. Commodore Sheikh Mahmudul Hasan, Dean, Bangabandhu Sheikh Mujibur Rahman Maritime University (Hydrographic Surveyer) emphasized on the daily accumulation of ripped nets (ripped by the water vessels) at the bottom and within the water level and are opined that it was a big concern for the marine ecosystem. Professor Gulshan Ara Latifa of DU, Commodore M Mahbubur Rahman of Coast Guard authority and others also supported the issue. Ms Alifa Binte Haque from Dhaka University informed that micro-plastics in the Bay of Bengal were also polluting the sea. Presence of micro-plastics and its impacts should also be included as marine litter in the Bay of Bengal. Captain S Firoz Ahmed, BN, Director (Hydrography) of Bangladesh Navy opined that the water vessels coming to the ports and going abroad litter on the seas. The MARPOL convention 1973 prohibits littering by the ships and international cruises coming to the ports of the country. In addition, operation of ship breaking industries generates litters to the Bay of Bengal. Hence these could be included in the list of litters of the report.

## **Discussion on the way forward:**

After rigorous discussion some significant propositions/suggestions were generated from the experts/participants.

### **Mass awareness**

There was a consensus that mass awareness is the key to reduce the littering on the land as well as on the sea and beaches. Almost all the participants agreed that whatever was thrown as a litter at any part of the country travels through the rivers and ends up in the sea. MrManiruzzamanKhandaker, from Dhaka University emphasized on the importance of education at the primary school level to develop the awareness on littering. MrSolaiman Hossain of Shahjalal University opined that the fishermen should be properly informed on the importance of marine ecosystem because they only emphasizes on the fish ignoring all other flora and fauna upon which fish depends for food. Awareness of fisherman was important to reduce the litter, he mentioned. He also added that the hawkers of the beach would also be responsible for littering and should be aware of consequences of marine litter. The representative from the Bangladesh Navy opined that rules and regulations under MARPOL Convention 1973 should also be a part of the awareness programme. The representative from the Green Belt Trust (NGO) opined that for the mass awareness coastal cleanup day should be a regular work instead of a one-day programme of the year. The Secretary of the Ministry of Environment and Forest mentioned that polythene was a big menace for the nature. If the common people reject polythene bags there would not be any production. Hence, mass awareness is very crucial to stop the use of plastics.

### **Source control of litters**

Identifying the source of marine litter and control of the littering at the source level came as an important suggestion in the consultation meeting. MsAlifaBinteHaque, Lecturer, Mrs. Gulshan Ara Latifa, Professor, Department of Zoology, Dhaka University and other participants opined that the sources of litters were in the main land which should be identified and reduced. MsAlifa also informed that the producers of plastic materials should be invited in these meetings as they could contribute/play a vital role in reducing the plastics. Alternatives of plastics could be a solution for reduction of plastic use, she added.

### **Research and development of data base**

Research has been identified as an important step to identify, manage and reduce the marine litter. The meeting confirmed that there was no formal research or data on the marine litter status of Bangladesh. Prof. Anwarul Islam, Department of Zoology, Dhaka University said that research is crucial even before the awareness programme. Plenty of tools are available for identifying the status of litters. He also suggested that emphasis should be given on the 'knowledge' and a data base could be developed in this regard. Md. Solaiman Hossain of Shahjalal University also emphasized on the research of identifying and reducing the marine litters and policy development.

### **Capacity development**

Capacity development at individual and institutional level is crucial for managing marine litters. Representative from the Ministry of Foreign Affairs informed that developed countries were mostly responsible for producing marine litters. Hence international campaign is very important for the global pollution of oceans and seas. In this regard capacity development is very crucial. Knowledge and capacity for managing own litters and for negotiating and bargaining for Bangladesh's interests in the international arena on the consequences of pollution of marine litter generated by developed countries need to be enhanced, he added.

### **International negotiation**

Negotiation with the polluting developed countries could help better management of marine litters. The DG of the Ministry of Foreign Affairs opined that both national and international stakeholders for managing the marine litters should be identified. In this case, the affected countries could form a group and negotiate with the polluting countries.

### **Development of Policy and planning**

The meeting agreed that short-term, medium-term and long-term policies and action plans were required for sustainable management of marine litters. Mr. Anwarul Islam, Dhaka University opined that the policy should include the trans-boundary issues. Various programmes could be taken to develop guidelines, rules and regulations. Long term planning is necessary, he added. Mr. Md. Jakaria, Senior Scientific Officer of Bangladesh Oceanographic Research Institute (BORI) mentioned that during development of policy, litters generated at the individual level and at the industrial level should have separate policies for mitigation and management. Incentives for the locals could be an option for reducing litters at the tourist areas. There were suggestions on whether there could be some restrictions on import of certain sensitive plastics which are more harmful than others. Director (Climate change and international convention) of Department of Environment Mr. Mirza Swakat Ali informed that the developed countries had policies for reusing and recycling of plastics. Policies and rules for marine litter management could incorporate those options.

### **Monitoring and evaluation**

The meeting also agreed that the policy and action plans should also incorporate strong monitoring tools. The representative of the Bangladesh Navy informed that monitoring of the marine litter management would be a vital part in order to reduce the litter sustainably. Littering by national and international cruises and sea vessels under MARPOL Convention, 1973 also require strong monitoring, he added. Annex five of MARPOL Convention 1973 describes in detail on the restrictions, management of and rules on marine litters. He suggested that the Ministry of Shipping can look after and monitor the sea vessels under the MARPOL convention.

### **Existing activities under DOE and other government organizations**

The meeting also discussed on the activities taken by the government on reducing solid wastes at the national level. Director (Air pollution) Mr. Md. ZiaulHaque of Department of

Environment mentioned that Bangladesh Government had developed the guideline on the waste management and had been working on the 3R policies. The government is also supporting activities on the biodegradable polythenes such as 'Sonaly Bag' made of Jute cellulose. The Secretary of the Ministry of Environment and Forest opined that the national report to be generated from this meeting should incorporate all the existing activities for reducing solid wastes and littering at the government and private level. Programmes such as compost plants, project of Community Based Ecosystem Conservation and Adaptation in Ecologically Critical Areas (CBA-ECA) of Bangladesh, activities of blue economy cell related to wastes could be incorporated, he added. The Chair informed the meeting that DoE had its own action plan. The Ministry of Fisheries and Livestock is also working on the issue. These activities could be incorporated in the report.

After detailed discussion the following decisions have been taken:

1. The report will incorporate all the issues discussed in the meeting.
2. The draft national report on the marine litter status in Bangladesh will be circulated for further comments to all stakeholders before finalization.

Finally, the meeting ended with a vote of thanks from the chair.

## Appendix III

### National consultation workshop 'Status of the Marine Litters in Bangladesh

#### Programme and participants

A national consultation workshop was held on the 'Status of the Marine Litters in Bangladesh'. *Place:* ParibeshBhaban, E/16, Agargaon, Sher-e-Bangla Nagar, Dhaka-1207; *Date:* 28 March 2018. The workshop was chaired by the Director General, Department of Environment and key-note paper was presented by Dr. Md. Kawser Ahmed, Professor and Chairman, Department of Oceanography, Dhaka University. The Secretary, MoEFCC attended as the chief guest of the workshop. Representatives from relevant Government institutions, Universities and Non-Government organizations attended the meeting.

#### Workshop agenda

- i) Presentations from key-note speaker on the status of monitoring and assessment of Marine Litter in Bangladesh. Dr. Md. Kawser Ahmed, Professor & Chairman, Department of Oceanography, Dhaka University presented on the status of marine litter. His presentation covered the definition of marine litter, world status, importance of managing marine litter, methodology of the study, and the results from the present survey of marine litter along the coast of Bangladesh.
- ii) Group work/discussion on the main topics of the workshop:
  - Category of litters in the Bay of Bengal
  - Mass awareness
  - Source control of litters
  - Research and development of database
  - Capacity development
  - International negotiation
  - Development of Policy and planning
  - Monitoring and evaluation
  - Existing activities under DoE and other government organizations
    - o 3R (Reduce, Reuse, Recycle) policies and involvement of NGOs and stakeholders
- iii) After detail discussion the following decisions have been taken:
  - The report will incorporate all the issues discussed in the meeting.
  - The draft national report on the marine litter status in Bangladesh will be circulated for further comments to all stakeholders before finalization.

## **Outcomes from the national consultation workshop**

Followings are the key issues opined/recommended by the participants/experts during the discussion session of the workshop:

- Presence of micro-plastics and its impacts should also be included as marine litter issues in the Bay of Bengal.
- Operation of ship breaking industries generates litters to the Bay of Bengal. Hence, these could be included in the list of litters.
- The vessels coming to the ports and going abroad are littering the sea.
- The daily accumulation of ripped nets (ripped by the water vessels) at the bottom and within the water level should be considered as a big concern for the marine ecosystem.
- Mass awareness is the key to reduce the littering on the land as well as on the sea and beaches.
- The awareness of marine littering should be initiated at the primary school level of education in the country.
- The fishermen should be properly informed on the importance of marine ecosystem since the awareness of fisherman is important to reduce the litter.
- For the mass awareness,coastal cleanup day should be a regular work instead of a one-day programme of the year.
- Mass awareness is very crucial to motivating the common people to reject the use of polythelene bags. Alternatives to plastics could be a solution for the reduction of plastic use.
- The source of marine litter should be identified and the control of the littering should be taken at the source level. Much emphasize should be given on land-based sources of marine litter.
- More and more research has been identified as an important step to identify, manage and reduce the marine litter.
- A national database on marine litter should be developed.
- Capacity development at individual and institutional level is crucial for managing marine litters. The international campaign among the trans-boundary countries is very important for the global pollution of oceans and seas. Negotiation with the polluting developed countries could help better management of marine litters.
- Both national and international stakeholders for managing the marine litters should be identified.
- Short-term, medium-term and long-term policies and action plans are required for sustainable management of marine litters.
- Litters generated at the individual level and at the industrial level should have separate policies as far as mitigation and management are concerned. Incentives for the locals could be an option for reducing litters at the tourist areas.
- There could be some restrictions on the import of certain sensitive plastics which are more harmful than others.

- Policies and rules for marine litter management, e.g. 3R (reduce, reuse and recycle) of plastics should be implemented.
- Monitoring of the marine litter management would be a vital part to reduce the litter sustainably. Littering by national and international sea cruises and sea vessels under the MARPOL Convention, 1973 also require strong monitoring. The Ministry of Shipping should take the initiative to monitor the sea vessels under the MARPOL convention. Coast Guard could be assigned for this job.

The meeting also discussed on the existing activities taken by the Government of Bangladesh on reducing solid wastes at the national level. Director (Air pollution) of the Department of Environment mentioned that the government had developed the guideline on the waste management and had been working on the 3R policies. The government is also supporting activities on the biodegradable polythenes such as 'Sonaly Bag' made of Jute cellulose. Programmes such as compost plants, project of Community Based Ecosystem Conservation and Adaptation in Ecologically Critical Areas (CBA-ECA) of Bangladesh, activities of blue economy cell related to wastes are working in these sectors. The DoE had its own action plan. The Ministry of Fisheries and Livestock is also working on the issue.

**Participants of the national consultation workshop 'Status of the Marine Litters in Bangladesh:**

1. Secretary, MOEFCC, Bangladesh.
2. Secretary, Marine Affairs Unit, Ministry of Foreign Affairs, Bangladesh.
3. Additional Secretary, Blue Economy Cell.
4. Director General, Bangladesh Coast Guard
5. Director General, Bangladesh Oceanographic Research Institute (BORI)
6. Director (Marine), Department of Fisheries, BD.
7. Director (Hydrography), Bangladesh Navy.
8. Dean, Bangabandhu Maritime University, BD.
9. Director, Bangladesh Oceanographic Research Institute
10. Dr. Md. Kawser Ahmed, Professor, Department of Oceanography, Dhaka University.
11. Gulshan Ara Latifa, Professor, Department of Zoology, Dhaka University.
12. Anwarul Islam, Professor, Department of Zoology, Dhaka University.
13. MoniruzzamanKhandakar, Professor, Department of Botany, Dhaka University.
14. District Commissioner, Cox's Bazar.
15. JobaerAlam, Assistant Professor, Department of Oceanography, Dhaka University.
16. Dr. Md. Monirul Islam, Associate Professor, Department of Fisheries, Dhaka University.
17. Dr. Md. Habibullah-Al-Mamun, Assistant Professor, Department of Fisheries, Dhaka University.
18. Dr. Md. Raknuzzaman, Associate Professor, Department of Fisheries, Dhaka University.
19. Muntasir Akash, Lecturer, Department of Zoology, Dhaka University.
20. AlifaBinteHaq, Lecturer, Department of Zoology, Dhaka University.
21. Dr. Md. Abdul Baki, Associate Professor, Department of Zoology, Jagannath University.
22. Solaiman Hossain, Lecturer, Department of Oceanography, Shahjalal Science and Technology University.
23. Mostafa, Lecturer, Department of Oceanography, Noakhali Science and Technology University.
24. ShahadMahbub, IUCN, BD.
25. Dr. Shahriar Hossain, Environmental-NGO.
26. CEO, Green Belt Trust, BD.
27. Directors (All), DoE, BD.
28. Deputy Directors, DoE, BD.
29. Assistant Directors, DoE, BD.