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## **Marine Environmental Pollution in Bangladesh and It's Protection**

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### ABSTRACT

The economic activities of Bangladesh are largely associated with the sea either for exploitation of natural resources or as a means of transportation. But the sea is being polluted by various human activities both on land and at sea behind the eyes of the people. In Bangladesh, awareness for the conservation of the environment has not been developed; what to talk about marine environment. But if the marine pollution is not monitored well in time and responded much earlier the consequence will probably go beyond the control of this poor country. This very important issue is almost ignored in Bangladesh. Though Bangladesh has not faced any fatal pollution yet, but Bay of Bengal is very vulnerable to marine pollution. So, comprehensive preventive measures must be taken immediately than to wait till it occurs.

Keywords: Surface, marine, pollution, protection, environment, coastal, Ocean, mineral, Sources.

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### **1 Introduction**

1.1 The opening statement of chapter 17 of the United Nations Conference on Environment and Development (UNCED) mentioned: "The marine environment including the oceans, seas and adjacent coastal areas form an integrated part, is an essential component of the global life support system and a positive asset that represents opportunities for sustainable development." But due to many reasons, state of marine environment is deteriorating day by day; as a result depletion of coastal resources such as fisheries, mangroves and coral reefs has emerged as a critical issue in Asia and the Pacific. Increasing urbanization, industrialization and tourism, exploitation of resources, marine transportation, coupled with a growing coastal population, have degraded coastal areas, reduced water quality and increased vulnerability on marine resources. Thus protection of these resources has become an issue of international concern.

1.2 For years, the sea, which covers more than 70 per cent of the earth's surface, and which is the home of millions of fish, crustaceans, mammals, micro-organisms and plants, has been the final receptacle of many wastes. Neglect and disregard of its natural purity caused dumping of an astonishing 20 billion tons of garbage and wastes including oil, toxic chemical, nerve gases, radioactive materials, industrial wastes etc into the sea. All these are not only threatening the livelihood of millions of people but also causing irreparable damage to the marine environment and disrupting the ecological balance.

1.3 Bangladesh, a littoral country in the South Asian region, has a vast sea area full of natural resources equal to two-third of its land territory. Like many other ocean areas of the world, the unique ecosystem of the coastal area of Bangladesh today is threatened because of many unwanted pollutants resulting from unscientific exploitation of natural resources and various environmentally detrimental activities both at sea and in the land. The marine environment of Bangladesh is becoming vulnerable to pollution and susceptible to disturbance in the balance of the ecosystem, loss of flora and fauna, migration of fisheries, accelerated corrosion etc. Even economic activities of the country may be severely disrupted if the sea is too polluted. Sporadic reports already have been received from the fishermen of the Bay of Bengal regarding the fall in quantity of fish catch. Experts claimed it to be the result of marine pollution.

1.4 This article will analyze marine pollution in general including its major sources and pollutants. It will then identify the sources of marine pollution in the coastal waters of Bangladesh and recognize the major pollutants from these sources. It will follow the likely effects of marine pollution.

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### **2 Key Dimensions Of Human-Ocean Interactions And Marine Pollution**

2.1 Dimension of Human-Ocean Interactions: The ocean affects our weather and climate, provides a home to fisheries, which are a major food source for the world. It is still largely unexplored in its depths. As the world population and standard of living grows, nations need to understand the impact of the ocean and the importance of sustainable use of ocean resources. Oceans had been used as a source of mineral and other resources, means of transportation, scientific research, recreation and tourism and for military purposes. But these human activities have primarily been exploitative which knowingly or unknowingly causing pollution and sometimes interrupting its natural evolution.

2.1 General Concept on Marine Pollution: The marine environment constitutes a major component of the natural environment. It has dynamic interactions with other components such as air, land, inland water etc. The coastal areas attract urban development, tourism and other economic activities. The regional seas are transportation routes for vessels used in international trade. A report by the UNEP has noted the fact that though the open seas are still relatively clean, coastal zones have seen a substantial rise in pollution due to man made activities. We have been traditionally considering water as a natural purifier and thus throwing anything and everything in the water without considering the consequence. When we throw even a paper in the water we do not know how long it will remain in the water and how much it will pollute the water. Following table will probably bring change in our concept about water:

**Table - I: Dissolving Time of Various Materials in Water**

| Material  | Time          |
|---|---------------|
| Paper   | 2-4 weeks     |
| Cotton Cloths   | 1-5 months    |
| Rope  | 3-14 months   |
| Woolen Cloths   | 1 year        |
| Painted Wood  | 13 years      |
| Tin Can   | 100 years     |
| Aluminum Can  | 200-500 years |
| Plastic Bottles   | 450 years     |
| <b><u>Life Span of Nuclear and Radio-Active Wastes*</u></b> |               |
| Plutonium   | 24,000 years  |
| Strontium   | 90 years      |
| Cesium  | 13-30 years   |

Source: HELMEPA (Published by IMO in October 1998).

\* The London Dumping Convention, IMO, London, (p 44).

2.3 Defining Marine Pollution: The term 'pollution' is used for describing inputs of wastes, the occurrence of waste in the sea and the environmental impact of waste. United Nations Conventions on Law of the Sea (UNCLOS) III defines marine pollution which is widely accepted as - "Pollution of the marine environment" means the introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities.

### 3 Sources of Marine Pollution

3.1 Coastal ecosystems are subject to severe and continuous degradation due to various human activities as these activities largely pollute the sea. About eighty per cent of the pollution entering oceans worldwide come from human activities on land. The river water also feed chemical contaminants originated from fertilizers and pesticides used in agricultural lands. The marine pollution from sea-based activities is largely associated with marine transportation and offshore mineral exploration activities. Many countries also find sea as an ultimate place for dumping wastes. Thus the sources of marine pollution can be grouped into following four areas:

- a. Land-Based Sources of Marine Pollution (LBSMP)
- b. Ship-Generated Marine Pollution
- c. Exploration of Natural Resources (like oil, gas etc)
- d. Dumping

## 4 Land-Based Sources of Marine Pollution

4.1 The Paris Convention for the Prevention of Marine Pollution from Land-Based Sources adopted in 1974 defines LBSMP as: "The pollution of the marine area (i) through watercourses, (ii) from the coast, including introduction through underwater or other pipelines, (iii) from man-made structures placed under the jurisdiction of a contracting party within the limits of the area to which the present convention applies."

4.2 Industries are one of the main areas of LBSMP. Three quarters of the world's mega cities are located by the sea, and 40 per cent of the world's population now lives within 60 kilometres of the coast. These cities have many industries like Mining, Forest based industries, Iron, steel and metals, Chemical industries etc. along or near the coasts which result marine pollution by discharging various wastes. Among the non-industrial polluters agricultural farms are the largest which add pollutants like commercial fertilizers, animal wastes, pesticides, insecticides and sediments in the marine environment. Urbanisation also generates sewage, one of the critical elements of marine pollution. Dredging of ports and harbours is probably the most significant in terms of propagation of pollutants.

## 5 Ship Generated Marine Pollution

5.1 Transportation of oil, chemical, hazardous material and other cargo through the sea cause substantial extent of pollution. Oil, gas etc may reach the seas in various ways like shipping accidents at sea, discharges from ships, spills during loading and unloading operations in ports. Besides, other discharges of various polluting agents from ships also result environmental degradation in marine life. Ship discharges include:

- a. Ballast water from cargo tanks oil tankers.
- b. Tank washings from oil tankers.
- c. Bilge waste from machinery spaces.
- d. Residues from fuel and lubricating oil purification units, spent lubricating oils and sludge from tankers.
- e. Sanitary wastes.
- f. Garbage.

## 6 Major Marine Pollutants

6.1 Oil: Pollution by oil receives more attention because its extent and effects are clearly visible. Oil<sup>1</sup> is not only a single substance but a complex mixture of many chemicals. Once spilled, oil spreads very rapidly, with lighter fractions moving most quickly. Oil spills pollute coastal waters and ultimately intoxicate the soil. Oil pollution has severe negative impact on flora and fauna of the coastal zone.

**Table II - Annual Inputs of Oil to the Marine Environment**

| <u>Source</u>           | <u>Annual Input (million tonnes)</u> |
|-------------------------|--------------------------------------|
| Offshore production     | 0.05                                 |
| Routine ship operations | 1.05                                 |
| Ship accidents          | 0.42                                 |
| Atmosphere              | 0.3                                  |
| Land-based sources      | 1.23                                 |
| Ocean dumping           | 0.02                                 |
| Natural sources         | 0.25                                 |
| Total                   | 3.32                                 |

Source: G R Chatwal, Encyclopaedia of Environment Soil and Marine Pollution, Delhi, Anmol Publications, 1997, pp 494.

6.2 Sewage: Raw sewages dissolved in the coastal waters are a variety of inorganic (nutrients and trace materials) and organic (biodegradable and persistent) materials. Suspended solids consisting of human excrement, inorganic grit and other organic and inorganic materials also join these.

6.3 Pesticides and Other Persistent Organic Chemicals: Chemicals and pesticides like Para Para Di Chloro Di Phenyl Tri Chloro Ethane (DDT) and the Polychlorinated Biphenyls (PCBs) are generally toxic, persistent in the environment and are bio-accumulated.

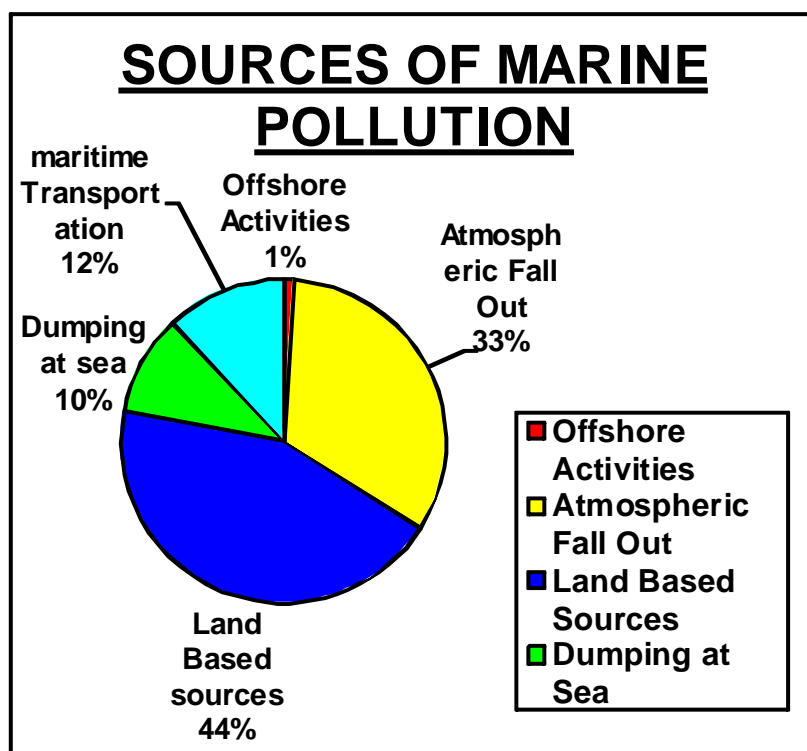
6.4 Radioactivity: Sources of radioactive material include waste discharges from nuclear fuel reprocessing plants, nuclear reactors, low-level radioactive waste dumped at sea, accidental discharges from the loss of nuclear powered submarines.

## 7 Marine Environmental Pollution in Bangladesh

7.1 Bangladesh, situated at the apex of the Bay of Bengal, has a vast coastal plain of more than 36,400 sq km, and a 710 km coastline which extends from the mouth of the Naaf River in the south to the mouth of Raimangal River along the Indo-Bangladesh border in the west. The population of Bangladesh's coastal districts in Chittagong, Noakhali, Barisal, Potuakhali and Khulna is about 24 million, which is about 23 per cent of the total population of Bangladesh.

## 8 Sources of Marine Pollution in Bangladesh

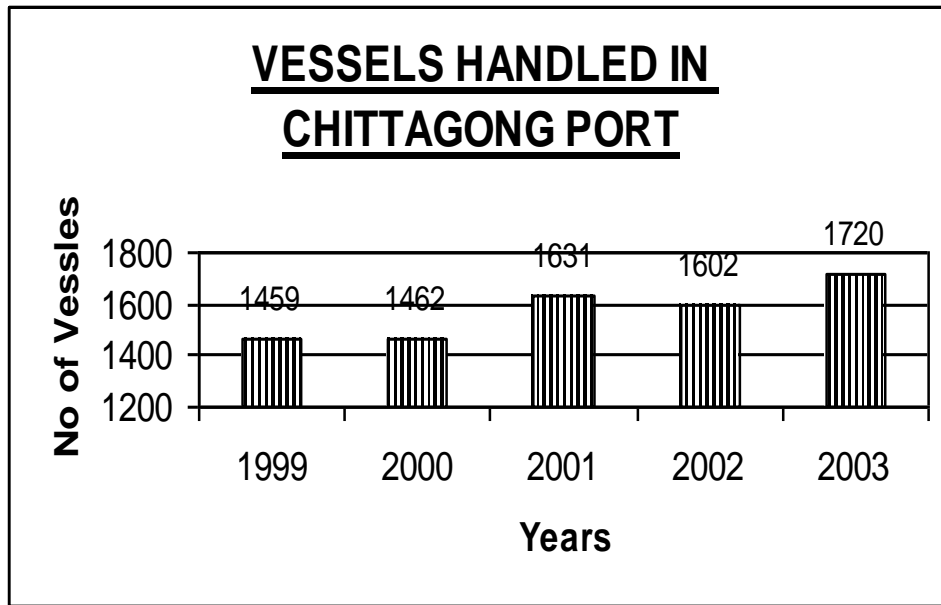
8.1 The coastal environment of Bangladesh is contaminated by oil tanker traffic, harbour operations and effluents discharged from petroleum processing, sewage and other wastes disposal by the Karnaphuli and Pussur rivers into the Bay of Bengal. Moreover, it has also been affected by industrial effluents, agricultural residues, some other human activities like



Source: "The London Dumping Convention, IMO, London, 1991, (44).

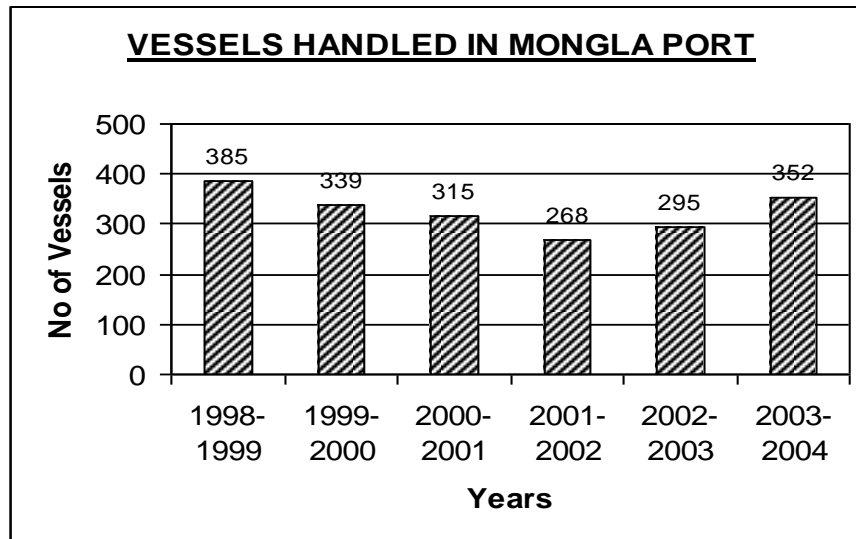
deforestation and irrational expansion of coastal shrimp farming, etc resulting in ecological degradation. Over fishing and dumping of discarded fishes in these areas are becoming a threat to the fishing grounds. Thus, the major sources of marine pollution in Bangladesh are:

- Land Based Sources.** Two major cities of Bangladesh are located along or near the coast. Contaminants from these cities, various industries and far from inland enter the sea water via Karnaphuli and Pussur Rivers and other several pathways and pollute the marine environment.
- Ship Based Sources** Chittagong Port handles nearly 1200 ships and 40-50 oil tankers and Mongla Port handles about 600 ships annually.<sup>2</sup> In addition, about 2500 registered power-driven river crafts and numerous unregistered small power driven boats including oil tankers ply in the coastal waters of Bangladesh.



Source: Souvenir Chittagong Port Authority 2003.

FIGURE I: NO OF VESSELS HANDLED YEARLY IN CHITTAGONG PORT



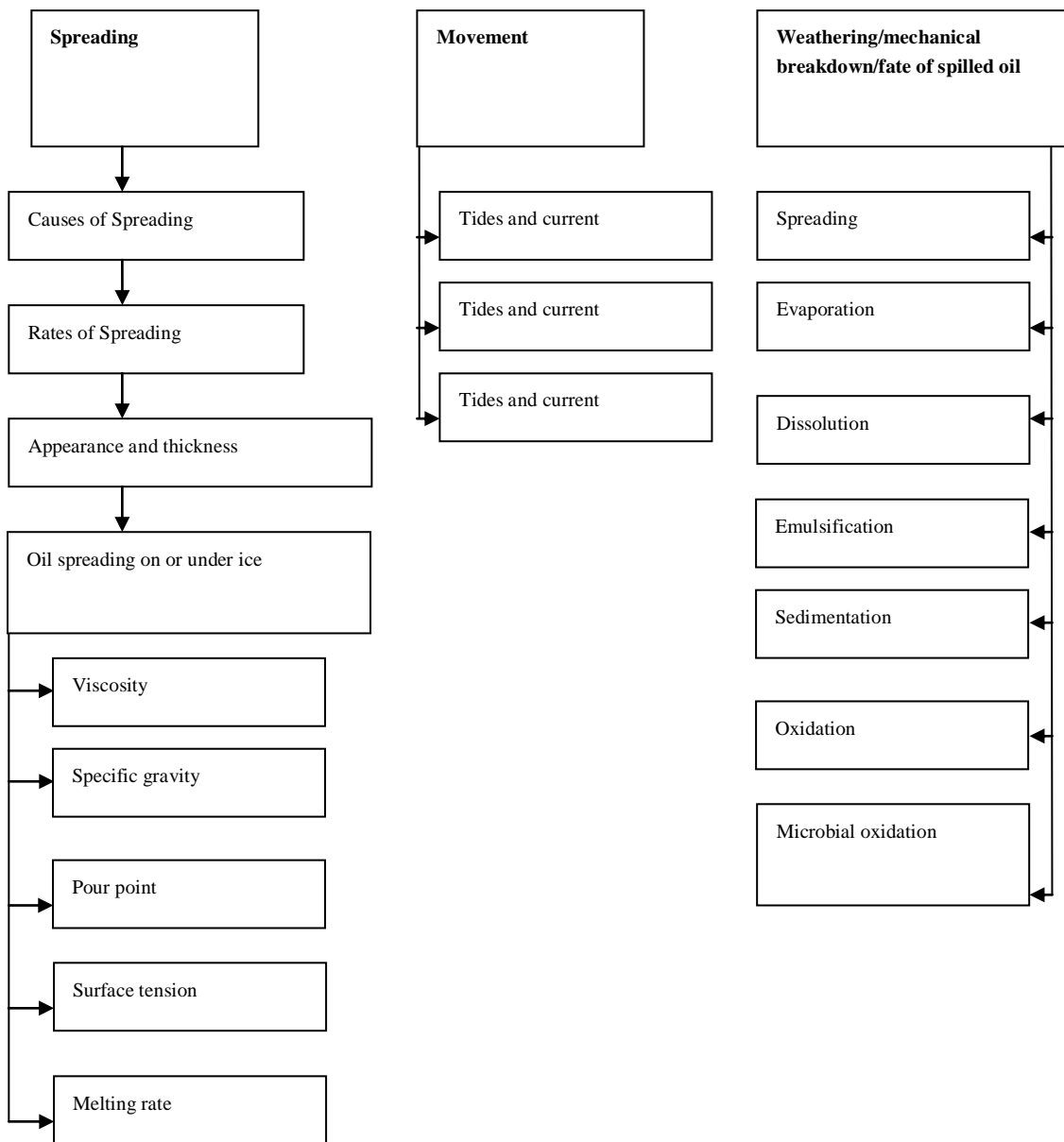
Source: Brief by Chairman Mongla Port Authority on 27 May 2004.

FIGURE II: NO OF VESSELS HANDLED YEARLY IN MONGLA PORT

**9 Major Marine Environmental Pollutants in Bangladesh**

9.1 Oil Pollution: Oil pollution results from the crude oil transportation, ballast and bilge water from different vessels, waste oil from ships and mechanized vessels, handling loss etc. International oil tankers routes of the southern Bay of Bengal also contribute to the oil pollution in the coastal and marine environment. The following diagram shows the behaviour of oil in the environment:

**FIGURE III - BEHAVIOUR OF OIL IN THE ENVIRONMENT**



Source: Draft Final Report Volume 2 on "Institutional Strengthening of CPA in Environmental Management" by Asian development Bank, May 18, 2004. Sec 6, p 4.

An estimation of oil and oily substances entering the sea in the Chittagong area is shown in the following Table:

**Table III : Oil and Oily Substances in the Chittagong Area**

| Oil and Oil Emulsion Source   | Estimated Amount of Discharge |
|---|-------------------------------|
| Chronic spillage of crude oil during transportation operations in Chittagong Port | 6000 metric tons/year*        |
| Bilge waters  | 2.4 million gallons/year      |
| Crude oil residue, process oil and wash water from refinery                       | 50000 metric tons/year        |
| Refuse oil from ship breaking activities near Fauzdarhat                          | 400 kg/year                   |

(\*Assuming 0.5% transportation during crude oil transfer at Chittagong Port) Source: ESCAP-1998

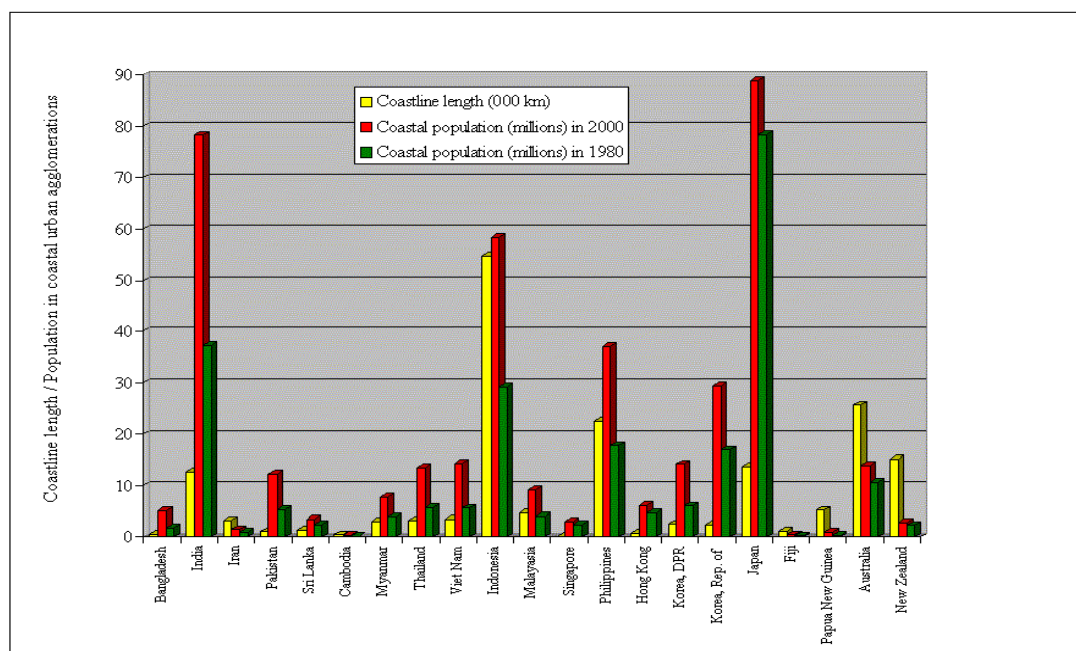
9.2 Pollutants Originating from Ship Breaking: At present there are approximately 150 established ship breaking yards in Chittagong. Aerial view of Chittagong Ship Break area is shown in Annex G which reflects the alarming picture of sea pollution. The ship breaking activities have a negative impact in the coastal environment, as it follows no rules and regulations, neglects safety measures for the environment.

9.3 Industrial Wastes: About 1252 manufacturing industries are situated near the coastal area (as listed in Annex H) both in Chittagong and Khulna, which is about 27.6% of the total industries of the country.<sup>3</sup> None of these industries have any approved waste treatment facilities.

9.4 Municipal Wastes. Chittagong, a metropolitan city, produces about 760 tons of solid wastes every day.<sup>4</sup> Sewage and wastes from all over the city run into the Karnafully River through a number of canals and then to the sea. Recently the Chittagong City Corporation (CCC) has begun dumping these wastes in two dumping grounds near Patenga Sea Beach and along the Karnafully Shah Amanat Bridge Approach Road.

9.5 Agricultural Wastes: The total amount of fertilizer and pesticides used at present in Bangladesh is about 8043 and 9200 tons/year respectively, which is increasing every year.<sup>5</sup> Pesticides and fertilizers are dumped or wasted away by rain and fall into the river systems and ultimately find their way into the seas. It is assumed that 25% of the total amount of pesticides used may reach the coastal water and cause pollution of seawater.

**GRAPH OF INCREASE OF POPULATION ALONG THE COASTAL AREAS OF VARIOUS COUNTRIES**



Source: UNEP (<http://www.rccap.unep.org/apeo/imgs/fig1-16.gif>)

9.6 Mangrove Deforestation and Sedimentation: Mangrove deforestation has increased the rate of erosion along the parts of the coast of Sundarbans area. Deforestation, heavy rainfall and natural calamities such as cyclones, tornado, tidal bore etc. cause erosion of soil.

9.7 Fishing Activity: Approximately 3000 registered and unregistered fishing vessels catch fish every day in the coastal water of Bangladesh. These fishing activities in the process pollute the marine environment as it is not scientifically conducted.

9.8 Solid Wastes: Use of non-biodegradable plastic products such as shopping bags, disposable syringes, bowls, nets, Polyvinyl Carbon (PVC), nylon ropes, plastic bottles, cans, packing materials etc. in Bangladesh are increasing day by day and causing pollution in the country.

9.9 Pollution due to Increase of Population: The marine environment is threatened by the burgeoning human population, growing most rapidly along the coast of Bangladesh. More people mean more pressure on natural resources, more urbanisation, more industrialisation and more pollution.

9.10 Other Wastes from Ships: Other than oil, different types of discharges from the ships, tankers, crafts and boats like, ballast and bilge water, bilge waste from machinery space, sanitary wastes, garbage etc are entering the water body of the marine environment.

9.11 Ballast Water: The water in many international ports is highly contaminated with sewage and agricultural run-off. High concentration of pathogens can be taken up in the millions of gallons of ballast water needed to stabilize a ship and subsequently transported throughout the world.

9.12 Other Sources of Marine Pollution: The world oceans are global in nature. Marine pollution originating in one place can easily affect other parts through the flow of ocean currents

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## 10 The Likely Effects of Marine Pollution

10.1 Marine pollution has severe environmental consequences in a number of areas including public health, food resources, and marine species integrity and their health. Each and every type of pollutants has its own consequence. Some of these are described below:

- a. Ecosystem Degradation: The ecosystem of coastal area of Bangladesh may be subject to severe and continuous degradation due to various human activities in the marine environment.
- b. Impact on Fish and Human Health: Sea water pollution in any form will have severe effects on fish and human health who will consume this fish. Re-production of fish will also be endangered. Moreover, fish species are likely to be migrated from the polluted zone of the sea. The impacts of various water pollutants are very harmful on the fish production and public health.
- c. Effects on Marine Birds: Marine birds in the Bay of Bengal may be highly vulnerable to oil spill and oil pollution. As the oil spill floats over the sea surface, the floating birds can easily come in contact with the oil spill and ultimately lose their lives.
- d. Loss of Flora and Fauna: The inability of individual marine organisms to reproduce, grow, feed or perform other functions can be caused by prolonged exposure to pollutants. Oil may block the openings of the air breathing roots of mangroves or interfere with the trees' salt balance, causing leaves to drop and the trees to die.
- e. Impact on Coastal Activities and Economic Affairs: Marine pollution can have serious economic impact on coastal activities of Bangladesh. Oil and chemical spills can adversely affect industries that rely on a clean supply of seawater for their normal operations. Contamination can reduce coastal amenities leading to public disquiet and interference with recreational activities.

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## 11 Existing Institutional Arrangements in Bangladesh for Control of Marine Pollution

11.1 Bangladesh has a number of organizations/agencies that are directly or indirectly responsible for the preservation of marine environment. In 1989 Ministry of Environment and Forest (MoEF) was created making responsible for environmental matters at the national level. Department of Environment (DOE) as the technical agency of this ministry looks after the environmental planning, management, monitoring and enforcement. Capabilities and limitations of some of these organisations are discussed below:

- a. MoEF: The MoEF carries out her responsibilities through other concerned organisations/agencies and it monitors the environmental aspects and suggests the measures to be taken for the conservation of the environment.
- b. DOE: The DOE is the principal agency of Bangladesh that looks after the environmental aspects. It is taking much praise worthy actions to preserve the environment of the country
- c. Director General (DG) Shipping. Shipping department is also concerned for the protection of marine pollution. But it has no infrastructure of its own to control marine pollution.
- d. Port Authorities: Chittagong Port Authority (CPA) has only two tugs which can counter oil spill to a limited scale.
- e. Bangladesh Navy: Bangladesh Navy maintains vigilance at sea which can support to detect any pollution activities to a limited extent.
- f. Bangladesh Coast Guard: Though Bangladesh Coast Guard has been entrusted with the duty of controlling marine pollution but it is still in forming stage.

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## 12 Legislation to Control Marine Pollution

### 12.1 International Law and Organizations

12.1.1 Early Development: Marine pollution was not a matter of concern in international arena until a few decades ago. In 1958 the first Law of the Sea Conference was held resulting in four conventions.

12.1.2 International Maritime Organisation: The International Maritime Organisation (IMO) was formed in 1958. One of the objectives of IMO was the protection of the sea environment against pollution from ship borne sources. Since the establishment of IMO, it so far has adopted more than 40 Conventions,



12.1.3 The London Dumping Convention: The preamble to the London Convention states: "Marine pollution originates in many sources, such as dumping and discharges through the atmosphere, rivers, estuaries, outfalls and pipelines, and it is important that states use the best practicable means to prevent such pollution and develop products and process."

## 12.2 National Laws

12.2.1 Bangladesh still did not promulgate any dedicated laws or regulations for the control of marine pollution. But it has formulated number of environmental laws which directly or indirectly relate to marine and coastal environment protection. Some of these laws of Bangladesh are:

- a. The East Pakistan Water Pollution Control Ordinance, 1970: The Water Pollution Control Ordinance 1970 was designed for the prevention, control and abatement of pollution of any water from disposals relating to wastes, sewerage etc.
- b. The Territorial and Maritime Zones Act 1974: 'The Territorial Waters and Maritime Zones Act 1974' aims to prevent mm mm,zand control marine pollution.
- c. The Territorial Waters and Maritime Zones Rules 1977: The Territorial Waters and Maritime Zones Rules 1977 (Bangladesh) deal with serious marine pollution infringements.
- d. The Coast Guard Act 1994: As per 'The Coast Guard Act 1994', Bangladesh Coast Guard is assigned with the task of seeking out marine pollution activities in the Bangladesh water and to arrange prevention of the same.
- e. The Bangladesh Environment Conservation Act 1995: The Bangladesh Environment Conservation Act 1995 was enacted with a view to provide for conservation, improvement of environmental standards and control and mitigation of pollution of the environment.
- f. The Environment Conservation Rules, 1997: The Environment Conservation Rules 1997 regulate the establishment of various industries units and projects and use of various environmentally vulnerable materials.
- g. The Environment Court Act, 2000: The Environment Court Act 2000 authorizes the government to prosecute any violation of environmental law of the country and to impose penalty, confiscate equipments or pass decree for compensation for such violation.

## 12.3 National Environment Policy

12.3.1 National Policy: Bangladesh formulated the National Environment Policy (NEP) in 1992. The NEP includes within its scope the protection of marine and coastal areas from all domestic and foreign activities causing pollution.<sup>6</sup> To achieve and implement the policy objectives of NEP, the National Environment Management Action Plan (NEMAP) was adopted in 1994.

## 12.4 Recent Development

12.4.1 The Marine Environment Conservation Act 2004 (proposed): Recently the Department of Shipping has prepared "The Bangladesh Marine Environment Conservation Act 2004 (proposed)" and put up to the Ministry of Law for promulgation.

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## 13 Weaknesses to Control Marine Pollution

13.1 Bangladesh is one of the world's least developed areas in controlling marine pollution. There are several factors that are contributing to the inability of Bangladesh to control marine pollution. Some of these factors are:

- a. Unawareness among the Sea Users: Sea Users of Bangladesh have very little idea on marine pollution and they are not much concerned on this issue.
- b. Lack in Laws Enforcement: Bangladesh lacks in law enforcement at sea which cause hundreds of ships visiting Bangladesh's ports to dump pollutants into the sea.
- c. Poor Organisational Set up: nstitutions exist in Bangladesh relating to marine environment conservation are mostly uncoordinated and institutionally weak. Environmental regulatory bodies are fragmented under various Ministries of the government.
- d. Laissez Faire Approach in Economic Development: Due to the laissez faire approach in economic and industrial policies of Bangladesh, numerous factories and other economic activities have been grown up without any attention to the protection of the marine environment.

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## 14 Ways For Control And Prevention Of Marine Pollution

14.1 Growing Awareness among People: It is sometimes found that awareness works better than law. Thus to control marine pollution effectively, awareness must be grown among the people responsible for causing pollution.

14.2 Implementation of National and International Rules and Regulations: Proper implementation of the related national rules, regulations and international conventions already ratified should be ensured by the concerned authorities.

14.3 Promulgation of Dedicated Laws for the Prevention and Control of Marine Pollution: Appropriate and specific rules should be enacted for the prevention of marine pollution in compliance with International Conventions.

14.4 Declaration of Marine Park and Maritime Protected Area: To preserve bio-diversity and marine fisheries “Marine Park” or “Maritime Protected Area” may be declared in the coastal area of Bangladesh.

14.5 Evaluation and Risk Management: Threats of marine pollution need to be evaluated and risk management is to be planned for better countermeasures. Sources of marine pollution and their location, volume and concentration are to be determined. Concerned agencies and organisations should be equipped with these facilities which will aid them in adopting appropriate countering measures.

14.6 Land-Based Reception and Treatment Plant of Ship Generated Wastes: CPA and MPA may be equipped with waste reception and treatment plants ashore. All the oily wastes, garbage and sewage of ships will be collected in the receptacle tanks of the plant.

14.7 Wastes Receptacle Facilities in the Coastal Cities: Instead of dumping in the low lying suburb of the city, more effective disposal arrangements of the city waste/garbage have to be made ashore.

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## 15 Conclusion

15.1 The relationship between human being and oceans has many facets. Sea provides means of transportation, natural resources, recreation and amenities etc. But human activities in relation to sea uses have primarily been exploitative in nature which has been polluting the sea. Most prominent sources of marine pollution are the land based activities and the ship oriented activities. Eighty per cent of the pollution entering oceans worldwide come from human activities on land. Marine transportation and offshore mineral exploration activities including dumping cause a substantial extent of pollution. Rivers that run into the sea also carry silt, untreated sewage, industrial waste and the assorted rubbish of consumers from the coastal cities and from far inland.

15.2 Bangladesh, a littoral country of the Bay of Bengal, has a vast coastal plain. Human activities both in land and at sea have resulted in contamination of coastal waters. Sewage disposal, industrial effluents, agricultural residues, deforestation etc are causing ecological degradation at sea. Two major cities of Bangladesh are located near the coast. Contaminants from these cities enter the sea water via Karnaphuli and Pussur Rivers. Bangladesh also has a big ship breaking industry along the coast of Chittagong which is another source of pollution. Chittagong and Mongla Ports handle a large number of local and foreign vessels including many fishing trawlers and boats. Various types of pollutants like oil, ballast water, wastes, garbage etc originate from these ship operations and cause marine pollution.

15.3 Marine pollution in Bangladesh need careful study and monitor for its control and protection. A number of ways open to Bangladesh by which it can control marine pollution. These include growing awareness among the people, implementation of rules and regulations, declaration of Marine Park, data management, establishment of land based waste treatment facilities, accidental oil spill fighting capability etc. Immediate attention of the concerned authority is required to take all possible measures for the prevention and control of marine pollution from all the sources.

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## 16 Recommendations

16.1 Considering all the relevant factors related to marine pollution and its effects the followings are recommended for the effective control of marine pollution in Bangladesh:

- a. Awareness on adverse effects of marine pollution to be grown amongst the concerned people.
- b. National and international rules and regulations to be implemented effectively.
- c. Dedicated laws for the prevention and control of marine pollution to be formulated and applied.
- d. Bay of Bengal may be declared as ‘Marine Park’ or ‘Maritime Protected Area’.
- e. Necessary arrangements may be made to evaluate marine pollution threat and risk management which will aid in adopting appropriate countering measures.
- f. Sea ports of Bangladesh may be equipped with waste reception and treatment plants.

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