



South Asia Co-operative Environment Programme and

United Nations Environment Programme *Develop the Regional Action Plan on Marine Litter in South Asian Seas (SAS) Region* (Bangladesh, India, Maldives, Pakistan and Sri Lanka)



Report on the

Regional Workshop to strengthen capacity for
Marine Litter Management in the South Asian Seas
(SAS) region

5 - 6 April 2018, Mumbai, India

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Introduction

Marine environment provides a vital resource base for the socio-economic and industrial development in the South Asian Seas (SAS) region. It includes economic interests such as fisheries, shipping, defence, trade, harbours and allied infrastructure and tourism. Most of these activities linked to marine and coastal sector are concentrated along the coastal belt. Consequently, increased urbanization and growing population pressure on marine and coastal belt have resulted in increased quantity of Marine litter and micro-plastic. The coast of Bangladesh, India, Maldives, Pakistan and Sri Lanka, as part of the SAS region possess delicate ecosystems with rich biological diversity round the island, coastal lagoons, mangrove forests and coral reefs etc are adversely affected by marine litters. It is a big challenge for the SAS region to protect the marine and coastal environment from marine litters and microplastic pollution.

The South Asia Co-operative Environment Programme (SACEP) is an intergovernmental organization of South Asian countries responsible for regional environmental issues. SACEP is also hosting the secretariat of 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). SACEP is mandated to coordinate sub-regional environment policies, strategies and action plans. SACEP is also involved in the capacity building, awareness raising and experience sharing among the member countries. Bangladesh, India, Maldives, Pakistan and Sri Lanka are the member of SASP.

Member States of the United Nations adopted resolution 2/11 "Marine Plastic Litter and Microplastics" during the second session of the United Nations Environment Assembly (UNEA-2) on 27 May 2016 in Nairobi. A global campaign "Clean Seas-turn the tide on plastic" has already been launched on 23 February 2017 during the World Ocean Summit in Bali, Indonesia. Member States were requested to announce their new commitment on action on marine litter. Paragraph 11 of resolution 2/11, requested the Executive Director of UN Environment to provide assistance in the development of national or regional measures and action plans to address marine litter. The resolution also recognizes the need for capacity building, knowledge transfer, awareness-raising and partnership to implement the activities.

In order to substantially reduce marine litter and microplastics, it is essential to develop national and regional policy/action plan and appropriate programmes and measures to reduce volume of litter in the marine environment and to control litter entering the marine environment, both from sea and land-based sources. SACEP Member Countries have requested SACEP to collaborate with UN Environment and assist to implement the activities on marine litter by formulating a regional policy on marine litter management in SAS region. SACEP had developed a regional marine litter management framework in SAS region in 2007 with the assistance of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities. The framework provided recommendations for further implementation. One of the important recommendations

was to develop a regional policy on marine litter management in SAS region. Member countries have no well-structured marine litter management action and as marine litter move irrespective of national territorial boundaries, the need for a regional plan get more importance. In this regard, preparation of a well-planned regional marine litter management action plan and capacity development of the countries can provide a strategic roadmap for the sustainable management of marine litter. As such this project aims to prepare a regional marine litter management action plan for the SAS region.

02. Objective of the activities

The main objective of this project is to strengthen capacity for marine litter management in the SAS region through the preparation of a regional action plan on marine litter.

1. National Marine Litter Action Plan: In preparation for the national action plan, SACEP conducted a desk-top research on the status of the marine litter management in the five-member countries (Bangladesh, India, Maldives, Pakistan and Sri Lanka). In each country, a consultation meeting will be organized inviting stakeholders across sectors including non-governmental organizations and the private sector in order to present the findings and to receive inputs from the stakeholders.
2. Preparation of a regional action plan on marine litter based on national information collection: In preparation for a regional action plan, SACEP conducted a desk-top research on the status of the marine litter management in the five-member countries (Bangladesh, India, Maldives, Pakistan and Sri Lanka). The report will compile existing scientific literatures, monitoring data on marine litter, and relevant national policies and strategies on marine litter. Based on the national reports, a regional report will be prepared as a synthesis on the status of marine litter management in the SAS region. The regional report will present a draft regional action plan on marine litter for the SAS region incorporating findings and recommendations from the national studies.
3. Regional consultation to build consensus: SACEP has organized a regional consultation on the national and regional action plan in order to present the draft and to receive comments from the member States. The Action Plan of the South Asian Seas Programme already approved by IMM (Inter-governmental Meeting of Ministers) has given mandate to SACEP to work on this area. The regional marine litter action plan will be presented to the next IMM of SASP. SACEP will also inform the GC (Governing Council) meeting of SACEP in its next meeting scheduled for late December 2017 for acknowledgement and complement the UNEP support.
4. Implementation of Clean Seas campaign in the SAS region: SACEP will develop awareness and communication materials for use in print and for distribution in electronic means such as social media in order to implement the Clean Seas campaigns in the SAS

region. Such communication materials would include videos, infographics, and brochures as agreed between SACEP and UN Environment. SACEP will develop contents that are fit with the need and the cultural context of the region and the SASP countries. Various events in SAS region including International Beach Cleaning Day are already planned to raise awareness on marine litter in the region. The communication materials will be disseminated at these events as well as online. These activities will help create awareness on marine litter among citizens, public, civil society and private sector stakeholders in the SAS region.

03. Agenda of the Workshop

The agenda for the workshop was composed of informative and technical presentations. It also **included discussions related to the project's work programme and schedule. In addition,** opportunity was provided for updates on progress made in relation to national marine pollution preparedness and response from each country delegation, recognizing that national response systems underpin regional cooperation planning. The details agenda is reported in Annex-I

04. Venue, Dates and Participants

4.1 Meeting Venue

The meeting was held in Mumbai, India at the Sevenska Design Hotel from 5 to 6 April 2018. Each of the five beneficiary countries involved in the project were represented by a delegation comprising a minimum of two persons. These country delegations included key personnel from those Ministries or Governmental Agencies involved in marine litter pollution issue at their country level i.e. the competent national authorities.

In addition to the SACEP Secretariat, number of international organizations were represented at the meeting. This enabled the sharing of experiences from other regions, particularly on day 2 during the technical preparatory workshop. The list of the participants is provided at Annex II.

4.2.1 Day One (5th April 2018)

The workshop began with an opening ceremony and opening Remarks by Director General SACEP (Dr. Muhamad Khurshid) who gave a welcome address proceeded by key note addresses from Host country (Dr.K Somasundar, Adviser, Ministry of Earth Sciences, Govt of India). The speeches were emphasized the importance and role of the SACEP project activities with UN environment to address the risks of marine Litter in the region and the need for collaboration and cooperation. The speeches appreciated both project sponsors and coordinators in facilitating the gathering of the key players in response **within the project's beneficiary** countries so that they could work

together in person and utilize this opportunity to discuss areas of further collaboration and knowledge sharing. The overall importance of protecting the marine environment was highlighted.

The opening ceremony was followed by a technical session, which began with a presentation of the UN Environment - SACEP Project by the Senior Programme Officer, South Asian Sea Programme. **The project's lead consultant then** made an introductory presentation to cover the current status and levels of preparedness in their respective region, the activities undertaken as on date, and the main objectives of the workshop. This was followed by presentations from the national consultants of each of the beneficiary countries, who summarized the national report in their respective countries and any subsequent progress made in the field of preparedness for response to a Regional Status report on Marine Litter. The Regional Technical presentation was made, based on the information of the five-national reports by the Regional Consultant. Summaries of the presentations can be found in section 4- 5 of the report.

4.2.2 Day Two (6th April 2018)

Technical presentations on day 2 allowed to discuss the 1st draft of regional action plan report by the regional project's lead consultant, to share their experiences with key preparedness, response and issues for the preparation of the regional Action plan on Marine litter. The regional Action Plan presentation was well received and has generated a lot of discussion, in particular to the following broad areas:

- a) Contents
- b) Chapters and sections
- c) Analysis
- d) Way forward

SAS countries highlighted their views and comments on the above mentioned potentially areas to adopt well as the administrative burden involved with this process. This lead to discussions on the establishment of funding mechanisms to address the shortfall of funds for the Marine Litter prevention for protection of marine biodiversity. The day ended with a summary of the current version of the regional action plan for Marine Litter response as agreed by the five-member state countries.

As a result of the through discussions during the workshop and the high level of interest in the topics covered, the workshop overran its allocated timeframe and therefore concluded with a short closing ceremony with addresses given by Host Country, Govt. of India and SACEP. All speakers expressed their gratitude to the participants of the workshop for their very active participation and to the project sponsors for facilitating the activity.

05. Summary of Presentations

The full presentation material used in each session, as well as key reference documents and the

agreed amendments to the regional plan in addition to the agreed action plan was distributed to all participants at the close of the meeting on USB stick and is retained on file by the SACEP Secretariat.

05.1 Host Country Presentation:

Dr. K. Somasunder, Adviser, Ministry of Earth Sciences and Dr.M.V. Ramana Murthy, Director, NCCR, Head of the delegation of host country emphasized that implementation of the appropriate action plan aimed for conservation of marine life and resources is essential as oceans cover **three quarters of the Earth's surface**, contain 97 per cent of the **earth's water, and represent 99 per cent** of the living space on the planet by volume. Utilization of ocean resources in a sustainable way is crucial as a large proportion of World's population livelihood depend on marine and coastal biodiversity. Globally, the market value of marine and coastal resources and industries is estimated at \$3 trillion per year or about 5 per cent of global GDP. Oceans contain nearly 200,000 identified species, but actual numbers may lie in the millions. Oceans absorb about 30 per cent of carbon dioxide produced by humans, buffering the impacts of global warming. Oceans serve **as the world's largest source of protein, with more than 3 billion people depending on the oceans** as their primary source of protein. Marine fisheries directly or indirectly employ over 200 million people. Subsidies for fishing are contributing to the rapid depletion of many fish species and are preventing efforts to save and restore global fisheries and related jobs, causing ocean fisheries to generate US\$ 50 billion less per year than they could. As much as 40 per cent of the world oceans are heavily affected by human activities, including pollution, depleted fisheries, and loss of coastal habitats where marine debris play a responsible role. Additionally, presence of micro plastic in the ocean has a direct impact on marine food webs. They emphasized that although their impact of micro plastics have not been realized completely by the South Asian Seas (SAS) Region countries, however, statutory regulations are essential to sustain the marine ecosystem health in the SAS regions. (Annex III)

05.2 SACEP Presentation:

Dr. Sivaji Patra, Senior Programme Officer from South Asia Cooperative Environment Programme (SACEP) made a presentation which covers the objectives of the project in general and the specific objectives of this workshop. He briefly presented the outline of the project starting from the first activity. He mentioned the importance of the workshops and designated national authorities and focal points within the countries. He underlined the risk of marine Litter in the region. He presented the steps taken and historical background for the regional marine litter activities coordinated by SASEP for the SAS region. He mentioned the great achievement on the regional Action Plan could be the beneficiary countries and the supportive role of the SACEP as a secretariat South Asian Seas Program. He finalized his presentation by indicating the general provisions of making the Regional Marine litter Action Plan. (Annex IV)

05.3 Presentations by National Consultants

05.3.1 Bangladesh

Dr. Kawser Ahemad shared the presentation from different study conducted in the various parts of the Bangladesh region. He clears that the main litter in the marine environment come are land-based and some are sea-based origin. Litter can be originated from any sources, land or sea (hydrocarbon production in deep sea). Wherever it is originated, it will come to the sea in some pathways such as different rivers, stream, flood, rain, wind, storms (for land-based source) and currents. In Bangladesh, most of the industries like food industries, garments, bricks, wood, metal, glass, paper mills, plastic factories, medical industries, paint factories and fish processing centres etc situated near the major river such as Buriganga, Shitalakhya, Balu, Turag, Karnaphuli, **Rupsa, Meghna etc. Besides these, "WE" are the source and origin of litter all over the world.** Marine litter varies from place to place; however, some materials are common to be found everywhere. For example-Plastics, Metal, Glass, Processed timber, Paper, Rubber, Cloth. Many studies show that, Plastic is the most abundant litter for all the marine environment and it is up to 80% of all marine litter. In every area, the plastic is the most abundant litter among all other the marine litter. In Katka area there is a difference, may be due to the little area coverage and more so less tourists visit this place. No clean activities present in Katka area. In Kuakata some dustbin are present and Kuakata Union Porishad maintain it. Though, these dustbins were not use properly and it was only available beside some of the beach benches. But the no cleaning activity present in the whole beach. In St. Martin Island, Berger company only provide some bucket near the beach benches for their advertisement. Along the beach no clean activity done by Govt., some NGO done the cleaning yearly but not every year. Plastic found in all area and most abundantly. Then the paper and cloth items are found all the area. During the observation the metal and wood items are not found in Kuakata and Kotka. Rubber and glass items are found in everywhere except Kotka. HE observed that the foamed plastic, cloth, paper and rubber are found almost same in all areas and concluded that a national regulatory action plan to be implemented to avoid unusual disposing to sea.

05.3.2 India:

Dr. Pravakar Mishra, NCCR, MoES, Chennai presented the national marine litter status of India. Peninsular India has a coastline of about 6100 km long. A number of major cities are located along the coast. As the weather is controlled by the monsoonal regimes, most part of the country get proportionate rainfall during May to December months. Cyclones and floods are common natural hazards along the coasts. The coast is endowed with number of major river systems, deltas, lagoon and mangroves. Most of the areas are flood prone. Three metropolitans viz., Kolkata, Chennai and Mumbai located along the coast are exposed to tremendous human pressure and activities. The topography and location of these cities make them usually flood prone during heavy precipitation. The adjacent coasts are subjected to high level of pollution due to direct discharge of untreated sewage, dumping of garbage, industrial flow and agricultural runoff

etc during flooding. Usually, the **term 'hot-spots' is used to describe the heterogeneity observed** in the distribution of marine litter; i.e., there are locations of relatively high abundance. The **mechanism by which 'hot-spots' form depends to a large degree on how plastic moves within and** between different compartments

Currently, in India, the recycling of plastics was 3.6 MT per annum and it provides employment to almost 1.6 million people (0.6 million directly, 1 million indirectly). The per capita consumption of plastics in India is lowest comparing to world scenario, consequently the plastic waste generation is very low. India **recycles about 60% of its plastics, compared to world's average of 22%**. There are 3,500 organized with additional 4,000 unorganized plastics recycling units are in operation. Most of the plastics (PE, PP, PVC, PET, PS,) are recycled via mechanical route. Engineering plastics like PBT, SAN and Nylon etc. are recycled by selected recyclers. Plastic waste contains the calorific value equal to fuel.

Understanding the ocean budget for marine litter and microplastics requires knowledge on both the inventory (stock) and movement (flux). Because it is difficult to quantify the fluxes than the stock, this is an area where even less is known. Alang-Sosiya ship breaking yard is one of the **world's largest ship breaking yard** with an annual turnover of US\$ 1.3 billion . Studies have been made to assess the accumulation plastic debris in the intertidal sediments (81 mg per kilogram) at Alang-Sosiya ship breaking yard and four polymers viz., polyurethane, nylon, polystyrene, polyester, and glass wool has been identified. Ingestion of plastic bags, debris in a stranded adult **female Longman's beaked whale near off Veraval, Gujarat coast** have been reported.

Threat to marine fauna due to ingestion of plastic bags and other non-biodegradable debris scattered on the ocean surface and at the seafloor is increasing at alarming proportions. Mumbai one of the most populous metropolitan cities on the west coast of India generate huge plastic litter. The abundance and distribution of plastic litter was quantitatively assessed in four beaches of Mumbai and their average abundance of 11.6 items m² (0.25 to 282.5 items per m²) and 3.24 g per m² (0.27 to 15.53 g per m²). The colored plastics were predominant with 67 % by number of items and 51 % by weight. More than 80 % of plastic particles were within the size range of 5–100 mm both by number and weight. Probably, the intense use of beaches for recreation, tourism, and religious activities has increased the potential for plastic contamination in urban beaches in Mumbai.

Similarly, Goa state located in the central west coast of India is one of the most famous tourist spots in Asia. The distribution of microplastic pellets along the Goa coast is observed mainly during the southwest (SW) monsoon, and whatever found during the northeast (NE) monsoon or other seasons are those reach coast during SW monsoon due to change in current and transport direction and are exposed to weathering processes. Vembanad Lake is a brackish wetland ecosystem in the southern India, with an area of 151,250 ha. The abundance of microplastics recorded from the sediment samples in the range of 96–496 particles per m² with a mean abundance of 252.80 ± 25.76 particles per m². Low density polyethylene has been identified as

the dominant type of polymer component of the microplastics. As clams and fishes are the major source of protein to the local population, the presence of MPs in the lake becomes critically important, posing a severe threat of contaminating the food web of this lake. The Microplastic particles present in the benthic invertebrates *Sternaspisscutata*, *Magelonacinta* (deposit feeders) and *Tellina* sp. (suspension feeder) from the surface sediments of off-Kochi, southwest coast of India are recorded.

The Lakshadweep islands (36 islands, 10 inhabited) situated off the Kerala coast are made up of coral reefs of Holocene age. The plastic debris abundance was investigated in the Lakshadweep Islands (Agatti, Kavaratti, Bangaram and Tinnakkara) during the northeast (NE) and southwest (SW) monsoon season of 2014 to 2015. A total of 10,778 (average abundance of 134.73 items per m²) pieces of microplastics were found from four Islands, 20% of which was plastic resin pellets. The distribution of plastic debris in Lakshadweep Islands during the SW monsoon is higher than those found in NE monsoon season. Despite the remoteness of the island a considerable amount of plastic debris were collected on the beaches. In both monsoon season, the wind and current pattern are favorable to transport the floating debris from offshore regions to the coast and deposited on beaches of Lakshadweep Islands. The number of pellets found in Tinnakkara Island was three-fold more than those from the Chennai coast. The abundance of plastic resin pellets in Tinnakkara Island could be derived from international tanker route ship accident and/or unintentional release and deposited by hydrodynamics.

The Gulf of Mannar is situated at southeast coast of India and **it is referred as the Biologist's paradise** because of the rich marine ecosystem. It is unique because of the presence of coral reefs, seagrass beds and mangroves, which act as spawning and feeding grounds and as shelter for many species of economically important finfish and shellfish.

Occurrence of shoreline marine litter during the southwest monsoon period was the maximum and the cool winter period was the minimum. The maximum shoreline litter was 94–95 items of 5409-6588 g and the minimum shoreline marine litter was 42 items of 2088g. Three major marine litter items such as plastic (48%), polystyrene (18%) and cloth (15%) were found. Fishing represented the largest source, tourism/recreation was the second and Sewage related debris was the third common source of marine litter.

The Marina beach in the southeast coast of India is the most crowded beach in the country and attracts about 30,000 visitors a day during weekdays and 50,000 visitors a day during the weekends and holidays. During summer months, about 15,000 to 20,000 people visit the beach daily. This beach is extensively used for recreational uses such as swimming, surfing and picnicking generates debris such as food wrappers, plastic bags and cups, trash bags, product containers, toys and floats. Marine litter was collected on four occasions between March 2015 and April 2015 from 10 transects, each 5m wide and 100m long, sorted and categorized by type, quantity and concentration rate along the coastline. The results indicated that the plastic, paper and wood litter occur in the greatest number followed by food waste and metal. The major

contributing factor for the debris abundance in Marina beach is the local recreational activity which suggests that the land-based sources provide major inputs to marine litter pollution at beach. Chennai metropolitan is located on the SE coast of India with 56 km coastline and is the capital city of Tamil Nadu state. Chennai is the fourth most populous metropolitan area and the sixth most populous city in India. The sources, distribution, surface features, polymer composition and age of microplastic pellets (MPPs) in surface sediments along the Chennai coast during March 2015 (pre-Chennai flood) and November 2015 (post-Chennai flood) were surveyed. White MPPs were the most abundant, and specifically Polyethylene (PE) and Polypropylene (PP) were the dominant polymer types of MPPs found on the coast during both the times. The abundance of MPPs in November 2015 was three fold higher than those found in March 2015, confirming that huge quantity of fresh MPPs washed through Cooum and Adyar rivers from land during the flood.

Chilika Lake is the Asia's largest brackish water lagoon situated in Odisha along the Indian east coast. It is one of the biodiversity hotspots and a good source of fishery in coastal wetlands of the entire east coast. Its Nalaban Island bird sanctuary serves as a wintering ground for thousands of migratory and resident birds every year. It is also one of the few lagoons in the world which supports congregation of Irrawaddy dolphins. Plastic litters are entering into the Chilika lagoon from many different sources. These include plastic waste of domestic and industrial origin through rivers and rivulets debouching freshwater into the lake and dumping of damaged plastic nets and **net residues used in 'gheri' culture (pen culture).** Of late, dumping of plastic materials like bottles, packing materials, water pouches, carry bags, etc. has aggravated the situation. The villages surrounding the lagoon have no proper waste disposal and management system, which promotes the addition of residual plastic into the lake system.

Andaman and Nicobar Islands are situated off the eastern coast of India in the Bay of Bengal and are also called Bay Islands. The islands, which have proximity to some of the South East Asian countries like Myanmar, Thailand, Malaysia, Singapore and Indonesia, comprise 572 islands, islets and exposed rocks. The island coast extends to 1912 km, which is almost one-fourth of the Indian coastline. Sea-surface current prevailing in that region might have resulted in debris being circulated continuously in the open sea and coastal areas, and subsequently washed ashore in Andaman coastal areas. The garbage generated in the coastal areas of Sumatra, Singapore, Malaysia, Indonesia and other South East Asian countries and by international shipping services is not disposed properly and dumped directly into the sea. This is taken by the currents and washed ashore on our pristine beaches of the Great Nicobar and Nancowry group of islands.

Apart from this foreign plastic invasion through oceanic circulation, plastic and glass find several ways, like our domestic materials, to enter into our pristine islands and subsequently into the coastal ecosystem, since there is no proper solid-waste disposal practice.

In the Bay of Bengal, debris density increased north of 17°N mainly due to small fragments probably carried in run-off from the Ganges Delta. The densities of floating litter (>1 cm) were greater and more variable in the Straits of Malacca (578 ± 219 items km⁻²) than in oceanic waters

of the Bay of Bengal (8.8 ± 1.4 items km^{-2}). The low densities in the Bay of Bengal relative to model predictions may result from biofouling-induced sinking and wind-driven export of debris items. The Ganges River is the 2nd largest emitter of plastics to the marine environment, and in this study the Bay of Bengal samples had 10 times more plastic particles than the South Pacific. This observation of more plastic film in the Bay of Bengal may be a reflection of coastal population density and their usage of thin film in the form of plastic bags distribution of the marine debris continuously released from the South India region.

He concluded by highlighting the following recommendations essentials to strengthen national action plan for Marine litter: (1) Segregating the collected marine litter especially the plastics into usable recycle products using low cost technology, (2) It should be the responsibility of the manufacturer to get back the possible used plastic products from the consumers by giving incentives, so that the quantity of litter going into the coastal environment can be greatly minimized, (3) Accordingly, public awareness has to be generated, as India does not have a National Marine Litter policy, it is the right time to have a policy that can take care of controlling the litter at the land boundary itself, as it is very difficult to remove the litter once it goes into marine environment, (4) Being plastic litter non-degradable as long as it remains in the marine environment, it constantly harm the biota from plankton to whales and finally the human being, and that demands the need of applying the measures of prevention at the point of origin itself.

05.3.3 Maldives:

Mr. Reefath Naeem presented the vulnerability of Maldives which was highlighted because of its unique distinct features such as its complex geography comprising 1,190 Islands (200 inhabited) and a disparate administrative arrangement, posing a unique challenge with respect to building preparedness and response capacity for marine Litter activities. As of now, Marine litter is one of the biggest environmental challenges in the Maldives. Significant increase in the magnitude of the problem in recent years. Estimated amount of per capita solid waste generation in the Maldives is between 1.7 - 3.5 kg per day and predicted to increase by 4% per annum. No formal studies conducted on typology and pathways of marine litter in the Maldives, except for ghost nets. Waste is generally not segregated at household levels. In community islands, waste is generally dumped in to the island foreshore, which is piled in a long row parallel to the sea and periodically burned to reduce the volume of discard. The remaining waste kept on the site for long term as well as those that are directly thrown on the beaches then tend to get carried away into the ocean by winds and tides. The most common practice for resorts is to separate food discards from other wastes and to dump them in the ocean outside their atoll often with the bag which the waste is contained in. Local community islands, 4.4% of households dispose general waste and 63% dispose kitchen waste into the seaside or beach. Tourist resorts and marine vessels, they dump food waste into the sea, sometimes in open channels. Debris blown into the sea from landfill islands and their impacts have not been formally quantified and identified completely in Maldives i.e a. Negative impact on human health and food safety, b.

snorkelers/divers may get entangled in submerged debris, c. Navigational hazard – and cause accidents d. Debris on shore can cause abrasions and cuts to beach users, e. Risk of infection through medical and sanitary waste and f. Ingested microplastics and chemical substances have the potential to disrupt cellular processes and damage tissue in organisms. At the conclusion of this presentation, he proposed to a. Build technical capacity to monitor and enforce compliance with legislation and polices on litter and solid waste management. ,b. Removal of marine litter from shorelines, benthic habitats and pelagic water, develop and implement a national education and outreach program on marine litter impacts, prevention and management to minimize the amount of both land and sea-based sources of marine litter and establishment of an integrated water management system with a strong communication strategy.

05.3.4 Pakistan:

Mr. Abdul Munaf Qaimkhani shared his presentation. Pakistan coast is about 1001 km long extending from the Indian border in the east to the Iranian border in the west. The maritime area of Pakistan extends up to Exclusive Economic Zone (EEZ) of 200 NM covering an area of about 240,000 sq. km. In addition, an area of about 50,000 km² of the Continental Shelf has been recently added to the maritime areas of Pakistan. Pakistan produce roughly more than 20 million tons of municipal solid waste with annual growth rate of 2.4 percent. Release of industrial and solid waste into the sea is serious environmental issue effecting millions of coastal population and marine ecosystem. Solid waste in Pakistan is generally composed of three categories:

1. Biodegradable: food waste, animal waste, leaves, grass, straws, and wood
2. Non-biodegradable: plastic, rubber, textile waste, metals, fines, stones
3. Recyclable material: paper, card board, rags and bones

Marine litter also introduced by people that use the beaches for recreational activities such as swimming, sailing and scuba diving. No authentic inventories on the potential sources and **quantity of marine debris have been compiled 65% of garbage that litter beaches along Pakistan's** coast consist of plastics. Marine pollution has tremendous economic, health and biodiversity costs. It poses a great threat to marine life including marine turtles, dolphins, whales, different species of birds . Floating debris create hindrances in smooth navigational operations. Dumped waste in the ocean eventually washes up on beaches and ruins beach aesthetic values and tourism . Polluted beaches pose a higher risk of catching diseases. Negative impact on marine fisheries resources and fishermen community. The following short and long-term steps required to overcome on the issue of safe waste disposal in Pakistan, such as:

- a. The provincial administrations of Sindh and Balochistan evolve a working strategy with municipalities, take stock of the situation and set priorities;
- b. PPP options can be explored for specialized domains such as hospital waste management;

- c. Research institutions, NGOs, and International agencies need to support in dissemination of best practices;
- d. Promote an integrated approach in dealing with different types of waste with particular focus on plastic debris;
- e. Launch marine pollution control programs with adequate legal cover and policies;
- f. Develop strong and robust monitoring mechanism to deal with marine plastics debris;
- g. Encouraged recycling to reduce the pressure of plastic debris releases into water bodies.

05.3.5 Sri Lanka

Mr.A.J M Gunushekara,National Consultant has presented the national Marine Litter activities in Sri Lanka. The amount of waste generated has been increased significantly with the development of economic status and the population of the country during last two decades.The urban areas people generates the higher amount of waste than that of the rural areas people.The present urban population of the country is 19. 2% of the total population. The urban populations are expected to grow from 4 million to 6.5 million in 2030 as the annual rate of change of urbanization is 1.36%. At present the municipal waste generation in Sri Lanka is around 6500 to 7000 Mt/per day Per capita waste generation is varying from 0.4 to 1kg per day based on the living status and areas of living. Present municipal solid waste collection of the country is 3500 Mt /d. The collection capacity is nearly 50 percent of the total waste generated. There are nine provinces in the country and the waste generated is varied in each province while the western province contributes 58 percent of the total waste generated.

Marine Debris has become a one of the major threat to the marine environment of Sri Lanka. The five provinces of the country have coast line and these five provinces population is relatively higher than the other provinces. The 35 % of the total population is located in the coastal region while 65 % of organized industries are located in the coastal region. The tourism industry of the country, mainly concentrated in the coastal region. Nearly 80 percent of the tourism related infrastructures are located in the coastal region. The fisheries industry is one of the main industry and which mainly rely on the coastal and marine environment and recommended to Introduce integrated National Marine Debris Management policy, strategy and management plan, Intensive management of marine debris sources Building of marine debris collection system, building of marine debris disposal and recycling, Customized education and research, further strengthen public private partnership. Use of market-based instrument for reduce and manage marine debris, Regional and international cooperation. (Annex V)

06. SAS Regional Consultant Presentation:

Dr. Anil Premaratna, Regional Consultant, presentation was prepared using information in the country reports which were prepared by the country expert selected by the SACEP. In addition to the country report information it was also included information through the available reports and literature on marine litter. The first part of the presentation was included to explain the present

status of the marine litter in the South Asian Seas (SAS) region and the second part was the management strategies available for marine litter management and status of the marine litter management strategies used by the SAS countries to manage the marine litter. The first part of the presentation, it was briefly explained each SAS coastal countries status of the marine litter quantities and their impacts to the environment, economy and society.

The second part of the presentation explained the management strategies available for marine litter management. In this section, it was highlighted the status of implementation experiences of each management strategies by each country through tables. (Annex VI)

Finally, all participants were requested to make some amendments on the national marine litter information in specific tabular form on the prospective information to develop the regional action plan (Annex VII)

07. Conclusion

The benefits of the regional workshop were numerous. The participants took keen interest in the topic and project, and either keen to assist their regional partners in building preparedness and response capacity for marine Litter to find out how other countries in the region are approaching this challenge. There was a lot of knowledge sharing, detailed discussion and offers of assistance made amongst the participants. The advantage and further value of the said meeting was very clear as in preparation to the regional Marine Litter action plan.

In relation to the UN Environment-SACEP Project, the requirement for consultation with the SACEP Governing Council in relation to amending or updating the Regional Action Plan. Therefore, the updated plan as agreed by the delegations represented at the workshop, in addition, to their recommendations for the future maintenance and implementation of the plan and the corresponding role of SACEP will be raised at the next planned meeting of the SACEP Governing Council as well as Inter Ministerial Meeting of SACEP.

The national consultants also shares their respective marine litter action plan with the audiences of the SACEP parallel events on the 8th 3R forum at Indore, India on 10th April 2018. Participants took interest in the Marine Litter recycling opportunity and challenges in the SAS region and also share views and comments.

The final report of the Marine litter Action Plan will be launched on the 2nd June 2018 at New Delhi, India in a side event of the World Environment Day 2018. As the theme of the World Environment Day 2018 is *Beat Plastic Pollution*, the SACEP Marine Litter Action Plan is well suited to the overall event in India.

Annexure-I



Mumbai

05-06th April 2018

REGIONAL WORKSHOP TO STRENGTHEN CAPACITY FOR MARINE LITTER MANAGEMENT IN SOUTH ASIAN SEAS (SAS) REGION

AGENDA

Goal of the meeting

To strengthen capacity for marine litter management in the South Asian Seas (SAS) region through the preparation of a regional action plan on marine litter.

Objectives of the Meeting

- Catalyse policy change and action to improve marine litter management in the South Asian Seas Region.
- Strengthening capacity for marine litter management in the South Asian Seas Region.
- Raise awareness on marine litter in the region through the implementation of the Clean Seas campaign.

Outputs

- A regional action plan on marine litter for the South Asian Seas Region.
- Five national reports on the status of marine litter management in SACEP countries that support the South Asian Seas Action Plan Information materials such as videos, booklets and infographics for the region.

Venue

- Svenska Design Hotel, SAB TV Road, Off Link Road, Andheri West, Mumbai, Maharashtra, Pin code- 400053, India



Ministry of Earth Sciences
Government of India



SACEP
South Asia Co-operative
Environment Programme



UN environment
United Nations
Environment Programme

Annexure-I



Mumbai

05-06th April 2018

Day 1- Thursday, 5th April, 2018	
08:30 - 09:00	Arrival and Registration of Participants
09:00 - 10:00	Opening Ceremony
	Opening Remarks by SACEP <i>(Dr. Muhamad Khurshid, Director General, SACEP)</i>
	Opening Remarks by UNEP
	Keynote address by Host Country (India), Ministry of Earth Sciences
	Vote of Thanks <i>(Dr. Sivaji Patra, Senior Programme Officer, SASP,SACEP)</i>
	Group Photo
10:00 - 10:30	Coffee Break
10:30 - 10:45	Marine Litters and SAS region <i>(Dr. Sivaji Patra, Senior Programme Officer, SASP,SACEP)</i>
10:45 - 11:00	National Status report presentation, Bangladesh <i>(National Consultant)</i>
11:00 - 11:15	National Status report presentation, India <i>(National Consultant)</i>
11:15 - 11:30	National Status report presentation, Maldives <i>(National Consultant)</i>
11:30 - 11:45	National Status report presentation, Pakistan <i>(National Consultant)</i>
11:45 - 12:00	National Status report presentation, Sri Lanka <i>(National Consultant)</i>
12:00 - 12:30	Global and Regional Status Report Presentation <i>(Regional Consultant)</i>
12:30 - 13:30	Lunch Break
13:30 - 16:30	Technical discussion for the development of Regional Action Plan based on the national status reports (Coffee Break 15:00 – 15:30)



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Annexure-I



Mumbai

05-06th April 2018

Day 2-Friday, 6th April,2018	
09:00-12:30	Review 1 st Draft on Regional Marine Litter Action Plan of SAS region (Coffee Break 10:00 - 10:30)
12:30-13:30	Lunch Break
13:30-15:00	Preparation of 2 nd cum final Draft on Regional Marine Litter Action Plan for SAS region.
15:00-15:30	Coffee Break
15:30-16:00	Closing Ceremony
	Closing Remarks by SACEP
	Closing Remarks by UNEP
	Closing Remarks by Host Country
16:00	End of Workshop



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UN environment
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Environment Programme

Annexure-II

Regional Workshop to strengthen capacity for Marine Litter Management in the South Asian Seas (SAS) Region			
05 - 06 April 2018, Mumbai, India			
NAME OF DELEGATION	DESIGNATION	INSTITUTION & ADDRESS	Country
Dr. Sultan Ahmed	Director (Natural Resources Management and Research)	Department of Environment, Agargaon, Dhaka - 1207, Telephone-Office+88 02 8181784, Telephone-Mobile+88 01552 28617 Email: sulbul2002@yahoo.com	Bangladesh (Absent)
Mr. Mohammad Kawser Ahmed	Chairman	Department of Oceanography University of Dhaka Dhaka-1000 Telephone -Office +880 29661920-59 ext. 7779 Telephone-Mobile +8801711951710 Email: kawser@du.ac.bd / kawser_du@yahoo.com	Bangladesh (Absent)
Dr. K. Somasundar	Adviser	Ministry of Earth Science, Prithvi Bhavan, Lodhi Road, New Delhi, Telephone -Office +91 11 24669513 Telephone-Mobile +91 9868773262 Email: soma-dod@nic.in	India
Dr. M. V. Ramana Murthy	Scientist - G (Head of the Host Country Delegation)	Room No.308, 2nd Floor, NCCR, NIOT Campus, Pallikaranai, Chennai-600 001 Telephone- Office +91 44 66783585 Telephone -Mobile +91 9444399819 Fax +91 44 66783487 Email : mvr@icmam.gov.in	India
Capt. K. P. Jayakumar	Dy. Nautical Advisor-cum Sr. DDG(Tech)	DIRECTORATE GENERAL OF SHIPPING, MUMBAI Telephone-Office +91 2225752048 ext 217 Telephone-Mobile +91 9049072719 / 9422641552 Email: jayakumar-dgs@nic.in	India
Dr. Pravakar Mishra	Scientist-F	ICMAM Project Directorate, NIOT Campus, Pallikarnai, Chennai Telephone-Office +91 044 66783591, Telephone-Mobile: +91- 9444054364 Fax: 044-66783487 E-mail: mishra@icmam.gov.in, pravakarmishra@yahoo.com	India

Annexure-II

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Dy Comdt. Ravindra G Gokhale (0937-D)	Coast Guard	Indian coast Guard Headquarters, Coast Guard Region West, Worli Seaface, Mumbai 400030 Telephone -Office +91 22 24370843 Telephone-Mobile +91 9869510438 Email: bhupenravi@gmail.com	India
Dr. P. Vethamony	IIT Mumbai	Telephone-Mobile: +91-9422845270 E-mail: vethamony@gmail.com	India (Absent)
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Ms. Eenas Mohamed	Environment Analyst	Environmental Protection Agency Green Building Hadhuvaree higon Male City Telephone- Mobile+960 7863118 Email: enas.mohamed@epa.gov.mv	Maldives
Me. Fayyaz Rasool	Manager	Marine Pollution Control Department, Karachi Port Trust (KPT), Ministry of Maritime Affairs, Karachi. Telephone -Office+92 21 99210425 Telephone-Mobile+92 333 2371492 Email: fayyaz19us@yahoo.com	Pakistan (Absent)
Mr. Abdul Munaf Qaimkhani	Deputy Inspector General of Forests (Retd)	Ministry of Climate Change Telephone -Mobile +92-321-5259339 Email: amqaimkhani@yahoo.com / amqaimkhani57@gmail.com	Pakistan (Absent)
Dr. P. B. Terney Pradeep Kumara	General Manager	Marine Environment Protection Authority, No.758, 2nd Floor, Baseline Road, Colombo 09 Telephone -Office +94 11 4615960 Telephone -Mobile +94 715169820 Fax +94 11 461 5960	Sri Lanka

Annexure-II

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Dr. Anil Premaratne	Chairman	National Aquatic Resources Research and Development Agency , Crow Island, Colombo 15, Telephone -Office +94 11 2521000 /2521006 Telephone -Mobile +94 718407395 Email: premaratnaanil@yahoo.com/ chairman@nara.ac.lk	Regional Consultant
Dr. Muhammad Khurshid	Director General	South Asia Co-operative Environment Programme (SACEP), 69/4, Maya Avenue, Sri Lanka Telephone-Office : +94 11 2589376 Fax: +94 11 2589369 Email: khurshid@sacep.org	SACEP
Jacintha S. Tissera	Administrative Officer	South Asia Co-operative Environment Programme (SACEP), 69/4, Maya Avenue, Sri Lanka Telephone-Office : +94 11 2504708 Fax: +94 11 2589369 Email: jacintha.tissera@sacep.org	SACEP
Dr. Sivaji Patra	Senior Programme Officer - Regional / SASP	South Asia Co-operative Environment Programme (SACEP), 69/4, Maya Avenue, Sri Lanka Telephone-Office : +94 11 5621320 Fax: +94 11 2589369 E-mail: spor_sasp@sacep.org	SACEP

Presentation Reading Pattern

1

2

3

4

5

6

Marine Litter in the South Asian Seas: Challenges and Opportunities

- ✓Background
- ✓Rationale
- ✓Approach
- ✓National Commitment

April 5, 2018, Mumbai
Ministry of Earth Sciences(MoES)

Background- Facts of Plastics

- 8 Million ton/y (1/3)
- 250 MT by 2025
- 10 trillion pieces
- Drift/spread
- Degradation
- Marine Biota – Mass mortality
- ingestion/entanglement ~700 species
- Vast space
- 2011 – IUCN- Joint Declaration (34)
- 2015 – UN SDG (193)
- 2016 – CBD (196)

Sources of Marine Pollution



80% land-based activities!



Rationale

Global

(13BCM, 50%O2, 30% CO2, 90%trade, 97%water , 0.2 m species, 200 m fishers,, 3 B protein, 40% ocean, 300 B economy)

Regional

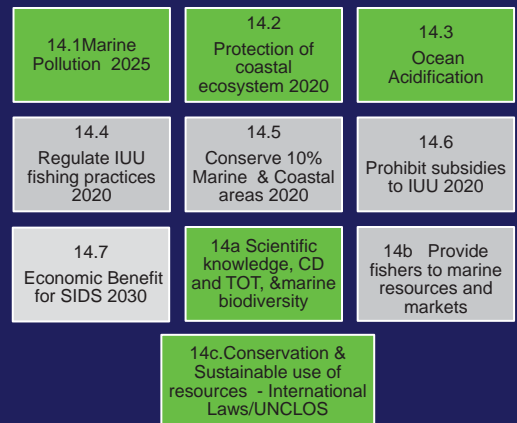
(SAS , Anoxic, 400 m, poor, 70% oil, Pollution, warming, ESA)

National

(8000km, 2.20 m.sqkm, 1300 island, 4.32 mt fish(14,5 m fishers, 25 MPA covering 10K sqkm, coral, mangrove)

SECTOR PRIORITY	ACTION
Private	<input type="checkbox"/> Footprint disclosure <input type="checkbox"/> Improve waste management <input type="checkbox"/> Reduce use and recycle <input type="checkbox"/> Content labelling <input type="checkbox"/> Support research to reduce impacts <input type="checkbox"/> Design for recycle
Public	<input type="checkbox"/> strategies for waste management <input type="checkbox"/> Collaborative research with local scientists <input type="checkbox"/> Develop guidelines and regulations <input type="checkbox"/> Use deposit schemes to encourage recycling <input type="checkbox"/> Consult with the private sector about mitigation <input type="checkbox"/> Eliminate or heavily tax single-use
Civil	<input type="checkbox"/> Develop and promote footprint tools <input type="checkbox"/> Make linkages in supply chains visible <input type="checkbox"/> Campaigns to make litter socially unacceptable <input type="checkbox"/> Articulate linkages from land-based to marine biodiversity loss <input type="checkbox"/> identify and expose the largest polluters

HOLITIC APPROCH -SDG-14



SDG 14 TARGETS of MoES

14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution

14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans

14.3 Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels

14(a) Increase scientific knowledge, develop research capacity and transfer marine technology, enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries

14(c) Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in UNCLOS

Mandate

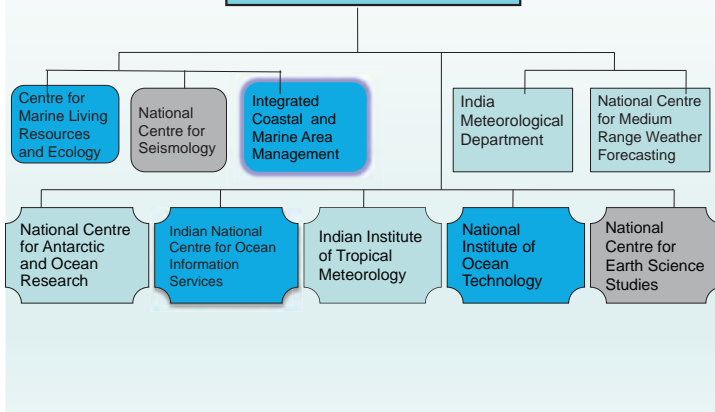
A knowledge and technology enterprise in the Earth System Science for public safety and socio-economic benefits

- Promote scientific research in Earth System sciences as a whole comprising the atmosphere, hydrosphere, cryosphere and the geosphere,
- Provide the best possible Information advisory services to various sectors for conservation of marine resources
- Conduct research survey and develop technology for harness ocean resources in sustainable way



The interactive Earth System

Ministry of Earth Sciences



Our mission

“Provide the Ocean Information and Advisory Services to Society, Industry, Government Agencies and Scientific Community through Sustained Ocean Observations and Constant improvements through Systematic and Focussed Research”.

Our stake holders

All those who depend on Sea for livelihood and those who leave on the coasts

- Fishermen
- Navigators
- Ports & Harbours
- Maritime Industries
- Navy & Coast Guard
- Disaster Management agencies
- Coastal population
- Academia and Researchers

INCOIS

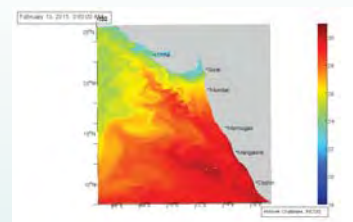


Marine Observation System Along Indian Coast (MOSAIC)

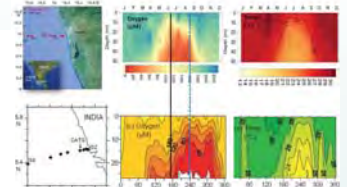
Towards establishing sustained coastal observatories to monitor and understand coastal processes for now-casting and forecasting water quality

Motivation for MOSAIC

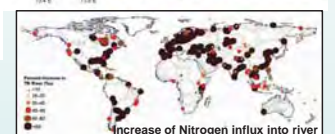
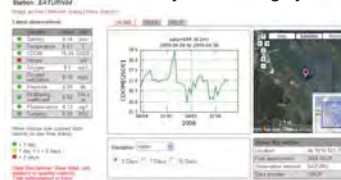
Operational: Coastal water quality
Model + data = Better forecasts



Scientific: Process studies



Water Quality Now-casting System



MOSAIC Plan, Aim and Deliverables

AIM



Proposed locations for establishing MOSAIC (shown as yellow dots) and proposed glider tracks (shown as green line)

- To establish sustained time-series observation using automated moored buoy at six different locations along the Indian coast to monitor and now-cast water quality of the Indian coastal waters.

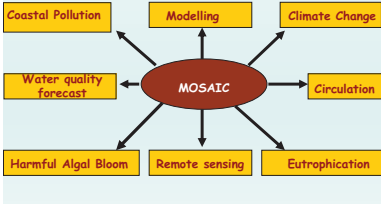
- To sample entire coastal ocean extensively using modern tools such as Gliders (with BGC sensors), uCTD etc

Deliverables

- To establish coastal water quality observation system for the now-casting of water quality parameters.

- To establish operational water quality forecasting system for the selected Indian coastal stations using high resolution location specific model with data assimilation in real-time

- To provide data and information to validate climatic change models and help to construct forecasting models to predict episodic events, occurrence of harmful algal blooms, and



14.1 Marine Observation System Along Indian Coast (MOSAIC)

14.1 Development Ballast Water Treatment Facility

- Establishment of lab based, land based and ship board facilities as per IMO guidelines.
- Monthly survey to generate baseline data on physico-chemical and biological parameters for inlet water quality during pre-monsoon, monsoon and post-monsoon seasons.
- Development various instruments facility and their calibration.
- NABL Accreditation for lab.
- Establishment of seawater intake system (open sea) and freshwater intake system from Swarnamukhi River.
- Construction of storage tanks.
- Development of surrogates rearing facility.
- Awareness development through workshops and conferences.



Water quality sampling sites



Layout of BW Test Facility

14.a Energy from Oceans- Ocean Thermal Energy Conversion (OTEC) Plant at Kavaratti

Future Activities

- Setting up of Ocean Thermal Energy Conversion (OTEC) powered desalination plant at Kavaratti in Lakshadweep

International Energy Agency – Ocean Energy Systems forum (IEA – OES)

India is now a member country of the IEA - OES. Under this,

- A 5 kW wave energy turbine will be designed and fabricated for testing at break water based OWC in Mutriku, Spain (an open sea test facility)
- India is one of a group of countries trying to start a multi-country task on OTEC
- The scaled up wave energy device for islands is being envisaged with participation from organizations within as well as outside India

Desalination – Fresh Water from Oceans

Island Desalination

- First ever plant in the world was installed at Kavaratti from concept to commissioning using naturally occurring temperature difference in 2005
- Subsequent plants at Minicoy and Agatti in 2011
- Setting up LTTD plants at other islands of Lakshadweep is on the anvil



1MLD Barge Mounted LTTD Plant

1 MLD plant on barge Sagar Shakthi, single point moored in deep waters was successfully demonstrated and good quality water was produced



Design for large scale desalination plants

2 x 1 MLD LTTD Plant at TTPS
Design for the establishment of Waste Heat Recovery LTTD plant in 2 modules each of 1 MLD capacity was completed

10 MLD offshore floating LTTD Plant

Preparation of a DPR for design and installation of an all weather platform mounted low temperature thermal desalination plant was completed

- Low temperature thermal desalination technology at North Chennai Thermal Power Station using condenser reject waste heat
- The desalination plant setup in 2008 is being continuously operated and fresh water is being generated
- The plant is able to generate fresh water of 2ppm

- Design, Fabrication, Testing and Installation of Solar Multi-Effect Distillation System for providing potable water in arid rural areas
- A 6 m³/hr Solar/Biomass based MED Desalination System was developed with technical support from NIOT, at Narippayur, Ramanathapuram



Ocean Monitoring Forecast System for RIMES member Countries (Seychelles, Sri Lanka and Maldives)



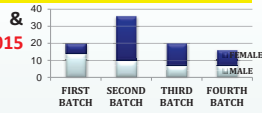
Reception Station 2

Deployment location



ORNAMENTAL HATCHERY UNIT AT AGATTI ISLAND

Parliament Standing Committee on Science & Technology visited hatchery on : 23rd Nov 2015 and 21st Jan 2016 .



Marketed by Society (Marine Aquatech Fish farmers Association-MATFA) . Each members earn an additional income through this.



Visit of PSC on S&T under the Chairmanship of Shri Bupendra Singh on Jan 21st 2016

14.2 Shoreline Management for Coastal Protection

Shoreline change maps of Indian coast (1990-2015)



- > About 30-45% of shoreline is experiencing erosion
- > Existing ~200 harbours & ports
- > Sediment transport rates varying 0-1.5 Mm³/year
- > Sea level rise, changed sea state- Impact on coast

Kerala



Pondicherry



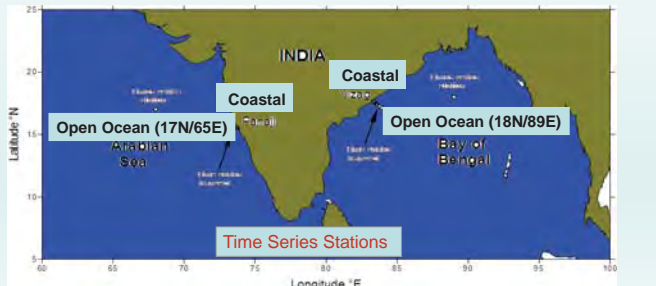
14.3 Ocean Acidification

Coastal & Estuary

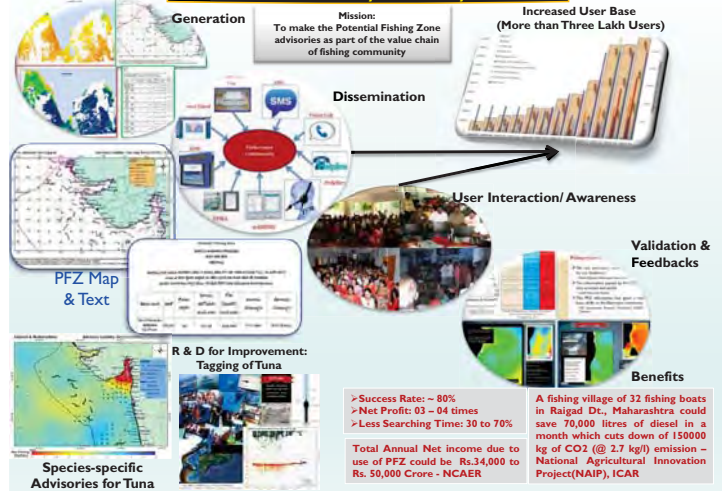
- Monitoring of Biochemical Processes
 - Estuarine Dynamics
 - Atmospheric Deposition
- Anthropogenic Impact on SW Coast
 - Heterotropic Bacteria

Open Ocean

- Monitoring of Biochemical Processes
 - Microbial Community – denitrification
 - Tropical level evaluation
 - Assessment of macro/meiobenthos
 - Fluxes through Th234
 - Anammox – Nitrogen loss
 - Biogeochemical modelling



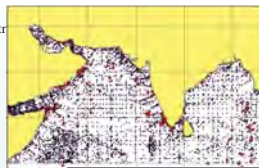
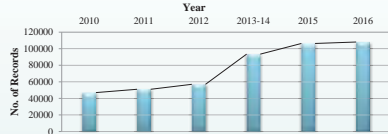
14.a Marine Fishery Advisory Service



Integrated Taxonomic Information System (IT IS)

1. Indian Ocean Biogeographic Information System (IndOBIS)

- ✓ 1,22,086 records (to date)
- ✓ 1095 voucher specimens from Indian EEZ maintained at FORV Referral Centre



2. Census of Marine Life (CoML)

- ✓ Bar-coding of around 800 deep sea samples collected from Indian EEZ, sequences submitted to Biotechnology Information (NCBI)

New Records Identified and Bar-coded

- Mammals
- Reptiles
- Fishes
- Ascidians
- Echinoderms
- Arthropods
- Molluscs
- Polychaeta
- Chaetognaths
- Cnidarians
- Bryozoans
- Sponges
- Sea weeds
- Phytoplankton
- Rotifers

Whale Stranding at Manappad (Tuticorin) on 13th January 2016

✓ Bar-coded and identified as *Globicephala macrorhynchus* and deposited in NCBI

Target	Global indicator	National Indicator
14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution	Index of coastal eutrophication and floating plastic debris density	Health index of area of coastal water in terms of percentage
14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans	Promotion of EEZ managed using ecosystem –based approaches	Percentage change in area under mangroves
14.3 Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels	Average marine acidity measured at agreed suite of representative stations	Coral health index of EEZ of India
14a Increase scientific knowledge, develop research capacity and transfer marine technology, enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries	Promotion of total research budget allocated to research in the field of marine technology	Allocation of budget resources for research as per the EEZ or coast line
14c Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in UNCLOS	Number of countries making progress in ratifying accepting and implementing through legal, policy and institutional frameworks, ocean-related instruments viz UNCLOS conservation and sustainable use of resources	Percentage compliance of international laws.



Thank You



Marine Litter and South Asia Seas Region



Dr. Sivaji Patra

Senior Programme Officer (Regional), South Asia Co-operative Environment Programme (SACEP)



REGIONAL WORKSHOP TO STRENGTHEN CAPACITY FOR MARINE LITTER MANAGEMENT IN SOUTH ASIAN SEAS (SAS) REGION
Sevenska Design Hotel, Mumbai, India,
5-6th April, 2018



ACKNOWLEDGEMENT

Slides materials are taken from below sources and I appreciate their contributions and their kind permissions in generating this presentation.

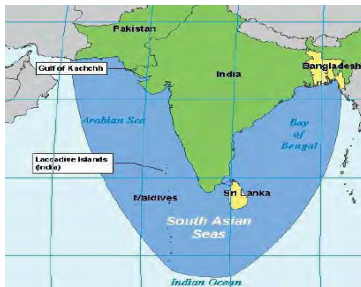
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16. https://www.huffingtonpost.com/entry/plastic-trash-animals-photos_us_58e9e61e46069948914df
17. www.beatpollution.org



SACEP and South Asian Seas Programme (SASP)



- Action Plan for SASP (sub-regional agreement) was formally adopted at a Meeting of Plenipotentiaries of the concerned countries held in New Delhi, on March 24th 1995.
- SACEP act as the secretariat for the implementation of the SASP.
- The overall objective of the SASP is to protect and manage the marine environment and related coastal ecosystems of the region in an environmentally sound and sustainable manner.



The 18 Regional Seas



Although there is no regional convention yet, SAS programme follows existing global environmental and maritime conventions and considers Law of the Sea as its umbrella convention.



Important Features of South Asian Seas Region

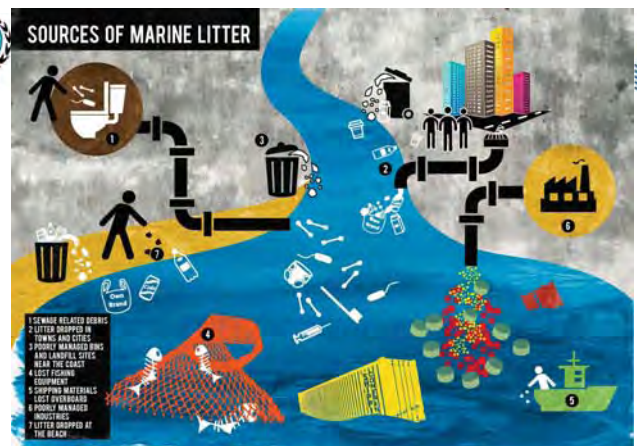


• The Action Plan in addition to specifying the needs under the main components of Environmental Assessment, Environmental Management, Environmental Legislation & Institutional and Financial Arrangements, identified the following priority areas:

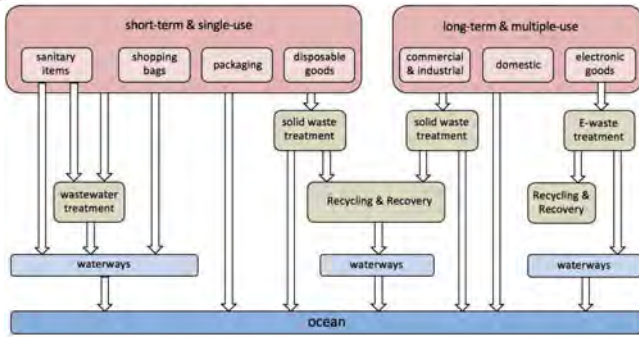
- ✓ Integrated Coastal Zone Management (ICZM),
- ✓ oil-spill contingency planning,
- ✓ human resource development and
- ✓ the environmental effects of land-based activities.



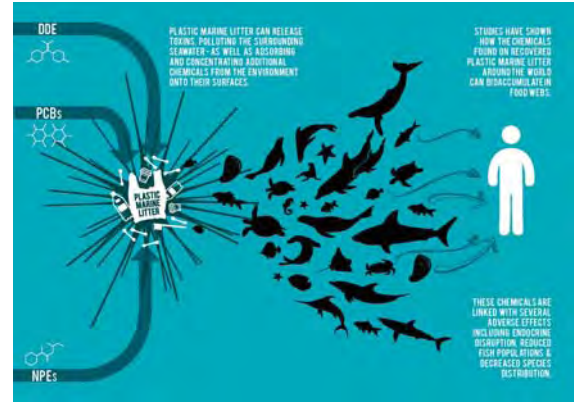
- IMO
- UNEP-GPA & Coral Reef Programme
- FAO
- Bay of Bengal Large Marine Ecosystem
- USDA
- Private Sector/Shipping Associations
- Other regional and sub-regional agencies



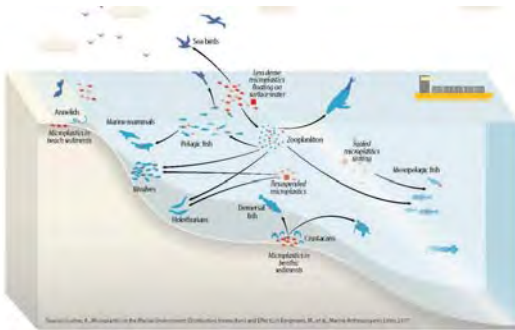
Marine Litter :100% Human Origin



Causes of Marine Litter

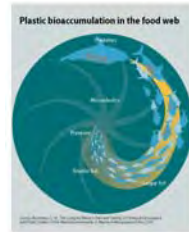


Ecological impacts of marine plastic debris and microplastics



✓ Potential pathways and its biological interactions

✓ Potential trophic routes in marine vertebrate and invertebrate



Marine Litter Activities at SACEP

A. SACEP has developed and published the following documents* on marine litter with the technical and financial support of UNEP.
(* The documents were formatted according to the guidelines of UNEP.)

- 2007: Marine Litter in the South Asian Seas Region
Part-1: Review of Marine Litter in the South Asian Seas (SAS) Region
Part-2: Framework on Marine Litter Management in SAS Region.
- 2007: Involved with UNCRD and IPLA in 3R activities for over a decade and is the partner for the IPLA for South Asia and have conducted consultative workshop on 3R at Dhaka, Bangladesh.

B. Prior to those activities, SACEP was also actively involved on Solid Waste Management in South Asian region and has done the following activities:

- ✓ Scoping Exercise on E-Waste Management in South Asia in New Delhi, India in 2007 in collaboration with the Development Alternative (DA).
- ✓ Organized the 'South Asian Games Waste Management Programme' at the South Asian Games held in Colombo, Sri Lanka in 2006.
- ✓ Supported the International Beach Cleaning week in SAS member states.
- ✓ Demonstrated plastic recycling machine at 2017 Beach cleaning campaign and donated it to the Marine Environment Pollution Authority, Sri Lanka for plastic recycling on regular basis.
- ✓ Plastic recycling enterprise survey in Colombo, Sri Lanka

2007: Marine Litter in SAS Region

Part-1: Review of Marine Litter in the South Asian Seas (SAS) Region

- ✓ From the available data it could be inferred that the major sources of marine pollution including debris/litter are domestic/industrial wastes, ports and harbours including fishing harbours and landing centres, ship breaking yards, fish/food processing industries, tourist resorts/beaches, solid waste dumping, urban runoff, oil rigs, coastal aquaculture, fishing industry including fishing gear, shipping including garbage from ships, recreational and leisure use, marine mining, construction activities, etc.
- ✓ Except for scanty information on beach litter, there is no information/data available on the open ocean floating and submerged marine litter/debris, as no systematic monitoring/sighting of such debris has so far been undertaken in this part of the South Asian Seas.
- ✓ There are no data available either on the economic loss due to marine litter problem, or on the negative impact of marine litter. Stray instances of entanglement of fish and endangered marine fauna are reported from the Indian waters.

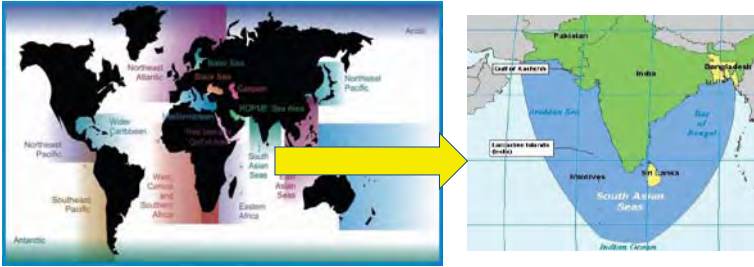
2007: Marine Litter in SAS Region

Part-2: Framework on Marine Litter Management in SAS Region.

- ✓ Marine Litter management is not a priority issue in any of the countries in the SAS Region.
- ✓ Currently, the SAS Region does not have any specific national or regional projects that deal exclusively with the issue of marine litter.
- ✓ The framework document also underscores the need for development of best practice guidelines for waste management which includes, waste avoidance, waste reduction, waste segregation, waste reuse, waste recycling or reclamation, waste treatment and waste disposal; Waste Management Plan incorporating waste reception facilities; and methods of disposal of different kinds of wastes as per MARPOL 73/78 Annex - I, II, IV & V.



South Asian Seas region (SAS)



Coral Reef in SAS region



- 1 Bangladesh - St. Martin's Island
- 2 India - Andaman and Nicobar Islands
- 3 India - Gulf of Mannar
- 4 India - Lakshadweep
- 5 India - Malvan coast
- 6 India - Gulf of Kachchh
- 7 Maldives
- 8 Pakistan - Astola Island and along Balochistan Coast
- 9 Sri Lanka - Gulf of Mannar and in coastal waters



Mangroves in SAS region



- 1 Bangladesh - Sundarbans
- 2 India - Sundarbans
- 3 India - Andaman and Nicobar Islands
- 4 India - Cauvery Delta
- 5 India - Gulf of Mannar
- 6 India - Gulf of Kachchh
- 7 Pakistan - Indus River Delta, Sindh
- 8 Pakistan - Balochistan coast
- 9 Sri Lanka - Gulf of Mannar and along the coastal lagoons and estuaries.



Mangroves are also present along coastal lagoons and estuaries on east and west coasts of India and Sri Lanka
Mangroves are scarce in the Maldives.



Seagrass meadows in SAS region



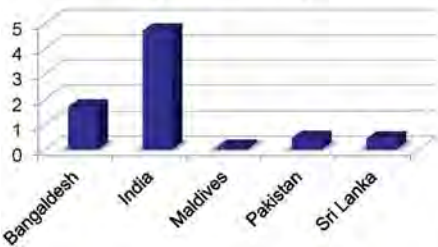
- 1 Bangladesh - Mainly along the eastern coast (scanty)
- 2 India - Andaman and Nicobar Islands
- 3 India - Gulf of Mannar & Palk Bay
- 4 India - Lakshadweep
- 5 Maldives
- 6 Sri Lanka - Gulf of Mannar & Palk Bay



Fisheries Production in SAS region (2010)



Total Fisheries Production (Million tonnes)

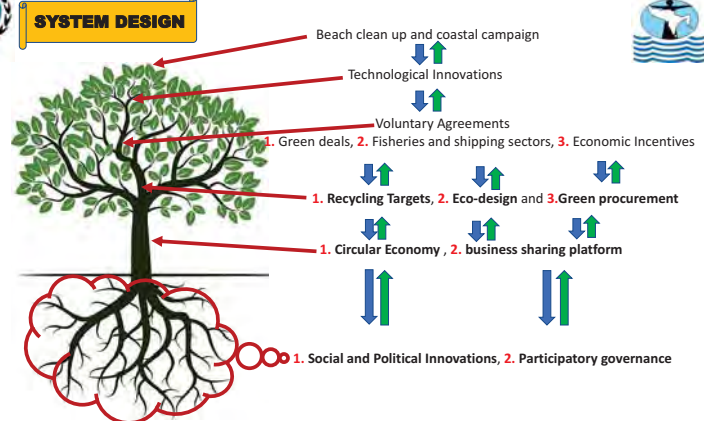


- Main catch:
- Indo-Pacific mackerels
 - Hilsa shad
 - Skipjack tuna
 - "Drums or croakers"

Source: APFIC, 2012



SYSTEM DESIGN





THANK YOU

Status of Marine Litter in Bangladesh

Kawser Ahmed
Department of Oceanography
University of Dhaka



SOUTH ASIA CO-OPERATIVE ENVIRONMENT PROGRAMME (SACEP)

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

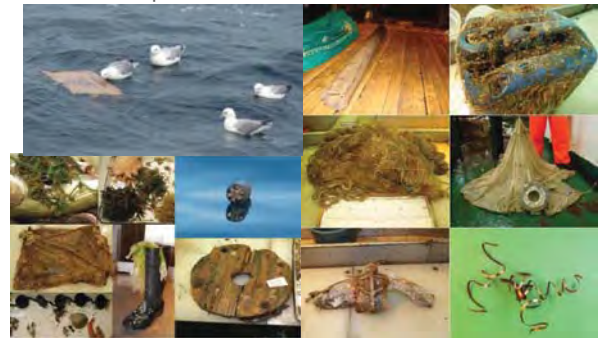
BANGLADESH - COUNTRY REPORT

NATIONAL STATUS INCLUDING DATA BASE, PROPOSED RECYCLING ENTERPRISE AND INTERVENTIONS ON MARINE LITTER

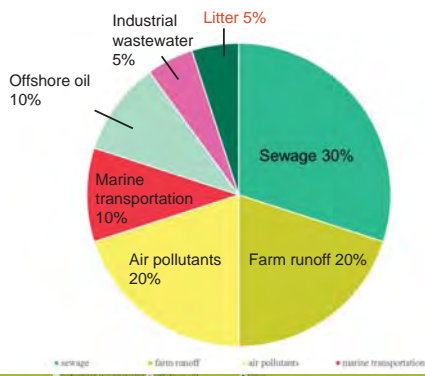
What is marine debris?

Marine litter has been defined by UNEP as “any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment”

Few examples..



Pollutants Entering the Ocean



What's Made of Plastic?



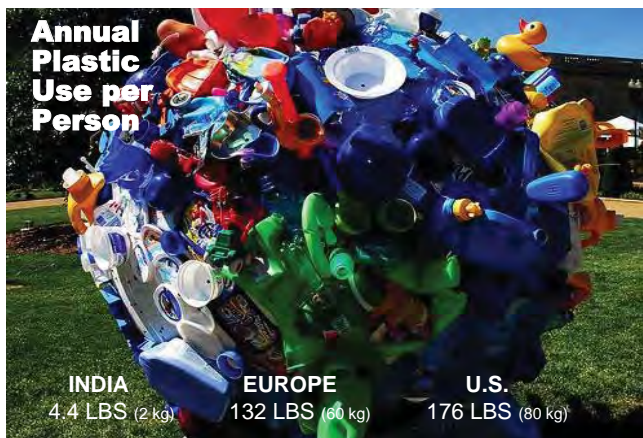
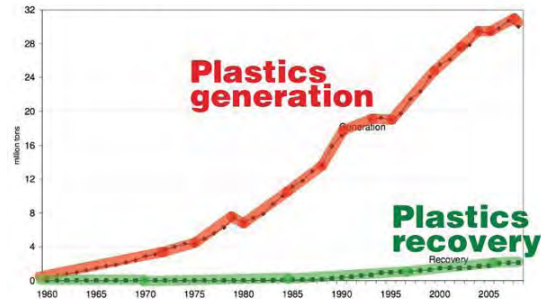
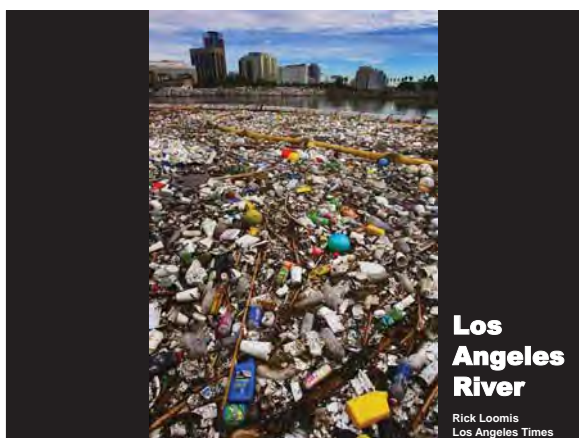


Figure 9. Plastics generation and recovery, 1960 to 2008



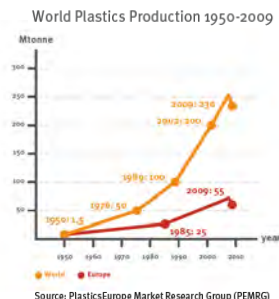
The “missing” 25%



Macroplastics emitted directly to the ocean from coastal zones	4.8–12.7 million tons of land-based plastic waste ends up in the ocean each year	Exact amount of plastics in ocean unknown; Few studies available; >100 million debris items in Regional Seas; possibly 5 trillion particles floating on the surface of the ocean; South Pacific gyre average abundance and mass approximately 27 thousand particles per km ² and 71 g/km ² , respectively.
Macroplastics emitted from rivers	1.15–2.41 million tons of plastic waste flows from rivers as a result of mismanaged waste/population increase.	Exact amount of plastics in ocean unknown; Few studies available; >100 million debris items in 12 Regional Seas [33]; possibly 5 trillion particles floating on the surface of the ocean.
Macroplastics from abandoned lost or otherwise discarded fishing gear	Current emission not well known; rough estimate 640 000 tons per year.	A very rough estimation of 10% of global marine litter by volume.
Primary microplastics	Current emission levels unknown	Estimated 32000–236 000 metric tons microplastics in oceans.
Secondary microplastics	Current emission levels unknown.	Estimated 32000–236 000 metric tons microplastics in oceans.

Facts about plastics (1)

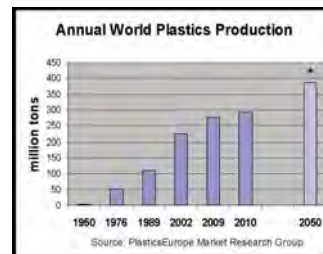
- Production is booming:
 - 5 million tonnes in 1950
 - 260 million tonnes in 2007
 - 500% increase over past 30 years.
- Much plastic thrown away within 1 year



13

Trends in Plastic use

- Plastic production and use has dramatically increased over recent years.
- A lot of it is plastic used by consumers like us. Think of all the things you buy in the store which are packaged in plastic or are made of plastic.



In many regions, plastics constitute between 60 and 80% of all marine litter

Regional examples:

- The Mediterranean seabed, plastics accounted for 77% of all debris, of which 93% plastic bags
- The ocean surface of the North Pacific, plastics accounted for 89% of all floating litter

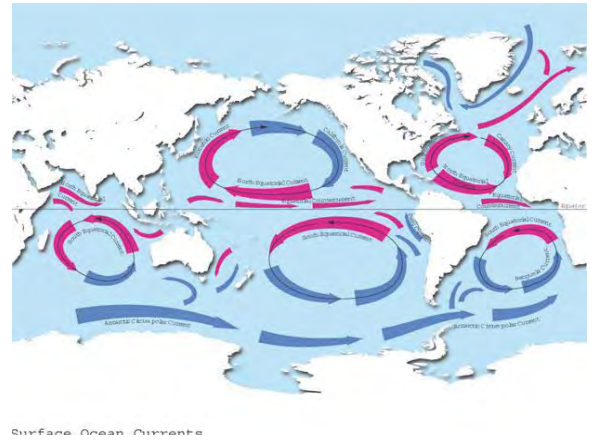
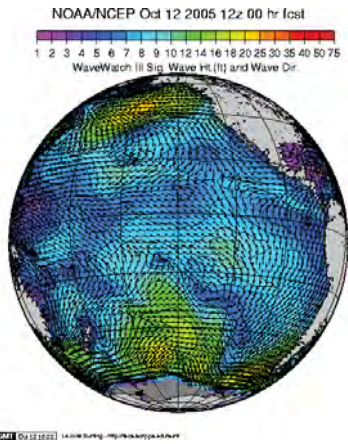


Scientists warned that, by 2050, the quantity of plastics in the oceans will outweigh fish.

Plastic materials in all shapes and sizes are omnipresent in our seas and oceans. They break down extremely slowly in the marine environment, taking in excess of 400 years.

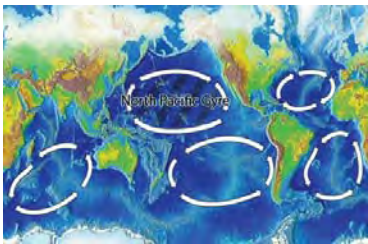


Fate of Marine Debris in the Sea

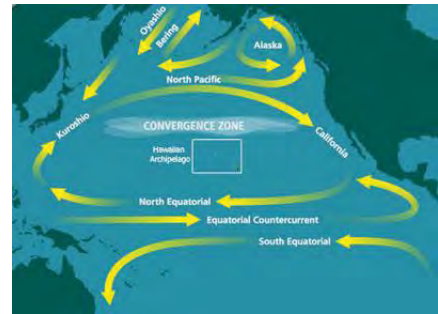


North Pacific Subtropical Gyre

- “Great Pacific Garbage Patch”
- Estimate: 46,000 pieces of floating garbage/mi².



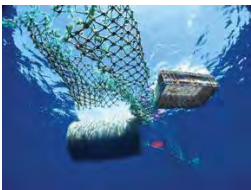
North Pacific Subtropical Gyre



135° to 155°W and 35° to 42°N

Waste on the ocean surface: pools of garbage

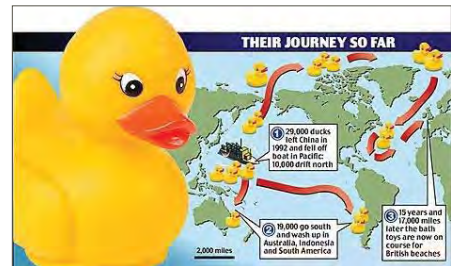
- two continent-sized areas of floating plastic in the Pacific Ocean
- Winds and sea currents drive marine litter together



23

Photo credits: Lindsey Hoshaw, Algalita Marine Research Foundation / PROSEA

Marine litter can travel great distances



- 1992: cargo ship leaving China loses 29,000 bath toys in the Pacific Ocean
- 2007: ducks found on British beaches (17,000 miles further) still fully intact

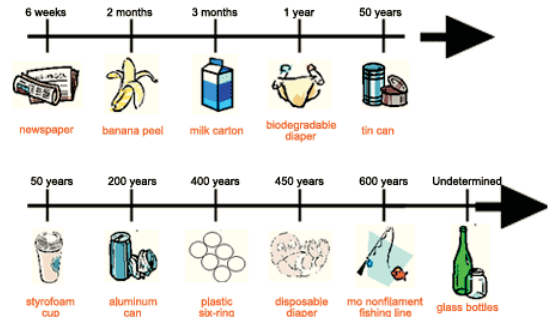
24

A plastic bottle takes 450 years to decompose



Illustration credits: Ocean Conservancy 25

Marine Debris Timeline



Sources of Marine Debris

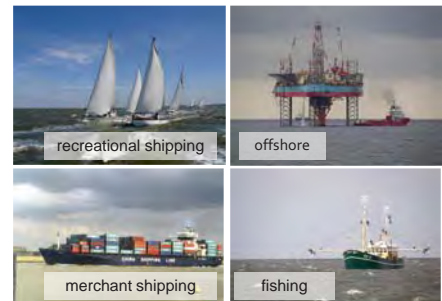
Sources of marine litter: land-based



Marine litter land based: River based



Sources of marine litter: ocean-based



Marine litter even found in remote, pristine areas



Uninhabited island, Philippines

Waste on beaches / coastal areas

Regional estimates:

- New Zealand: 100,000 plastic pellets per km² of beach near industrial centers.
- Sweden: 73,000 m³ of marine litter gathered on 300 km of rocky shores.



Waste on the seabed

Regional estimates:

- European seabed: large marine debris ranged up to 101,000 pieces per km²
- Tokyo Bay: plastics made up 80-85% of the seabed



30-40% of debris originates from ships at sea

Estimated that 5 million items of marine litter are thrown overboard or lost from ships everyday

Over 46,000 pieces of plastic litter are believed to be floating on every square mile of ocean

Marine litter found all around the world



Problems with Marine Debris

Fate of marine litter entering the ocean

Of all litter that enters the sea

- 15% keeps floating on the surface
- 15% washes ashore (beaches, other coastal areas)
- 70% ends up on the seabed

(Estimates of 'Save the North Sea project')

Stranded plastic along shorelines creates an aesthetic issue, which has negative impacts for tourism (Jang et al., 2014), negative impacts on recreational activities, vessel damage, impairment in marine environments, invasive species transport and damage to public health (Hardesty et al., 2015).

Stranded shoreline plastic also negatively impacts shipping, energy production, fishing and aquaculture resources (Cole et al., 2011; Sivan, 2011).

A conservative estimate of the overall economic impact of plastics to marine ecosystems is ~\$13 billion US/year (Raynaud, 2014)

However, reported impacts of marine plastic debris on marine life include nearly 700 species, from tiny zooplankton to the largest whales, including fish destined for human consumption.

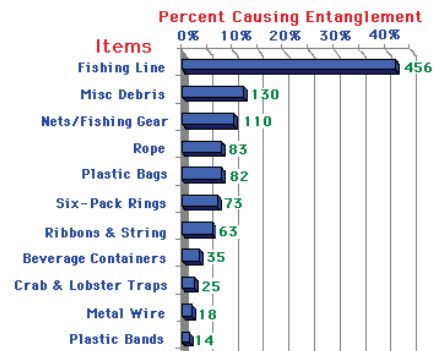
Of the hundreds of marine species impacted, 17% are IUCN red listed species and at least 10% have ingested plastics (Gall and Thompson, 2015).

Ecological damage

However for most organisms, marine litter has serious consequences:

- Entanglement
- Ingestion
- Dispersal of invasive species
- Smothering of seabed communities

Next slides focus on entanglement and ingestion



Economic damage and safety risks

- Clean up costs
- Loss of tourism
- Entanglement of propellers
- Damage to fishing industry



Marine pollution: nets and plastic debris



Laysan albatross



Laysan ducks



Sooty tern



Laysan finch

Net Damage

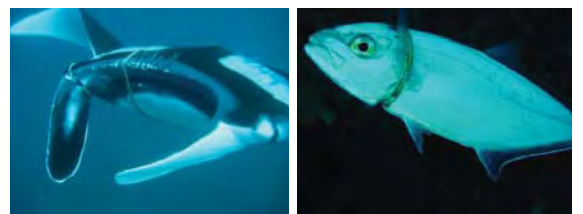


- 100,000 marine mammals & 2 million sea birds die each year after ingesting or being trapped in plastic debris

Entanglement (sea mammals)



Entanglement (fish)



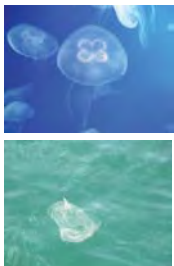
Entanglement (sea birds)



Entanglement (sea turtles)



Ingestion



Litter sometimes resembles food



Ingestion (sea turtles)



Plastic removed from gut of dead leatherback turtle

Ingestion (laysan albatross)



What happens to plastics once they are ingested?

- Some species: regurgitated or excreted with faeces
- Other species: plastics remain inside body for ever
- Plastics have no nutritional value → starvation
- Added chemicals absorbed by the animal's tissues



Especially worrying when microplastics are ingested by small animals
(chemicals bioaccumulate in food chain)

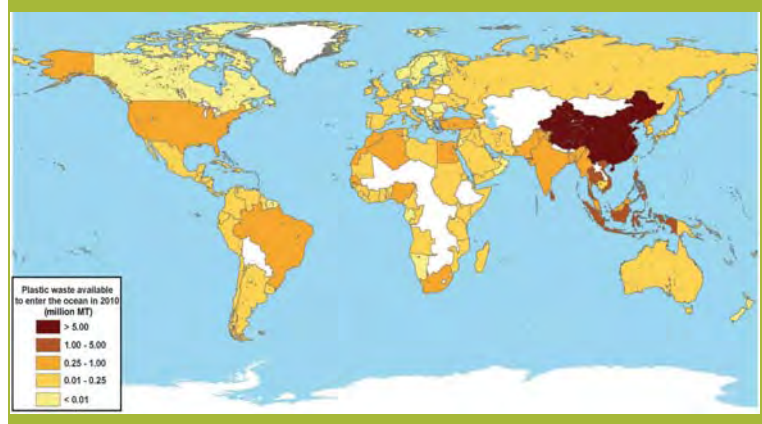
Why do animals ingest debris, and what is the effect on marine wildlife populations?

Globally, approximately **one third of marine turtles have likely ingested debris**, and this has increased since plastic production began in the 1950s.

Most items eaten by turtles are plastic and positively buoyant. Smaller oceanic turtles are more likely to ingest debris than coastal foragers; herbivores are more likely to ingest debris than carnivorous species;

oceanic leatherback turtles and green turtles are at the greatest risk of ingested marine debris effects; and **benthic turtles show a strong selectivity for soft, clear plastic that resembles natural prey such as jellyfish.**

Around the world, nearly half of all seabird species are likely to ingest debris. A global hotspot for seabird impacts exists in the Tasman Sea south of Australia. CSIRO predicts that plastics ingestion in seabirds may reach 95 per cent of all species by 2050, taking into account the steady increase of plastics production.



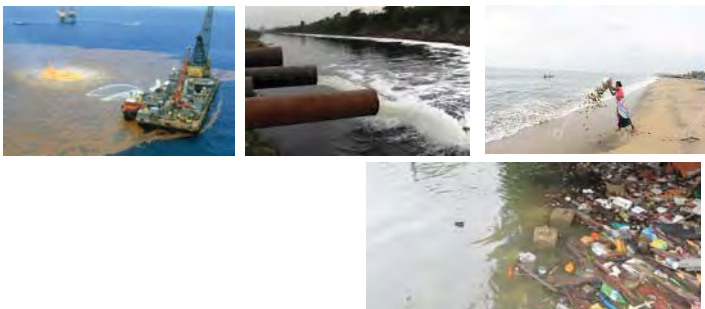
Of the plastic that comes from land:



Status of Marine Litter in Bangladesh

Common source, pathway and type of Marine Litter

➤ There is no standard scientific study about marine litter in Bangladesh. It is difficult to say specific origin, typology, pathway and their trends.



Introduction

Bangladesh has low laying riverine area and many inland waterways with a 710 km coastline area along the Bay of Bengal.



Each year thousands of tons of waste are dumped into the oceans. Gradually but surely the seas are turning into underwater landfills and this is waste that nobody owns and that nobody takes responsibility for.

Objectives

The main objectives of this study-

- ✓ 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.

Investigation method

- If we start talking about sea, marine or ocean, then the first name come to our mind is Cox's Bazar and Chittagong Saint Martin, Kuakata and Katka (Sundarban). So, these two areas were selected primarily for marine litter monitoring.
- According to UNEP/IOC Guidelines on Survey and Monitoring of Marine Litter- there are 2 methods- count with weight and only counting. In this study only counting method is applied.
- A preliminary investigation was conducted from 3rd to 7th November, 2017 in Cox's Bazar and Chittagong districts, 21th January, 2018 in Kuakata, 23th January, 2018 in Katka and 6th to 8th February, 2018 in Saint Martin Island.



Study Area



The common type of marine litter that found in Bangladesh

Continue..

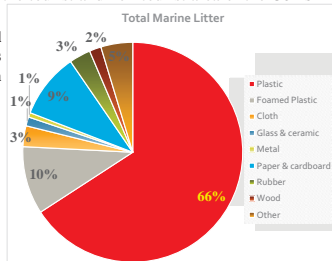


Quantification

We observed total 9471 numbers of marine litter in the tourist and non-tourist area of the Cox's Bazar and Chittagong Districts.

Type of marine litter's category and their total quantity (count in number) that observed in Cox's Bazar, Chittagong, Kuakata, Katka and Saint Martin Island.

Serial	Type	Number
1	Plastic	6179
2	Foamed Plastic	945
3	Cloth	290
4	Glass & ceramic	125
5	Metal	63
6	Paper & cardboard	907
7	Rubber	299
8	Wood	164
9	Other	443

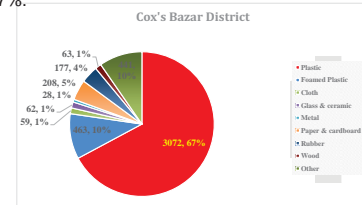


Marine litter types and quantities observed in Cox's Bazar and Chittagong Districts of Bangladesh.

Cox's Bazar District

Continue..

- Cox's Bazar is the most southern part among the all the districts of Bangladesh and it has the world's largest sea beach.
- The Laboni Beach and the Inani Beach situated here.
- Total amount of marine litter found in Cox's Bazar district was 4573 numbers.
- This figure implies that the concentration of plastics is in the top above all other types of litter and that was 67%.

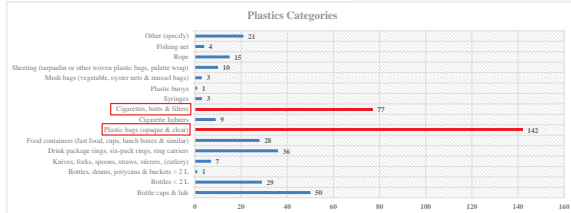
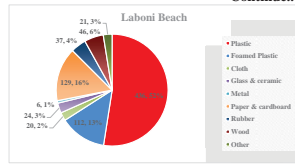


Total Marine Litter observed in Cox's Bazar District

Laboni Beach (Cox's Bazar)

Continue..

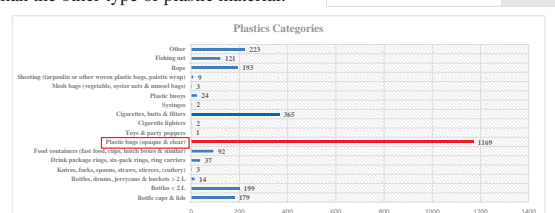
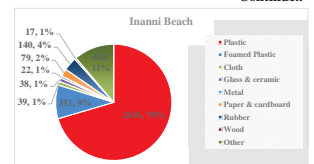
- Most popular and crowded beach in Cox's Bazar district
- During low tide, approximately 5.5 kilometers was observed
- Total 831 numbers of marine litter
- Among the plastic category, the quantity of plastic bags (opaque & clear) is high then the cigarettes, butts & filters.



Inani Beach (Cox's Bazar)

Continue..

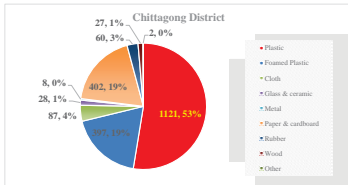
- Inani beach is far away from the Cox's Bazar main town and beside Himchari Hill.
- During low tide, approximately 5.5 kilometers was observed
- Total 3742 numbers of marine litter
- The abundance of plastic bags (opaque & clear) is too high than the other type of plastic material.



Chittagong District

Continue..

- Chittagong is a district located in the south-eastern region of Bangladesh. It is a port city and second largest city in Bangladesh.
- Patenga Beach and Ananda Bazar Beach situated here. However, the Ananda Bazar Beach is not popular like Patenga Beach.
- Ananda Bazar Beach is fully muddy beach where, Patenga Beach is mostly sandy beach and large rock stones between the main land and beach (artificial) to reduce the erosion.
- Total amount of marine litter observed in Chittagong district was 2132 numbers.

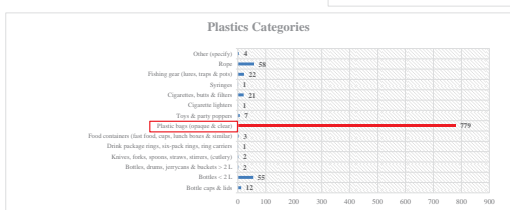
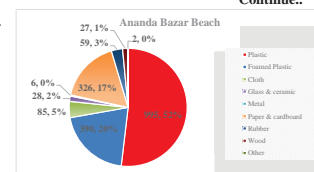


Total Marine Litter observed in Chittagong District

Ananda Bazar Beach (Chittagong)

Continue..

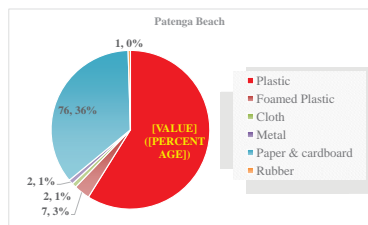
- Ananda Bazar Beach is located in a corner of Chittagong district, is not well known among the tourists. It is situated near the municipal waste dumping zone of Chittagong district.
- During low tide, approximately 6 kilometers was observed.
- Total 1918 numbers of marine litter.



Patenga Beach (Chittagong)

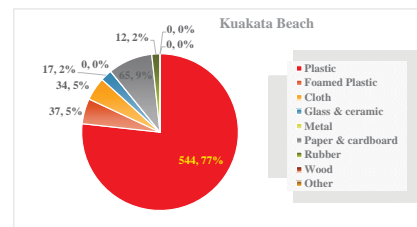
Continue..

- Patenga is a sea beach located 14 kilometers south of the port city of Chittagong.
- Large blocks of stones have been laid to prevent erosion.
- During low tide, approximately 1.5 kilometers was observed.
- Total 214 numbers of marine litter



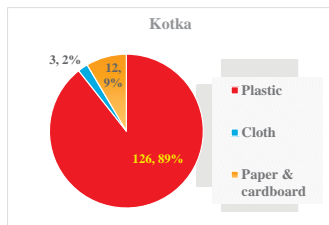
Kuakata Beach

- Kuakata is southeastern part of Bangladesh and 18 km long sandy beach.
- During low tide, approximately 1.5 kilometers was observed.
- Total 214 numbers of marine litter.



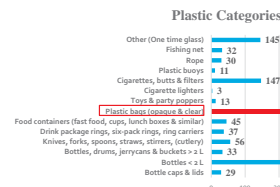
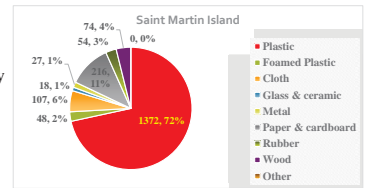
Kotka Beach

- Kotka beach is one of the beautiful tourist spots among the entire Sundarbans. It is actually a sanctuary area for the wild animals and UNESCO declared world heritage site
- Approximately less than 1 kilometers was observed.
- Total 141 numbers of marine litter.

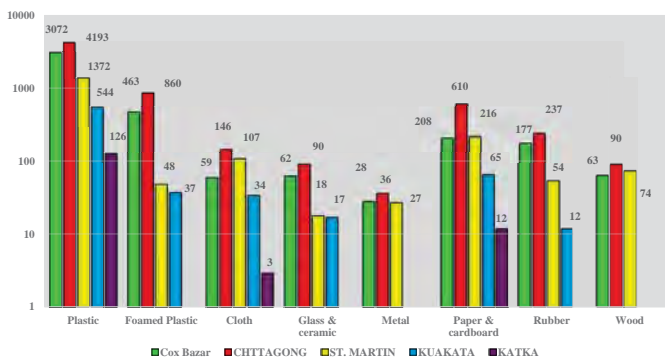


Saint Martin Island

- **St. Martin's Island** is a small island (area only 8 km²) in the northeastern part of the Bay of Bengal.
- Approximately 6 kilometers was observed.
- Total 1916 numbers of marine litter.



Spatial Differences in Five Area



local stakeholders meeting

1. Lack of data on marine litter
2. The responsible authorities are reluctant of cleaning the beach
3. People are not aware of marine litter and hence they still are contributing to marine littering
4. Some NGOs and local add media showed their interests to reduce the litter but they have not sufficient financial support
5. Lack of implementation of rules and regulations to prevent marine littering
6. No strategies for the management of marine litters
7. The waste management protocols are not followed properly by the local industries
8. Plastic bags are still being used
9. No service in remote areas regarding management of marine litter

Regulation and Management of Marine Litter

In recent years, marine litter has become a significant environmental concern for governments, scientists, non-governmental organizations, and members of the public world-wide. It is not only threat for environment only it is also threat for public health

A large number of instruments at international, regional and national levels have been adopted to tackle marine litter problems.



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 including **Bangladesh**, the information is either unavailable or even if available it is scanty.
- No recent marine litter monitoring program was conducted in **Bangladesh**. **The last data about marine litter monitoring in Bangladesh was found in the SACEP/UNEP report in 2007.**
- Therefore, it is important to manage the marine litter in Bangladesh and addressing the source and impact of marine litter on environment, wild life and human health.



GLOBAL INITIATIVES TO MINIMIZE MARINE PLASTIC WASTE AND MARINE DEBRIS

International Instrument to Tackle Marine Litter

- A. United Nations Convention on the Law of the Sea (UNCLOS)
- B. Annex V of MARPOL 73/78
- C. London Protocol
- D. UNEP Regional Sea Program
- E. UNEP/IOC Guidelines on Surveying and Monitoring of Marine Litter
- F. UNEP/FAO Abandoned, Lost or Otherwise Discarded Fishing Gear
- G. Honolulu Strategy
- H. UNEP Global Partnership of Marine Litter



Regional Instruments to Tackle Marine Litter

- A. EU PRF Directive
- B. EU Marine Strategy Framework Directive
- C. Helsinki Convention
- D. OSPAR Initiatives on Monitoring Marine Litter
- E. Barcelona Convention
- F. CCAMLR Marine Debris Program



What can be done?

By garnering the information needed to identify sources and hotspots of debris, we can better develop effective solutions to tackle marine debris.

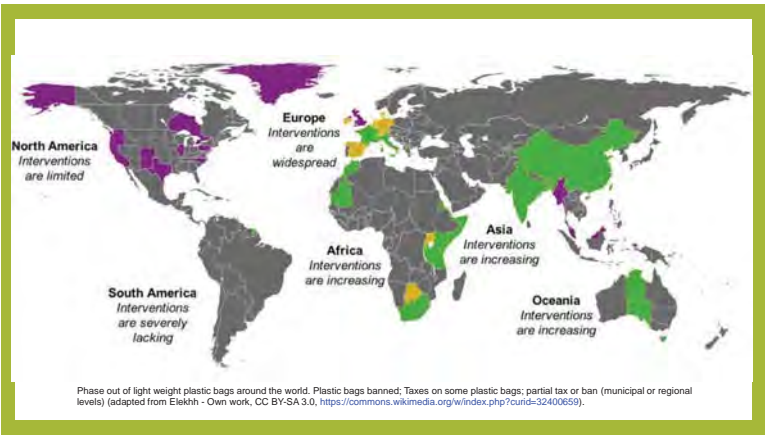
The most effective way to reduce and mitigate the harmful effects of marine debris is to prevent it from entering the marine environment in the first place. This requires incorporating understanding of debris into local, regional and national decision-making; improved waste management efforts; education and outreach activities; development of technology solutions; anti-dumping campaigns; reducing losses of fishing gear at sea; and incentives to reduce debris, such as South Australia's container deposit scheme (which has reduced the number of beverage containers, the dominant plastic item in the environment, by a factor 3).

Working together, scientists, industry, coastal managers and citizen can make significant strides to reduce marine debris impacts in coastal areas and in the marine environment.

SDG target related to marine litter

SDG 6 Clean water and sanitation
 Target 6.3: improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.
SDG 11 Make cities and human settlements inclusive, safe, resilient and sustainable.
 Target 11.6: focus on municipal and other waste management By 2030, reduce the adverse per capita environmental impact of cities, by paying special attention to air quality and municipal and other waste management.
SDG 12 Responsible consumption and production Ensure sustainable consumption and production patterns.
 Target 12.4: achieve the environmentally sound management of chemicals and all wastes throughout their life cycle
 Target 12.5: focus on waste generation reduction through prevention, reduction, recycling and reuse By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.
SDG 14 Life below water Conserve and sustainably use the oceans, seas and marine resources for sustainable development.
 Target 14.1: focus on waste generation reduction By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.
 Target 14.2: sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans.
 14.c Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in UNCLOS, which provides the legal framework for the conservation and sustainable use of oceans and their resources

Types	Examples of measures
Preventive	Source reduction (e.g. eco design), waste reuse and recycling, waste converted to energy, port reception facilities, gear marking, debris contained at points of entry into receiving waters, various land-based waste management initiatives
Mitigating	Various debris disposal and dumping regulations, i.e. waste discharged outside certain distances from land, wastes not containing harmful substances to the marine environment allowed for discharge, prohibition of waste discharge into ecologically sensitive areas, prohibition of the disposal of certain types of garbage into seas
Removing	Beach and seafloor cleanup activities, derelict fishing gear retrieval programs, marine debris monitoring
Change of Behavior	Educational campaigns, economic/incentive tools



Chronology of global plastic bag policy interventions

Germany (1991)	Hong Kong (2009 and 2015)
Denmark (1994)	Malaysia (2011)
Bangladesh (2002)	Wales 2011
Ireland (2002)	Argentina (Buenos Aires) 2012 (2017)
South Africa 2002 (2003)	Canada (Toronto) 2012–13
India (2002 and 2005)	Italy (2013)
Taiwan (2003)	Mauritania (2013)
Rwanda 2004 (2008)	Scotland 2014
Eritrea (2005)	England 2015
Tanzania (2006)	U.S. (Hawaii) (2015)
Botswana (2007)	EU 2015
Canada (Municipal) (2007–2010)	Canada (National) (2016)
Kenya (2007 and 2011)	Israel (2016)
Uganda (2007 and 2013)	Netherlands (2016)
U.S. (California)	Puerto Rico (2016)
China (2008)	Morocco (2016)
U.S. (Washington D.C.) 2009 (2010)	Papua New Guinea (2016)
Myanmar (2009 and 2011)	U.S. (New York City) 2016 (2016)
Australia (2009, 2011, 2013)	Canada (Montreal) 2016 (2018)

Chronology of global microbead policy interventions

U.S. (Illinois) 2014 (2017–2019)
Austria, Belgium, Sweden, Netherlands, Luxembourg (Multi-national) 2015
U.S. (National) 2015 (2017–2019)
U.K. (Multi-national) 2016 (2018)
Canada (National) 2016 (2018–2019)

Some actions in Bangladesh



What can we do to reduce the amount of plastic waste that ends up in the ocean?



Refuse: Don't use single-use plastic items!

Reduce: Use less of those plastic items you can't do without..



Reuse: and reuse them again and again..



Recycle: then recycle them when you can't use them anymore.

Redesign your lifestyle!!

National 3R Strategy for Waste Management in Bangladesh

- At the G8 summit, G8 countries agreed to launch the 3R Initiative in 2004
- In 2009, the National 3R strategy Development Project has been implemented as a collaborative capacity development programme in six Asian countries including Bangladesh
- This strategy has been ratified by the Government of Bangladesh (GOB) in 2010
- Department of Environment has formulated the National 3R (Reduce, Reuse and Recycle) strategy for Bangladesh
- The strategy sets the goal of waste reduction, reuse and recycling and minimizing waste disposal in open dumps, rivers, flood plains and landfills

Existing situation of recycling in Bangladesh

- The process of recycling in Bangladesh is very much in practice informally without control of any statutory body.
- Recycling is mainly done through unorganized sector, an informal network of waste pickers, door-to-door collectors, primary and secondary dealers, and finally the recycling industries.
- Recyclables (plastic, metal, glass, paper etc.) are mainly recycled informally using local and inefficient technologies in an unhealthy working condition.
- In Bangladesh, recovery and recycling occurs in three phases-
 - Phase-1:** the waste generators separate waste which has higher market value
 - Phase-2:** the scavengers rummage through the wastes near the bins for collecting recyclable materials of low market value
 - Phase-3:** the waste pickers collect recyclable materials from the waste vehicles immediately after unloading at dumpsites

3R pilot project in Bangladesh

- Ministry of Environment and Forest (MOEF) using the Climate Change Trust Fund initiated a demonstration project of 3R (First phase) in 4 communities in Dhaka and 2 communities in Chittagong.
- The main purpose of the project is to create awareness on source segregation and recycling of waste and reduction of emission of Green House Gases from waste.
- To address 100 tons of waste of 50,000 families, 70 thousand bins of three different color (Green= Organic, Yellow= Recyclable inorganic and Red= Hazardous) for Dhaka and 50 thousand for Chittagong has been distributed.
- 180 tricycle vans for Dhaka and 100 for Chittagong with three separate compartments have been made to collect three types of waste.
- For recycling of waste, in Dhaka a compost plant of 15 ton capacity and in Chittagong 10 ton capacity has been designed.



Source-segregation in three colored bins



Three Chambered Waste Collection vans for separate collection

National Consultation Meeting

- was held in Department of Environment, Ministry of Environment and Forest, Government of Bangladesh on 28th April 2018
- Keynote speaker was Professor Kawser Ahmed, Department of Oceanography, University of Dhaka

Recommendations on what different sectors can do to reduce marine litter:

- NGOs** – implement awareness-raising campaigns on the sources and impacts of marine litter
- Policy makers** – check and improve local waste management services and motivate and inform citizens on sustainable consumption
- Consumers** – give greater consideration to the packaging used when making purchasing choices, avoid single use plastic bags and avoid littering
- Plastic industry** – extend and improve producer's responsibility over the entire product lifecycle
- Waste management sector** – exchange ideas and best practices with other waste professionals, municipalities and other stakeholders
- Fisheries sector** – cooperate in initiatives to promote fisheries professionals as "Guardians of the Sea", including monitoring and fishing-for-litter initiatives
- Shipping sector** – ensure that there are no disincentives for vessels to bring their litter ashore rather than dumping at sea
- Port authorities** – apply a waste fee system aimed at a maximum delivery of waste from ships

Recommendations (...contd.)

2. Enforcement of legislation and policies of marine litter management
3. Long-term Monitoring and Funding
4. Ensuring the collection and sharing of marine litter data
5. Identify the marine litter pollution hotspots and fix the target
6. Raising public awareness on the source, impacts and management strategies of marine littering
7. Inclusion of marine litter issues in the local waste management plan

Alternatives to plastic



Refusing to use plastic is the best thing you can do to reduce plastic pollution in the ocean. Here are some tips:

- Bring your lunch in reusable plastic or metal containers... no need to use plastic baggies!
- Use a reusable water bottle instead of a plastic bottle. Check out www.kleankanteen.org
- Don't use plastic lids, straws, take-out containers, or bags when you go out to eat. Instead, bring your own containers for take out or leftovers.

Talk with your family about how you can reduce the amount of plastic you use at home.

BE CREATIVE!!!!

Check out this video for an example of creative reusing: <https://www.youtube.com/watch?v=5vbLT4>



Message



You may be telling yourself at this point that changing your lifestyle will not make any significant difference, but

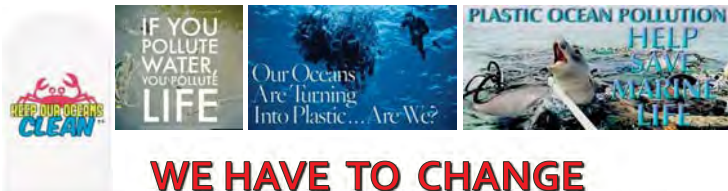
Your actions will make a difference!

Your friends may change their plastic use habits because you changed yours.

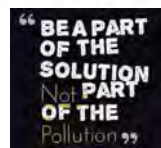
People may ask you why you say "No Straw please". Start a conversation about plastic pollution, and you may convince them to reduce their plastic use.

Over time, your behavior will influence the behaviors of many people you interact with!

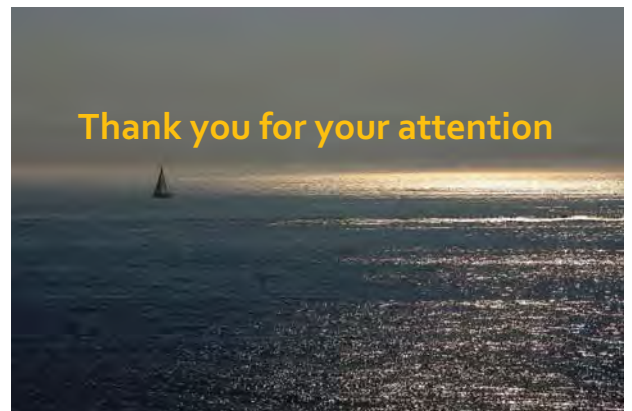
In turn, each of these people will have the same effect on the people around them. **The Domino Effect!**



WE HAVE TO CHANGE OURSELVE TO SAVE THE OCEAN



Thank you for your attention



SOUTH ASIA COOPERATIVE ENVIRONMENT PROGRAMME (SACEP) DEVELOPMENT OF A REGIONAL MARINE LITTER ACTIVITY IN THE SOUTH ASIAN SEAS (SAS) REGION

INDIA – COUNTRY REPORT on REGIONAL ACTION PLAN ON MARINE LITTER

Dr. P. Vethamony : National consultant

Dr. Pravakar Mishra
Country Focal Point
ICMAM- Project Directorate
Ministry of Earth Sciences
Chennai- 600100



1. Introduction and background

Marine litter (ML)

"Marine litter includes any form of anthropogenic manufactured or processed materials discarded, disposed of, or abandoned in the marine environment, either deliberately or unintentionally, and may be transported to the ocean by rivers, drainage, sewage systems or by wind"

- Marine Strategy Framework Directive (MSFD)

Types of Marine litter

- | | |
|---------------------|--------------------------|
| 1. Plastics | 5. Paper and cardboard |
| 2. Metal | 6. Rubber |
| 3. Glass | 7. Clothing and textiles |
| 4. Processed timber | 8. Tar balls |

Sources of marine litter

1. Land based:
- Littering
 - River runoff
 - Extreme natural events (hurricane, flood, tsunami, etc.,)



80% marine debris are land based (Jambeck et al., 2015)

2. Ocean based:
- Fisheries (derelict gear)
 - Ocean cargo and cruise industry



Global plastic production and Marine plastic litter

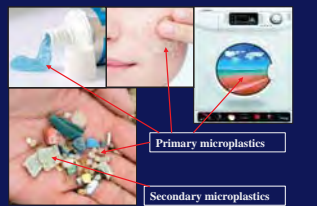
- Global plastic production: 1.5 million metric tonnes in 1950 to 322 million metric tonnes in 2015 (Plastic Europe, 2016). Part of these plastics pollute the marine environment due to improper waste management and coastal and marine activities.
- ~275 MMT of plastic waste – generated in 192 coastal countries in 2010; ~ 4.8 to 12.7 MMT entering the ocean (Jambeck et al., 2015).
- Largest quantities of plastic wastes are entering into the ocean from Asian countries and other middle income and rapidly developing countries.



The **majority of ML consists of plastics**. Plastics are generally divided into **macro-plastics** and the smaller **microplastics**; the plastic particles <5 mm in diameter including **nanoplastics** (UNEP, 2016).

Micro- and nanoplastics:

- **Microplastics:** plastic particles with diameter <5 mm.
- **Nanoplastics:** plastic particles with diameter <100 nm
- **Primary microplastics:** Manufactured in microscopic size. Ex. micro beads in toothpaste and cosmetics; Plastic resin pellet - industrial raw material for the production of plastic products.
- **Secondary microplastics:** Larger plastic items – fragmentation into small pieces (<5mm) by mechanical (wind, waves and currents), chemical (UV radiation) and biological (microbes) factors.



Circulation of Marine litter

Marine litters (especially microplastics) are distributed between five main ocean compartments:

1. On or near the ocean surface (including the upper layers mixed by wave action)
2. In the water column
3. On the seafloor
4. On the shoreline including buried in intertidal sediments
5. In biota

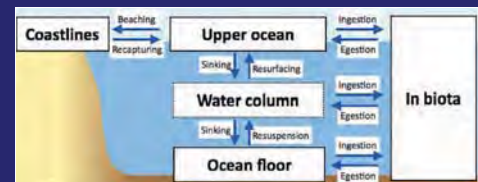


Figure. Overview of compartments and fluxes of marine litter (especially microplastics), Source: GESAMP, 2016

Where the marine litter goes? and how it gets there?

- Ocean **currents** are the major force enabling the long-distance transport of marine litter from coasts to open oceans.
- Global ocean circulation driven by **wind** and **thermohaline processes** form five subtropical gyres that accumulate large amount of plastic debris, which has caused extensive ecological concern.
- The trajectory and speed of marine litter are controlled by their physical characteristics (**density, size, and shape**) and ocean dynamic conditions (**wind, waves, tides, thermohaline gradients and the influence of benthic sediments**)

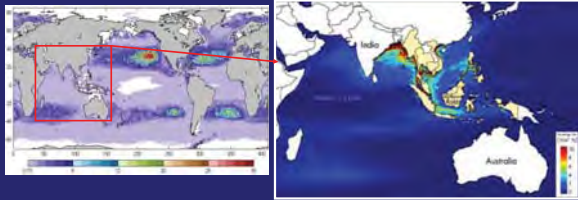
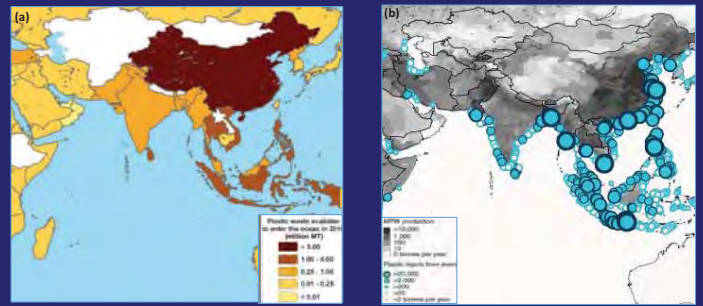


Figure: (Left) Simulated distribution of floating plastic in world ocean; (Right) Image showing high concentrations in coastal waters, using as the source term the estimated influx of plastics from SE Asia due to 'mismanaged waste' (Source: UNEP 2016).

Quantity of plastics from land

Out of the top 20 countries releasing waste into the oceans, 10 have shores on the Indian Ocean (Jambeck et al., 2015). Between 1.15 and 2.41 million tons of plastic waste currently enters the ocean every year from rivers, with over 74% of emissions occurring between May and October. The top 20 polluting rivers, mostly located in Asia, account for 67% of the global total (Lebreton et al., 2017).



Mismanaged plastic waste in Asia

Mass of river plastic flowing into oceans in tonnes per year

Plastic waste inputs from land into the ocean

Table. Annual and cumulative quantities (millions of metric tons (MMT)) of mismanaged plastic waste and plastic marine debris for 2010-2025.

Year	Mismanaged plastic waste [MMT/year]	15% marine debris (MMT)	25% marine debris (MMT)	40% marine debris (MMT)
2010	31.9	4.8	8.0	12.7
2015	36.5	5.5	9.1	14.6
2020	41.3	6.2	10.3	16.5
2025	69.9	10.5	17.5	28.0
Cumulative	618.7	92.8	154.7	247.5

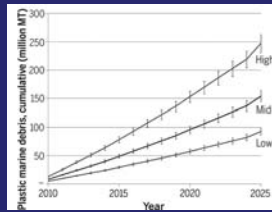


Figure. Estimated mass of mismanaged plastic waste (millions of metric tons) input to the ocean by populations living within 50 km of a coast in 192 countries, plotted as a cumulative sum from 2010 to 2025

- The amount of mismanaged plastic waste generated annually by populations living within 50 km of a coast worldwide (192 coastal countries with at least 100 permanent residents that border the Atlantic, Pacific, and Indian oceans and the Mediterranean and Black seas) that can potentially enter the ocean as marine debris have estimated.
- Assuming no waste management infrastructure improvements, the cumulative quantity plastic waste available to enter the marine environment from land is predicted to increase by an order of magnitude by 2025 (Jambeck et al., 2015).

Table. Top 20 countries ranked by mass of mismanaged plastic waste in 2010 and 2025 (MMT)

Rank	Year 2010		Year 2025		% pop. Change since 2010
	Country	Mismanaged plastic waste [MMT/ year]	Country	Mismanaged plastic waste [MMT/ year]	
1	China	8.82	China	17.81	3.7%
2	Indonesia	3.22	Indonesia	7.42	11.9%
3	Philippines	1.88	Philippines	5.09	26.0%
4	Vietnam	1.83	Vietnam	4.17	13.3%
5	Sri Lanka	1.59	India	2.88	18.7%
6	Thailand	1.03	Nigeria	2.48	45.1%
7	Egypt	0.97	Bangladesh	2.21	18.5%
8	Malaysia	0.94	Thailand	2.18	5.4%
9	Nigeria	0.85	Egypt	1.94	25.0%
10	Bangladesh	0.79	Sri Lanka	1.92	9.0%
11	South Africa	0.63	Malaysia	1.77	23.6%
12	India	0.60	Pakistan	1.22	26.6%
13	Algeria	0.52	Burma	1.15	11.1%
14	Turkey	0.49	Algeria	1.02	18.4%
15	Pakistan	0.48	Brazil	0.95	10.6%
16	Brazil	0.47	South Africa	0.84	7.2%
17	Burma	0.46	Turkey	0.79	16.2%
18	Morocco	0.31	Senegal	0.74	44.3%
19	North Korea	0.30	Morocco	0.71	14.1%
20	United States	0.28	North Korea	0.61	5.0%

(Source: Jambeck et al., 2015)

Table. Top 20 polluting rivers as predicted by the global river plastic inputs model

(Source: Lebreton et al., 2017)

Catchment	Country	Lower mass input estimate (ty ⁻¹)	Midpoint mass input estimate (ty ⁻¹)	Upper mass input estimate (ty ⁻¹)	Total catchment surface area (km ²) ¹	Yearly average discharge (m ³ s ⁻¹) ²
Yangtze	China	3.10 × 10 ³	3.33 × 10 ³	4.80 × 10 ³	1.91 × 10 ⁶	1.58 × 10 ⁴
Ganges	India, Bangladesh	1.05 × 10 ³	1.15 × 10 ³	1.72 × 10 ³	1.57 × 10 ⁶	2.08 × 10 ⁴
Xi	China	6.46 × 10 ²	7.39 × 10 ²	1.14 × 10 ³	3.89 × 10 ⁵	5.53 × 10 ³
Huangpu	China	3.35 × 10 ²	4.08 × 10 ²	6.73 × 10 ²	2.62 × 10 ⁵	4.04 × 10 ³
Cross	Nigeria, Cameroon	3.38 × 10 ²	4.03 × 10 ²	6.5 × 10 ²	2.38 × 10 ⁵	2.40 × 10 ³
Brantas	Indonesia	3.23 × 10 ²	3.89 × 10 ²	6.37 × 10 ²	1.11 × 10 ⁵	8.18 × 10 ²
Amazon	Brazil, Peru, Columbia, Ecuador	3.22 × 10 ²	3.89 × 10 ²	6.38 × 10 ²	5.91 × 10 ⁶	1.40 × 10 ⁵
Pasig	Philippines	3.21 × 10 ²	3.88 × 10 ²	6.37 × 10 ²	4.07 × 10 ⁴	2.07 × 10 ³
Irrawaddy	Myanmar	2.97 × 10 ²	3.53 × 10 ²	5.69 × 10 ²	3.77 × 10 ⁵	5.49 × 10 ³
Solo	Indonesia	2.65 × 10 ²	3.25 × 10 ²	5.41 × 10 ²	1.58 × 10 ⁵	7.46 × 10 ²
Mekong	Thailand, Cambodia, Laos, China, Myanmar, Vietnam	1.88 × 10 ²	2.28 × 10 ²	3.76 × 10 ²	7.74 × 10 ⁵	6.01 × 10 ³
Imo	Nigeria	1.75 × 10 ²	2.15 × 10 ²	3.61 × 10 ²	7.92 × 10 ⁴	2.79 × 10 ²
Dong	China	1.57 × 10 ²	1.91 × 10 ²	3.17 × 10 ²	3.33 × 10 ⁴	8.54 × 10 ²
Serayu	Indonesia	1.33 × 10 ²	1.71 × 10 ²	2.99 × 10 ²	3.71 × 10 ⁴	3.70 × 10 ²
Magdalena	Colombia	1.29 × 10 ²	1.67 × 10 ²	2.95 × 10 ²	2.61 × 10 ⁵	5.93 × 10 ²
Tamsui	Taiwan	1.16 × 10 ²	1.47 × 10 ²	2.54 × 10 ²	2.68 × 10 ⁴	1.08 × 10 ²
Zhujiang	China	1.09 × 10 ²	1.36 × 10 ²	2.31 × 10 ²	4.01 × 10 ⁴	1.33 × 10 ²
Hanjiang	China	1.03 × 10 ²	1.29 × 10 ²	2.19 × 10 ²	2.95 × 10 ⁴	7.35 × 10 ²
Prego	Indonesia	9.80 × 10 ¹	1.28 × 10 ²	2.29 × 10 ²	2.24 × 10 ⁴	2.79 × 10 ²
Kwai Ibo	Nigeria	9.29 × 10 ¹	1.19 × 10 ²	2.08 × 10 ²	3.63 × 10 ⁴	1.92 × 10 ²

Sources of plastics from Ocean

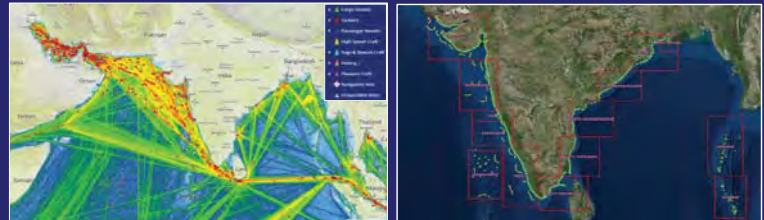


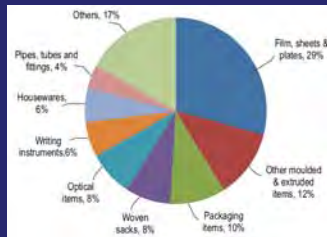
Figure. National and international tanker routes

Figure. Potential fishing zones

- An annually averaged tanker traffic density map provided by Automatic Identification System and the potential fishing zones provided by Indian Ocean Colour satellite data have illustrated above.
- The impact of major shipping accidental losses can be significant locally. The pattern of shipping accidents roughly correlates with shipping traffic density.
- Shoreline surveys adjacent to busy shipping routes, such as Lakshadweep islands, reveal a higher proportion of shipping-related debris (Mugilarasan et al., 2016). Some of this material may be casually thrown overboard, but some arises from accidental losses.
- Commercial fishing in these potential fishing zones may also cause for the presence of discarded and lost fishing gear such as long-lines and trawl nets.

Plastic production and consumption in India

The level of plastic consumption India is a tenth of the United States of America



Per capita plastic products consumption (Kg/person)
(Source: FICCI, 2017)

Product wise breakup of plastic product exports in 2012-13
(Source: Plastindia, Analysis by Tata Strategic)

Plastic recycle in India

- Currently in India, number of organized recycling units for plastics is ~3,500 along with additional ~4,000 unorganized recycling units.
- Most of the plastics (PE, PP, PVC, PET, PS,) etc. could be recycled via mechanical route.
- Engineering plastics like PBT, SAN and Nylon etc. are recycled by selected recyclers.
- In India, recycling of plastics is currently 3.6MnTPA and it provides employment to almost 1.6 Million people (0.6 million directly, 1 million indirectly).
- India recycles about 60% of its plastics, compared to world's average of 22%. Plastic waste contains the calorific value equal to fuel.
- India has among the lowest per capita consumption of plastics and consequently the plastic waste generation is very low.

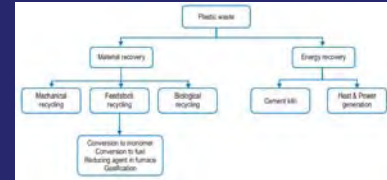


Table: Plastic Waste Consumption (Source: Central Pollution Control Board)

S. No.	Description	World	India
1.	Per capita per year consumption of plastic (kg)	24	6-7
2.	Recycling (%)	15-20	60
3.	Plastic in Solid Waste (%)	7	9

Figure. Plastic recycling flow diagram

Hot-spots

- The term 'hot-spots' is used to help describe the heterogeneity observed in the distribution of marine litter; i.e., there are locations of relatively high abundance.
- The mechanism by which 'hot-spots' form depends to a large degree on how plastic moves within and between the five different compartments.
- Understanding the ocean budget for marine litter and microplastics requires knowledge on both the inventory (stock) and movement (flux). Because it is much harder to measure fluxes than stock, this is an area where even less is known.

West coast of India

(i) Alang-Sosiya ship-breaking yard, Gujarat

- Alang-Sosiya ship-breaking yard is the world's largest ship-breaking zone, with an annual turnover of US\$ 1.3 billion and is on the western coast of Gulf of Khambhat.
- The accumulation of small plastic debris in the intertidal sediments at Alang-Sosiya ship breaking yard, India was assessed by Reddy et al. (2006).
- Four polymers (polyurethane, nylon, polystyrene, polyester, and glass wool) identified in extracts from sediments.
- Overall, there were on average **81 mg of small plastics fragments per kg of sediment.**



(ii) off Sutrapada, Veraval, Gujarat

- Ingestion of four thick plastic bags in the stranded adult female Longman's beaked whale near off Sutrapada, Veraval, Gujarat coast were found by Kaladharan et al. (2014).
- Threat to marine fauna from the ingestion of plastic carry bags and other non-biodegradable debris scattered on the ocean surface and at the seafloor is increasing at alarming proportions.

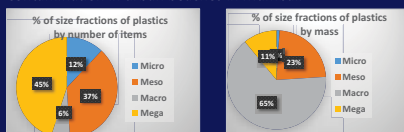
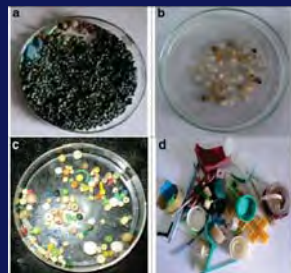


Figure. Post-mortem being carried out on the Longman's beaked whale and found ingestion of plastic bags (Kaladharan et al., 2014)

- Marine organisms are known to ingest microplastic particles (Nerland et al., 2014).
- Many commercially important marine organisms are known to contain microplastics with several possible routes for exposure; for example via the mouth and thereby the digestive system or via the gills.
- Ingestion of microplastics is well known and the digestive system is often examined when looking for the presence of microplastics.

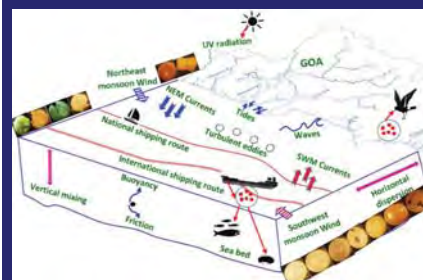
(iii) Mumbai coast, Maharashtra

- Mumbai is the most populous metropolitan city on the west coast of India and the capital of the state of Maharashtra.
- The abundance and distribution of plastic litter was quantitatively assessed in four sandy beaches in Mumbai, India by Jayasiri et al. (2013).
- Overall, average abundance of 11.6 items m⁻² (0.25–282.5 items m⁻²) and 3.24 g m⁻² (0.27–15.53 gm⁻²) plastic litter was recorded in Mumbai beaches.
- The coloured plastics were predominant with 67 % by number of items and 51 % by weight.
- More than 80 % of plastic particles were within the size range of 5–100 mm both by number and weight.
- Probably, the intense use of beaches for recreation, tourism, and religious activities has increased the potential for plastic contamination in urban beaches in Mumbai.



(iv) Goa beaches

Goa State located on the central west coast of India is one of the most famous tourist spots in Asia

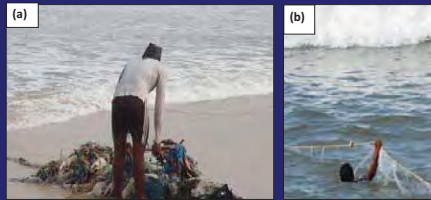


Schematic diagram for the sources and transport pathways of microplastic pellets along the Goa coast (Veerasingam et al., 2016a).

- The distribution of microplastic pellets along the Goa coast, west coast of India are arrived at the coast mainly during the southwest (SW) monsoon, and whatever found during the northeast (NE) monsoon or other seasons are those reached on the coast during SW monsoon, but further undergone weathering processes, for example, colour changing from white to yellow due to exposure to sun (Veerasingam et al., 2016a)
- White colour pellets were the most abundant, and Polyethylene (PE) and Polypropylene (PP) were the dominant polymer types of pellets deposited on all the beaches.

(v) Mangalore beaches, Karnataka

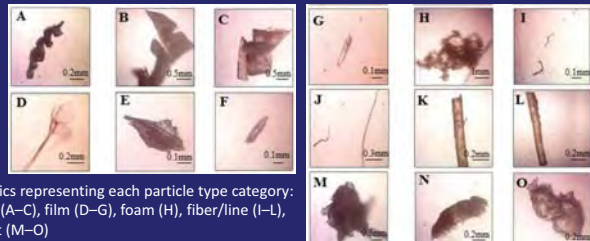
- The Mangalore coast is situated on the west coast of India, stretching to about 22 km of coastal district of Dakshina Kannada, Karnataka.
- Marine litter survey was conducted in the beaches of Mangalore by Sulochanan et al. (2014).
- Maximum total number and weight of marine litter was observed in Thannerbhavi (632 numbers/m²) and Chitrapur (10,923.05 g/m²) beaches respectively.
- Group of litter comprising nylon and plastic rope was the most abundant in the beaches.



Marine litter found along the coast: (a) Fishing and abandoned net (b) Casting the Maranabale net

(vi) Vembanad Lake, Kerala

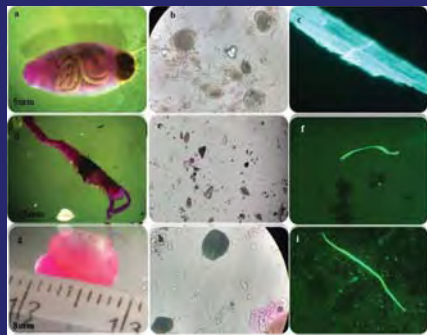
- Vembanad Lake is the largest brackish wetland ecosystem in the southern India, with an area of 151,250 ha.
- The abundance of microplastics recorded from the sediment samples in the range of 96–496 particles m⁻² with a mean abundance of 252.80 ± 25.76 particles m⁻².
- Low density polyethylene has been identified as the dominant type of polymer component of the microplastics (Sruthy and Ramasamy, 2017).
- As clams and fishes are the major source of protein to the local population, the presence of MPs in the lake becomes critically important, posing a severe threat of contaminating the food web of this lake



Microplastics representing each particle type category: fragment (A–C), film (D–G), foam (H), fiber/line (I–L), and pellet (M–O)

(vii) Off Kochi, Kerala

- Microplastic particles present in the benthic invertebrates *Sternaspis scutata*, *Magelona cincta* (deposit feeders) and *Tellina sp.* (suspension feeder) from the surface sediments of off-Kochi, southwest coast of India



- The microplastic particles and thread-like fibres detected in these organisms were identified to be polystyrene.
- Examination of the microplastic particle in *Sternaspis scutata* by epi-fluorescent microscopy showed fragmentation marks on the surface suggesting that the microplastic particle was degraded/weathered in nature.

Figure. Microscope images of the benthic invertebrates (a *Sternaspis scutata*; d *Magelona cincta*; g *Tellina sp.*) and corresponding images representing the gut contents (b *Sternaspis scutata*; e *Magelona cincta*; h *Tellina sp.*) and the epifluorescence images of the microplastic particles found in the gut (c *Sternaspis scutata*; f *Magelona cincta*; i *Tellina sp.*) (Source: Naidu et al., 2018)

(viii) Lakshadweep Islands

- The Lakshadweep islands (36 islands, 10 inhabited) situated off the Kerala coast are made up of coral reefs of Holocene age.
- The plastic debris abundance was investigated in the Lakshadweep Islands (Agatti, Kavaratti, Bangaram and Tinnakkara) during the northeast (NE) and southwest (SW) monsoon season of 2014–2015 .



- A total of 10,778 (average abundance of 134.73 items m⁻²) pieces of microplastics were found from four Islands, 20% of which was plastic resin pellets.
- The distribution of plastic debris in Lakshadweep Islands during the SW monsoon is higher than those found in NE monsoon season.
- Despite the remoteness of the island a considerable amount of plastic debris was present. In both monsoon season, the wind and current pattern are favorable to transport the floating debris from offshore regions to the coast and deposited on beaches of Lakshadweep Islands.
- The number of pellets found in Tinnakkara Island was three-fold more than those from the Chennai coast.
- The abundance of plastic resin pellets in Tinnakkara Island could be derived from international tanker route ship accident and/or unintentional release and deposited by hydrodynamics.

East coast of India

(i) Gulf of Mannar, Tamil Nadu

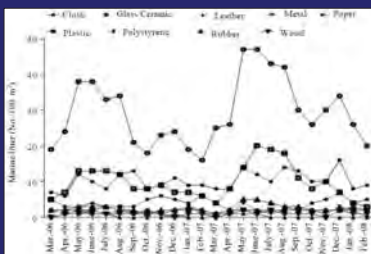
- The Gulf of Mannar is situated at southeast coast of India and it is referred as the Biologist's paradise because of the rich marine ecosystem. It is unique because of the presence of coral reefs, seagrass beds and mangroves, which act as spawning and feeding grounds and as shelter for many species of economically important finfish and shellfish.

- Occurrence of shoreline marine litter during the southwest monsoon period was the maximum and the cool winter period was the minimum .

- The maximum shoreline litter was 94–95 items of 5409-6588 g and the minimum shoreline marine litter was 42 items of 2088g.

- Three major marine litter items such as plastic (48%), polystyrene (18%) and cloth (15%) were found.

- Fishing represented the largest source, tourism/recreation was the second and Sewage related debris was the third common source of marine litter.

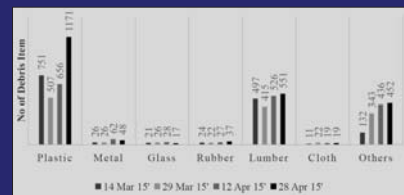


Month-wise quantity of shoreline marine litter in the northern Gulf of Mannar (Ganesapandian et al., 2011).

(ii) Marina beach, Tamil Nadu

- The Marina beach in the southeast coast of India is the most crowded beach in the country and attracts about 30,000 visitors a day during weekdays and 50,000 visitors a day during the weekends and holidays. During summer months, about 15,000 to 20,000 people visit the beach daily.
- This beach is extensively used for recreational uses such as swimming, surfing and picnicking generates debris such as food wrappers, plastic bags and cups, trash bags, product containers, toys and floats.
- Marine litter was collected on four occasions between March 2015 and April 2015 from 10 transects, each 5m wide and 100m long, sorted and categorized by type, quantity and concentration rate along the coastline by Arunkumar et al. (2016).

- The results indicated that the plastic, paper and wood litter occur in the greatest number followed by food waste and metal.
- The major contributing factor for the debris abundance in Marina beach is the local recreational activity which suggests that the land-based sources provide major inputs to marine litter pollution at beach.

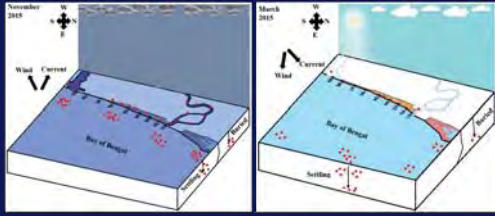


Composition of marine litter collected on the Marina beach

(iii) Chennai, Tamil Nadu

- Chennai metropolitan is located on the SE coast of India with 56 km coastline and is the capital city of Tamil Nadu state. Chennai is the fourth most populous metropolitan area and the sixth most populous city in India.
- The sources, distribution, surface features, polymer composition and age of microplastic pellets (MPPs) in surface sediments along the Chennai coast during March 2015 (pre-Chennai flood) and November 2015 (post-Chennai flood) were studied by Veerasingam et al. (2016b).
- White MPPs were the most abundant, and specifically Polyethylene (PE) and Polypropylene (PP) were the dominant polymer types of MPPs found on the coast during both the times.
- The abundance of MPPs in November 2015 was three fold higher than those found in March 2015, confirming that huge quantity of fresh MPPs washed through Cooum and Adyar rivers from land during the flood.

- The winds and surface currents during November were the driving forces for the transportation and deposition of MPPs from the sea to beaches



(iv) Chilika lagoon, Odisha

- Chilika Lake is the Asia's largest brackish water lagoon situated in Odisha along the Indian east coast. It is one of the biodiversity hotspots and a good source of fishery in coastal wetlands of the entire east coast.
- Its Nalaban Island bird sanctuary serves as a wintering ground for thousands of migratory and resident birds every year. It is also one of the few lagoons in the world which supports congregation of Irrawaddy dolphins.
- Plastic litters are entering into the Chilika lagoon from many different sources. These include plastic waste of domestic and industrial origin through rivers and rivulets debouching freshwater into the lake and dumping of damaged plastic nets and net residues used in 'gheri' culture (pen culture).
- Of late, dumping of plastic materials like bottles, packing materials, water pouches, carry bags, etc. has aggravated the situation.
- The villages surrounding the lagoon have no proper waste disposal and management system, which promotes the addition of residual plastic into the lake system (Sahu et al., 2013).



(v) Andaman and Nicobar Islands

- Andaman and Nicobar Islands are situated off the eastern coast of India in the Bay of Bengal and are also called Bay Islands. The islands, which have proximity to some of the South East Asian countries like Myanmar, Thailand, Malaysia, Singapore and Indonesia, comprise 572 islands, islets and exposed rocks. The island coast extends to 1912 km, which is almost one-fourth of the Indian coastline.
- Sea-surface current prevailing in that region might have resulted in debris being circulated continuously in the open sea and coastal areas, and subsequently washed ashore in Andaman coastal areas.
- The garbage generated in the coastal areas of Sumatra, Singapore, Malaysia, Indonesia and other South East Asian countries and by international shipping services is not disposed properly and dumped directly into the sea (Dharani et al., 2003).
- This is taken by the currents and washed ashore on our pristine beaches of the Great Nicobar and Nancowry group of islands.
- Apart from this foreign plastic invasion through oceanic circulation, plastic and glass find several ways, like our domestic materials, to enter into our pristine islands and subsequently into the coastal ecosystem, since there is no proper solid-waste disposal practice.



(vi) Bay of Bengal, Northeast Indian Ocean

- In the Bay of Bengal, debris density increased north of 17°N mainly due to small fragments probably carried in run-off from the Ganges Delta (Ryan, 2013).
- The densities of floating litter (>1 cm) were greater and more variable in the Straits of Malacca (578 ± 219 items km⁻²) than in oceanic waters of the Bay of Bengal (8.8 ± 1.4 items km⁻²).
- The low densities in the Bay of Bengal relative to model predictions may result from biofouling-induced sinking and wind-driven export of debris items.
- In the Bay of Bengal, Eriksen et al. (2018) found 41% fragments and 40% film.
- According to Lebreton et al. (2017) the **Ganges River is the 2nd largest emitter of plastics** to the marine environment, and in this study the **Bay of Bengal samples had 10 times more plastic particles than the South Pacific**. This observation of more plastic film in the Bay of Bengal may be a reflection of coastal population density and their usage of thin film in the form of plastic bags



Prevalence of marine litter along the Indian beaches:

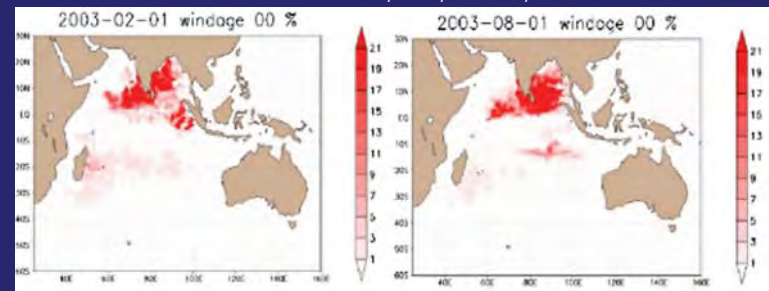


- Synoptic picture of status and composition of beach litter from 254 selected beaches along the maritime States of Peninsular coast of India as well as the Union Territories of Andaman and Lakshadweep Islands from the **one time observation** conducted between October 2013 and January 2014 (Kaladharan et al., 2017).
- Beach litter from different maritime States and the UTs showed that **Odisha coast has the lowest (0.31 g/m²) quantity and Goa coast (205.75 g/m²) the highest quantity** of beach debris..
- Andaman and Lakshadweep islands recorded values higher than Kerala, Tamil Nadu, Andhra Pradesh, Odisha and West Bengal. Samples of debris collected from beaches revealed that all the items were domestic and anthropogenic discards.

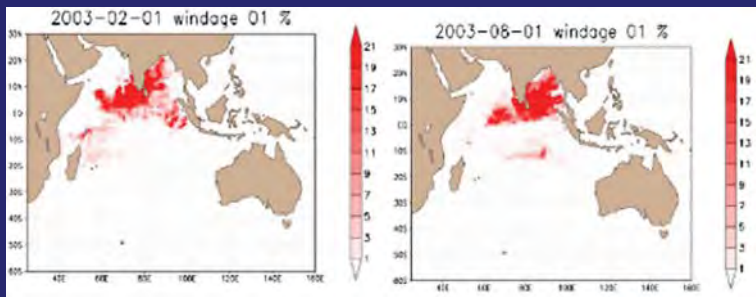
- Plastic litters such as single use carry bags and sachets of soft drinks, edible oils, detergents, beverages, cases of cosmetics, toothpaste, PET bottles, ice cream containers etc., recorded highest mean of 25.47g/m² from Goa coast and the lowest (0.08g/m²) from Odisha.

Pathways of marine debris using numerical simulations

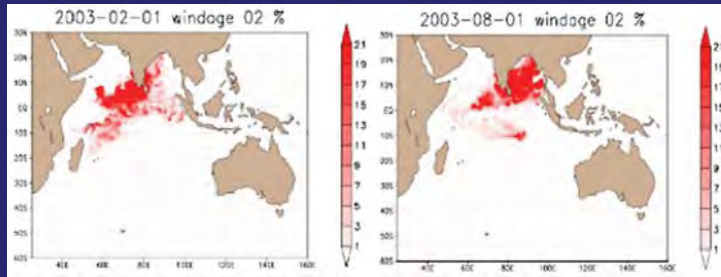
- To determine the pathways of marine debris, the Surface Current from Diagnostic model of near-surface ocean currents, forced by satellite sea level and wind data used (Duhec et al., 2015). 0–1%, 2–3%, or 4–5% of wind vector was added to the model debris velocity already advected by ocean currents.



Distribution of the marine debris continuously released from the South India/Sri Lanka region, starting from 1 August 1999, for 0% windage during SW and NE monsoon (Duhec et al., 2015).



Distribution of the marine debris continuously released from the South India/Sri Lanka region, starting from 1 August 1999, for 1% windage during SW and NE monsoon. In this study, the year 2003 from the model has been chosen, because it represents well the potential advection of debris to Alphonse (Duhec et al., 2015).



Distribution of the marine debris continuously released from the South India/Sri Lanka region, starting from 1 August 1999, for 2% windage during SW and NE monsoon.

The pathways of tracers with 0% windage released from India/Sri Lanka, are transported into the Bengal Bay, Somalia or Indonesian coasts but have a low probability to reach Southern Ocean. Regardless of the season, tracers with 1% and 2% windage released from those both regions, have high probability of being washed onto the Alphonse Island Southern Ocean.

Tar ball deposition along the west coast of India

Deposition of tar balls along the west coast of India, particularly Goa and Gujarat coasts, is a common phenomenon; **it occurs only during pre-monsoon to southwest monsoon** season every year (Suneel et al., 2013)

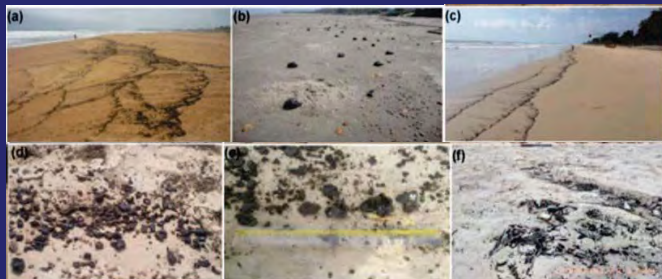


Figure. Deposition of tar balls on Goa coast (a) is on 02/09/2010 at Candolim, (b) is on 25/05/2011 at Mandrem, (c) is on 26/05/2013 at Mobor, (d) is on 08/06/2014 at Candolim, (e) is on 05/06/2015 at Naaulim, (f) is on 23/03/2016 at Majorda beaches (Source: Suneel et al., 2015).

Sources of tar ball deposition along the west coast of India

Based on chemical fingerprinting analysis and mathematical particle trajectory models it is found that the sources of tar ball deposition along the west coast of India are **leakages in offshore oil fields off the Mumbai-Gujarat coast and accidental spillages during the transportation of crude oil** in the Arabian Sea (Suneel et al., 2013, 2014, 2016).

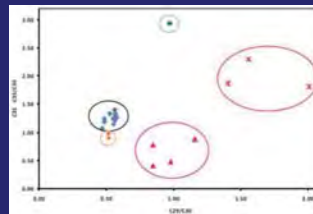


Figure. Cross plot of homohopane index. The red circle represents Middle East Crude Oil, pink-outh East Asian Crude Oil, orange-Cairn and Niko oil, green-MS-C Chitra crude oil; black circle represents tar balls of Gujarat coast (blue color) and Bombay High Hut (pink color top) and Bombay High Mut (pink color down) (Source: Suneel et al., 2014).

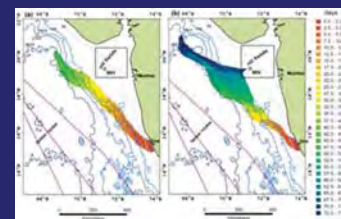


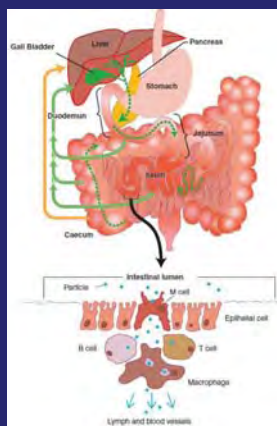
Figure. Trajectories of tar balls using backtracking simulation for May 2013 and 2014 (Source: Suneel et al. 2016).

National Impact of Marine Litter

Human health

- Plastic pollution is the most widespread problem affecting the marine environment. It also threatens ocean health, food safety and quality, human health, coastal tourism, and contributes to climate change.
- Several chemicals used in the production of plastic materials are known to be **carcinogenic and to interfere with the body's endocrine system**, causing developmental, reproductive, neurological, and immune disorders in both humans and wildlife.

Figure. A diagram illustrating a proposed recirculation pathway for polymer nanoparticles (ammonium palmitoyl glycol chitosan) after oral administration. The nanoparticles are taken up into the blood from the gut through M cells, and from there through the lymphatic system (shown in yellow) and into the liver and gall bladder. Particles are then re-released into the gut together with bile (shown in green) before excretion in faeces and urine (Source: Garrett et al., 2012).



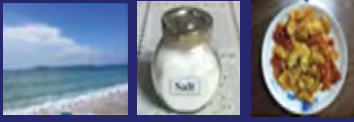
Entanglement of large size plastics in various marine biota



(Source: <https://genxmedia.wordpress.com/2013/11/22/the-ocean-is-broken/>)

Food safety

- Invisible plastic has been identified in **tap water, salt** and are present in **all biota samples collected in the world's oceans**, including the Arctic (GESAMP, 2016).



- Yang et al. (2015) ~1000 microplastic particles/year ingestion by human from salt. Salt produced from the microplastic contaminated sea water by crystallisation.

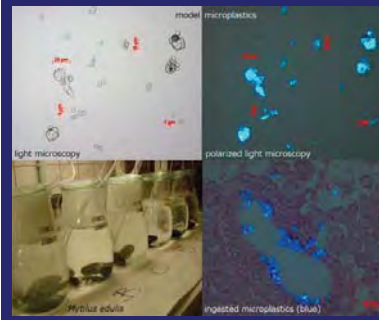


Ingestion of plastics by zooplankton

Plastics found in fish

Plastics found in sea bird

Effect of microplastics in biota



Uptake and effects of microplastics on cells and tissue of the blue mussel *Mytilus edulis* L. after an experimental exposure (Source: Moos et al., 2012).



Uptake and retention of microplastics by the shore crab *Carcinus maenas*

- External exposure results when microplastics contact the outer surfaces of the organism, including gills. Dietary exposure is resulted in crabs having microspheres in their stomach. This suggests that trophic transfer of microspheres is possible within the marine food chain, especially at the lower levels (Watts et al., 2014).

Effect of microplastics in biota

- Toxic contaminants accumulate on the surface of plastic materials as a result of prolonged exposure to seawater. When marine organisms ingest plastic debris, these contaminants enter their digestive systems, and overtime accumulate in the food web. The transfer of contaminants between marine species and humans through consumption of seafood has been identified as a health hazard (Bergmann et al., 2015).
- Koelmans (2015) found that the role of microplastics can be understood from chemical partitioning to microplastics and subsequent bioaccumulation by biota, with microplastic as a component of the organisms' diet.

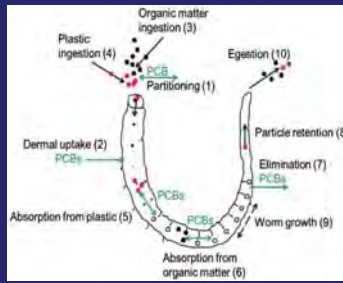
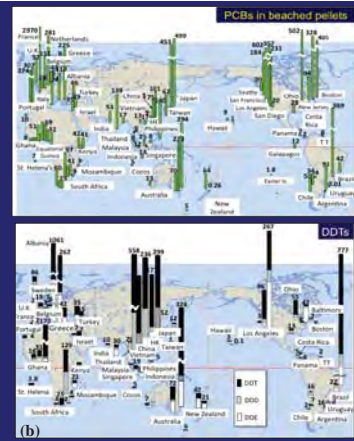


Figure. Schematic representation of processes required for plastic-inclusive bioaccumulation modeling (example for PCBs accumulation in a lugworm *Arenicola marina*): 1 Partitioning between plastic, sediment and water, 2 dermal uptake, 3 organic matter (food, biofilm) ingestion, 4 microplastic ingestion, 5 absorption from plastic, 6 absorption from organic matter, 7 elimination, 8 particle retention, 9 worm growth, 10 egestion (sediment and plastic). Same or similar process descriptions can be used for other marine/aquatic organisms (Source: Koelmans et al., 2013).

Impacts of ingested material and associated chemicals

- In the aquatic environment, the ingestion of plastics establishes a potential exposure pathway for other chemical contaminants including metals, and persistent, bioaccumulative, and toxic contaminants that may be sorbed from the water column to plastic or incorporated into the plastics during manufacture (Engler, 2012).
- International Pellet Watch (IPW) team members have generated the global pollution map based on the concentrations of persistent organic pollutants (PCBs, DDTs, HCHs, Hopanes and PAHs) adsorbed by microplastic resin pellets.
- Plastic also contains additives, chemicals added to improve the desirable properties of the plastic product. Many of these additives are known hazardous substances and can leach from the plastic surface.



- Plastics once released into the environment can also accumulate known persistent organic pollutants (POPs).
- Plastic particles have the potential to act as vectors for the transport and release of sorbed contaminants and additives.



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

National waste management committee	Constituted in 1990 was to identify the recyclable contents in solid waste picked up by rag-pickers.
Strategy Paper	A manual on SWM has been developed by the MoUD in collaboration with the NEERI in August, 1995
Master plan of Municipal Solid Waste	A stratagem was formulated by the combined efforts of MoEF, CPCB, and ULBs to develop a master plan for SWM with emphasis to biomedical waste in March, 1995
High Powered Committee	In 1995, a High Powered Committee constituted under the Chairmanship of Dr. Bajaj, to encompass a long-term strategy for the SWM using appropriate technology
Hazardous Waste (Management, Handling and Transboundary movement) Rules (1989, amended January 2003, August 2010)	to control, manage and handling of hazardous waste

Biomedical Waste (Management and Handling) Rules (1998)	to control, manage, and handling of waste generated from hospital, super speciality centers, and nursing homes
Municipal Solid Waste (Management and Handling) Rules, 2000	Guidelines for MSW and be implemented by ULBs for scientific management.
Plastic Waste (Management and Handling) Rules, 2009	It deals with scientific disposal of plastic waste and extended producer responsibility clause has also been incorporate in it
E-Waste Management and Handling Rules 2011	It is applicable to stake holders associated with the manufacturing, handling, utilizing, processing, and recycling electrical and electronic-related waste items.

GOI is continuously encourages urban local bodies (ULBs) to implement these rules at ground level and recently draft notification for municipal solid waste (Management and Handling rules 2015) is also under formulation (Ministry of Environment, Forest and Climate Change, 2015).

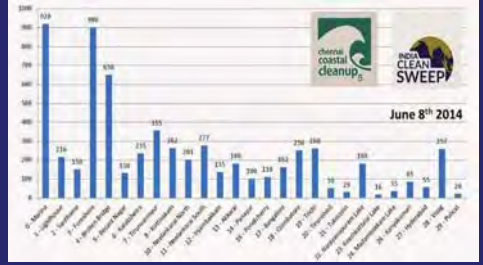
National Marine Litter monitoring programme

Table: State wise participation and debris collection (Source: Indian Coastal Guard, Ministry of Defence)

Sl	State/UT	No. of Participants	Debris collected (Kg)
1	Delhi	650	1000
2	Gujarat	1971	11630
3	Daman	700	12000
4	Maharashtra	6320	13300
5	Goa	880	1350
6	Karnataka	5000	10500
7	Kerala	430	460
8	L&M Islands	719	1950
9	Puducherry	1292	2545
10	Tamil Nadu	2840	15400
11	Andhra Pradesh	1000	4000
12	Odisha	466	165
13	West Bengal	753	1405
14	A & N Islands	1581	5630
	Total	25602	81335

- Towards ongoing efforts of the Indian Government for the 'Clean India' (Swachh Bharat Abhiyan) and Hon'ble Prime Minister's appeal for mass cleanliness and sanitation campaign through "Swachhta Hi Seva"; the Indian Coast Guard conducted International Coastal Cleanup day-2017 (ICC-2017) in all Coastal States /Union Territories on 16 Sep 2017 along with SACEP, UNEP, SAS, NGOs, NCC cadets, NSS, School and college students, Industries and citizens.
- The nationwide campaign resulted in the collection of approx 81,335 Kgs of marine litter. Debris collection was highest in Tamil Nadu with approx 15,400 kgs and in Maharashtra was approx 13,300 kgs

- During 8th June 2014, around 6200 volunteers from various schools, colleges, NGOs, corporates and individuals collected and segregated 50 tonnes of garbage in 27 beaches, lakes, rivers in 10 cities of Tamil Nadu
- Out of the total collected volume of garbage: 32% plastics, 18% glass, 50% others. Among the collected debris 80% of the materials was recycled to minimize the materials that eventually moves to the garbage dump.



Knowledge gaps

Looking to the future, here we present a list of knowledge gaps that deserve further attention from the scientific community and policy makers.

- The research on marine litter, especially microplastics is brought in public only a decade ago; adequate large scale research is not yet initiated.
- Employ a clear and standardised size definition of a microplastic, with further size definitions for nano- and mesoplastics.
- Optimise and implement routine, high-throughput microplastic sampling methodologies to better compare the results from different study areas.
- Develop appropriate methods for detecting minute microplastics and nanoplastics within the water-column and sediment.
- Expand knowledge of the fate and behaviour of microplastics within the water-column, including the effects of fragmentation and bio-fouling.
- Develop methods for determining microplastic uptake by biota throughout the marine food-web and expand the use of sentinel species (e.g. Fulmars) in detecting microplastic abundance.
- Determine the impact (i.e. mortality, morbidity and/or reproduction) of ingested microplastics on marine biota, and understand the transfer of this contaminant within the food-chain.
- Determine the impact (i.e. mortality, morbidity and/or reproduction) of leached plastic additives and adsorbed waterborne pollutants to biota, transferred via microplastics on marine biota.

Recommendations

- Segregating the collected marine litter especially the plastics into usable recycle products using low cost technology.
- It should be the responsibility of the manufacturer to get back the possible used plastic products from the consumers by giving incentives, so that the quantity of litter going into the coastal environment can be greatly minimized. Accordingly, public awareness has to be generated.
- As India does not have a National Marine Litter policy, it is the right time to have a policy that can take care of controlling the litter at the land boundary itself, as it is very difficult to remove the litter once it goes into marine environment.
- Being plastic litter non-degradable as long as it remains in the marine environment, it constantly harm the biota from plankton to whales and finally the human being, and that demands the need of applying the measures of prevention at the point of origin itself.
- Though tar balls reach the west coast of India every year during the southwest monsoon months, it is not yet clear whether the source of crude oil is from the Bombay High or tanker wash; even if it is from the Bombay High, it is not sure whether the crude oil is from the operational discharge or the natural seepage. Hence, field surveys and research efforts are needed to confirm the source and apply mitigation measures.

Short term priorities to mitigate the marine litter

- Evaluation of the behaviour (floatability, density, effects of wind, biofouling, degradation rates) and factors affecting the fate of litter (weather, sea state, temperature-driven variations, slopes, canyons, bays, etc.) and affecting the transport of litter;
- Use of comprehensive models to define source and destination regions of litter (especially accumulation areas, permanent gyres, deep sea zones), estimate residence times, consider the average drift times and Tran boundary transport to and from SAS regions/subregions;
- Evaluation of the rates of degradation of the different types of litter, quantification of the degradation products (to nanoparticles) and evaluation of the environmental impact of litter-related chemicals (phthalates, bisphenol A, flame-retardants, etc.) on marine organisms;
- Identification of sources for direct inputs of microparticles of litter;
- Establishment of the environmental impacts of microlitter, in particular in relation to the potential physical and chemical impacts on wildlife, resources and the food chain;

- Evaluation of biological impacts (on metabolism, physiology, survival, reproductive performance and ultimately on populations or communities);
- Evaluation of the risk of the introduction of invasive non-indigenous species;
- Study of dose–response relationships in relation to the types and quantities of marine litter in order to enable science-based definitions of threshold levels for good environmental status;
- Evaluation of direct costs of marine litter to the maritime industry, fishing industry, local authorities and governments and in terms of impacts on ecosystems goods and services;
- Development of automated monitoring systems (ship-based cameras, microlitter quantification etc.) and impact indicators (aesthetic impact, effects on human health, and harm to the environment); and
- Optimization of monitoring (standards/baselines, data management/quality assurance, extension of monitoring protocols to all SAS regions/subregions).

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

National institutions

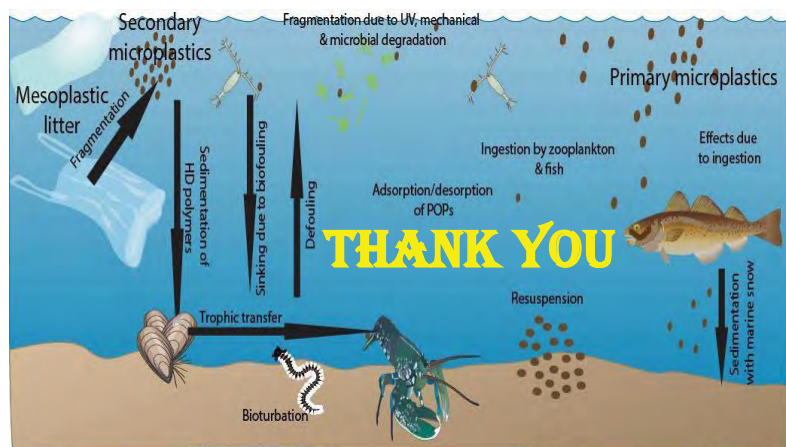
- Ministry of Environment and Forests
- Ministry of Earth Sciences
- Ministry of Agriculture
- Ministry of Water Resources
- Ministry of Defence (Indian Coast Guard)
- Ministry of Surface Transport
- Ministry of Petroleum and Natural Gas
- Ministry of Tourism
- Ministry of Mines
- National Solid Waste Association of India, Mumbai
- Central Pollution Control Board (CPCB), New Delhi;
- National Engineering and Environmental Research Institute (NEERI), Nagpur;
- Central Institute of Plastics Engineering and Technology (CIPET), Chennai;
- Centre for Environmental Science & Engineering, IIT- Bombay, Mumbai
- TERI (The Energy and Resources Institute), New Delhi
- Environmental and Water Resources Engineering Division, IIT-Madras, Chennai
- Centre for Rural Development and Technology, IIT Delhi

Sub-national & local companies

- SELCO International Limited, Hyderabad
- Zanders Engineers Limited, Mohali, Punjab
- Ramky Enviro Engineers Ltd., Hyderabad
- Jindal ITF Urban Infrastructure Ltd, Delhi
- Mailhem Engineers Pvt. Ltd., Pune
- Southern Cogen Systems Pvt Ltd, Mysore, Karnataka

Acknowledgments

1. Dr. M. V. Ramana Murty, Director, ICMAM PD/ MoES, Chennai
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4. United Nations Environment Programme (UNEP)
5. South Asia Co-operative Environment Programme (SACEP)



Marine Litter Action Plan

Regional workshop to strengthen capacity for marine litter management in South Asian seas (SAS) Region.

5th – 6th April 2018
Mumbai

Rifath Naem
Environmental Protection Agency



Ministry of Environment and Energy

- Policy and Planning
- Research and Development
- Projects Implementation

Environmental Protection Agency

- Monitoring and Implementation of Regulations

Waste Management Corporation

- Management of Regional Waste Management Facilities
- Collection at Regional Level

Island Councils

- Management of Island Waste Management Facilities
- Collection at Island Level

GUIDING PRINCIPLES



Should be responsible for the waste they produce (Polluter Pay Principle)



Should manage their waste according to the plans and guideline of the council area /Municipality



Should prepare, implement and manage an island waste management plan



Should be responsible for collection and usage of fee from households, businesses and government institutes, within the purview of that council

GUIDING PRINCIPLES



Establish waste management system using the fee collected



Ensure proper waste management through utility companies



Every island should have waste management system capable of managing waste produced



The means of carrying out a system should be provided by the government

GUIDING PRINCIPLES



Allocation of Regions, Construction of a RSWMF within the region
Provide equipment and means for a Proper Waste Management System



Establish a waste transfer system for the remaining waste after being managed within the island waste management plan



If an island can generate an income from managing waste, encourage this and create the means for the island community to carry this out

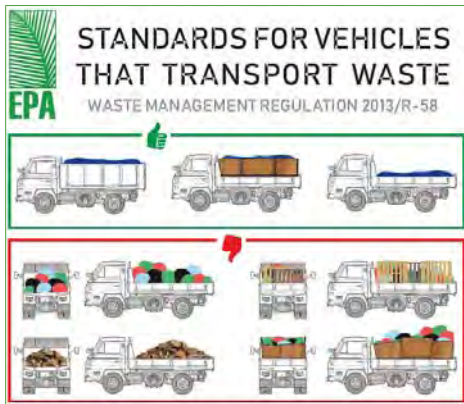


Continuous awareness and educational campaigns on waste management at a national level

Waste Management Regulation 2013/R-58

- EPA mandated with enforcement under Environment Protection & Preservation Act (4/93)
- Purpose: implementing and regulating national waste management policy
- Standardization (waste collection/transport/treatment /storage)
 - Island Waste Management Plans & Installations
 - Hazardous Waste management
- Prohibition of unauthorized waste dumping & littering

Waste transportation standard



Island Waste Management Centers



Waste segregation in B. Maalhos island IWMC

Island Waste Management Centers

Compacting metals for exportation



Composting for agriculture



Waste management in B. Maalhos island IWMC

Waste Transfer to regional centers



- Vessels need to follow the same method for waste transportation
- All vessels are required to have sealable dustbins
- Harbour operators required to install a suitable facility for waste deposit (and keep records)



Waste transfer from a pick up to a vessel (not according to standard)

Coastal clean up events & waste auditing



International Coastal Cleanup Day (2017) in Hulhumale', collecting 179 bags of plastics, 28 metal and aluminium, 28 glass and 180 bags of general waste.



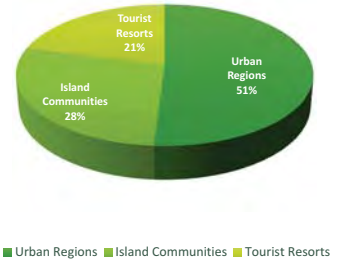
Marine Litter Action Plan



Introduction and Background

- Marine litter is one of the biggest environmental challenges in the Maldives.
- Significant increase in the magnitude of the problem in recent years.
- Estimated amount of per capita solid waste generation in the Maldives is between 1.7 - 3.5 kg a day, and predicted to increase by 4% per annum (MEE, 2017)
- No formal studies published on typology and pathways of marine litter in the Maldives, except for ghost nets

Proportion of Waste Generated



Current Practices

- Waste is generally not segregated at household levels.



Waste Disposal at island foreshore in Rasdhoo Island Community -30th March 2016 (Photo by Kovelli)

- In community islands, waste is generally dumped in to the island foreshore, which is piled in a long row parallel to the sea and periodically burned to reduce the volume of discard

Current Practices



"Rubbish Island", Thilafushi, near Malé in the Maldives (Photo by Alexis McGivern)

- The remaining waste kept on the site for long term as well as those that are directly thrown on the beaches then tend to get carried away into the ocean by winds and tides.

Current Practices



"Food Waste Storage Containers in Store Room" (Ministry of Tourism, 2015, p. 33)



Trash bag near Bandos Island Resort region -22nd November 2013 (Photo by Hussain Nashid)

- The most common practice for resorts is to separate food discards from other wastes and to dump them in the ocean outside their atoll often with the bag which the waste is contained in.

Sources and Circulation of Marine Litter



Where do they come from?

Local community islands

- 4.4% of households dispose general waste and 63% dispose kitchen waste into the seaside or beach

Tourist resorts and marine vessels

- They dump food waste into the sea, sometimes in open channels

Debris blown into the sea from landfill islands

International waters...



National Impact of Marine Litter

Social impacts	Economic impacts	Ecological/ Environmental impacts
Negative implication on human health and food safety – entanglement, navigational hazards, food contamination etc.	Lower revenues from tourism – due to loss of aesthetic values	Threats to marine wildlife through entanglement especially through ghost nets and mistakenly ingesting marine debris as food
Diminished intrinsic and social values associated with marine environment – decreased aesthetic value.	Damaged fishing gears and vessels – entanglement, collision, loss of production time, cost to replace gear.	Alter marine habitats through physical interference – smothering, obstruction of sunlight, abrasion and entanglement

Management Agencies



Legal Instruments Governing Solid Waste Management

- The main regulation governing solid waste management in the Maldives is the National Solid Waste Management regulation (Directive number 2013/R-58)
- 2013/R-58 states to refer to the tourism regulation for ways to store, manage, and dispose of waste generated within resorts
- Regulation on the Protection and Conservation of Environment in the Tourism Industry (pursuant to the Law No. 2/99 – Maldives Tourism Act) stipulates the standards for environmental protection and facilitate sustainable development of the tourism industry.

Policies, Strategies and Ongoing Activities

- Saafu Raajje campaign
- National Solid Waste Management Policy 2015 (Saafu Raajje Initiative)
- National Biodiversity Strategy and Action Plan 2016-2025
- Pledge to reduce the use of non-biodegradable plastics
- Formulation of WAMCO
- Partnerships with Parelly for the Oceans
- Collaboration with fishers to collect drifting plastics
- Establishing waste management programmes and facilities in various islands
- Banning single-use plastic bags in some islands
- Ocean clean-ups and waste audits

National Marine Litter Monitoring Programme

Monitoring Organisation	Sampling region	Indicators used for monitoring and its methodology	Baseline and targets in the context of monitoring marine litter in the sea
Olive Ridley Project	Across Maldives	Geographic location of ghost net with attributes such as – length, type of twine, number of strands, type of material, entangled species of turtle, carapace length, and photos etc. are collected through the citizen science protocol.	Abundance of ghost nets and their points of origin identification.
Korallion Lab	Lhaviyani, Vavaru Island - six sites in natural accumulation zones	Method 1: Quantification of long-term accumulation of plastic debris within a grid of 1m ² (1x 1 m) Method 2: daily abundance of plastic particles within a grid of 0.5 x 0.5m(0.25m ²) was placed in the high tide drift line of the south-facing shoreline	Abundance of macro-, meso and microplastic detection in correlation to population density Detection of various types of polymers and noted prevalence of polystyrene of all sizes.

Gaps, Research and Analysis Knowledge Needs

- Insufficient data on the extent of marine litter in the Maldives.
- Degradation of marine litter in the environment and its potential physical and chemical impacts on marine systems are unknown
- Lack of a marine litter monitoring programme in the country
- Absence of a specific policy for marine litter and overlapping of agency responsibilities
- Limited awareness and outreach on the issue of marine litter
- Weak waste prevention and management mechanisms

Proposed Way Forward

- Conduct baseline studies on the status of marine litter in Maldives
- Assess impacts of marine litter at a national level
- Synergise monitoring efforts
- Implement a marine litter policy
- Provide options for proper waste storage at sea or low cost disposal opportunities at local islands or port reception facilities to reduce incidents of ocean dumping
- Develop, strengthen and implement laws and policies to support solid waste prevention, minimisation and management

Proposed Way Forward

- Build technical capacity to monitor and enforce compliance with legislation and polices on litter and solid waste management
- Remove marine litter from shorelines, benthic habitats and pelagic water
- Develop and implement a national education and outreach programme on marine litter impacts, prevention and management to minimise the amount of both land and sea based sources of marine litter
- Establish an integrated water management system with a strong communication strategy



Photo: Olive Ridley Project



THE MARINE LITTER ACTION PLAN STATUS REPORT (PAKISTAN)

by

Abdul Munaf Qaimkhani

INTRODUCTION

- Pakistan coast is about 1001 km long extending from the Indian border in the east to the Iranian border in the west
- The maritime area of Pakistan extends up to Exclusive Economic Zone (EEZ) of 200 NM covering an area of about 240,000 sq. km
- In addition, an area of about 50,000 km² of the Continental Shelf has been recently added to the maritime areas of Pakistan
- Pakistan produce roughly more than 20 million tones of municipal solid waste with annual growth rate of 2.4 percent
- Release of industrial and solid waste into the sea is a serious environmental issue effecting millions of coastal population and marine ecosystem



Marine Litter Status

- Solid waste in Pakistan is generally composed of three categories:-
 - Biodegradable: food waste, animal waste, leaves, grass, straws, and wood
 - Non-biodegradable: plastic, rubber, textile waste, metals, fines, stones
 - Recyclable material: paper, card board, rags and bones
- Marine litter also introduced by people that use the beaches for recreational activities such as swimming, sailing and scuba diving
- No authentic inventories on the potential sources and quantity of marine debris have been compiled
- 65% of garbage that litter beaches along Pakistan's coast consist of plastics



Circulation of Marine litter

- presently NIO is studying this phenomena in Pakistani waters
- Multinational companies mostly also working in Pakistan has pledged that their all packaging material will be reused, recycled or composted by 2025 to enhance circular economy
- By adopting new circular approach of 3R, the marine litter particularly plastic products may provide bases for large scale jobs
- A strategy for waste disposal through circular economy will be required to reduce waste including plastic litter at land and in sea
- The only long-term solution is to reduce plastic waste by recycling and reusing more.



National Impact of Marine Litter

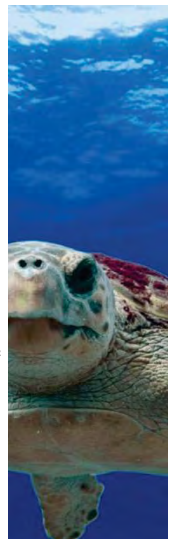
- Marine pollution has tremendous economic, health and biodiversity costs
- It pose a great threat to marine life including marine turtles, dolphins, whales, different species of birds
- Floating debris create hindrances in smooth navigational operations
- Dumped waste in the ocean eventually washes up on beaches and ruins beach aesthetic values and tourism
- Polluted beaches pose a higher risk of catching diseases
- Negative impact on marine fisheries resources and fishermen community



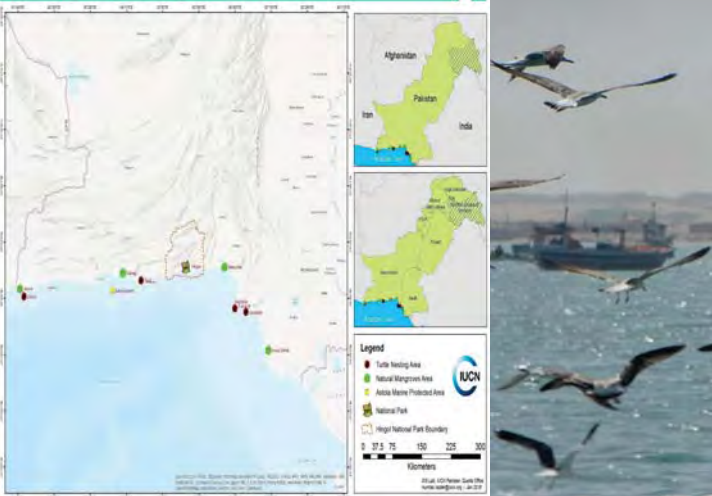
Important Biodiversity Hotspots

The important biodiversity hotspots in coastal and marine waters of Pakistan includes:

- **Ramsar Sites:** 8 Ramsar sites
- **National Park:** Hingol national park
- **Wildlife Sanctuaries:** 5 wildlife sanctuaries
- **Sea Turtle Nesting Beaches:** Sandspit & Hawksbay, Ormara and Astola beaches
- **Astola Island Marine Protected Area:** First MPA of Pakistan
- **Churna Island:** Potential Marine Protected Area
- **Mangroves:** Indus Delta mangrove ecosystem



Biodiversity Hotspots along the Coast of Pakistan



Management Agencies

Agencies directly and indirectly responsible for efficient marine litter management:

1. Karachi Port Trust - Marine Pollution Control Unit.
2. Karachi Metropolitan Corporation.
3. Gwadar Deep-Sea Port Authority.
4. Port Qasim Authority.
5. Sindh Solid Waste Management Board.
6. District Municipal Councils.
7. Private firms hired by the Governments.
8. Pakistan Navy for naval bases.



Management Policies/Acts

Following policies and acts are formulated to address coastal and marine pollution but not included marine litter specifically:

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



Marine Litter Monitoring

- Pakistan Environmental Protection Act (PEPA) -1997 provides a framework including monitoring of marine pollution / marine litter
- However, no monitoring mechanism is in place to check transboundary shipments of waste and dumping of plastic at sea
- Karachi Port Trust (KPT) established Marine Pollution Control Department to assess, monitor and remove marine debris from port area
- The Maritime Security Agency is empowered under its own Act, 1994 and PEPA, 1997 to monitor marine pollution including marine debris in open waters of Pakistan
- Robust and integrated monitoring programme is need of the hour to monitor marine debris
- Role of NIO may be required in marine litter monitoring



Gaps and Research

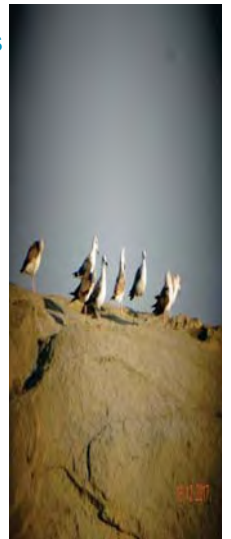
To rid the coastal and marine waters from a plague of debris particularly from plastic waste is quite challenging task for the responsible authorities.

- Need effective marine governance to ensure implementation of SDG 14 through integrated approach and shared cooperation between SAS countries
- Need scale up capacity building efforts for sound waste management domestically and regionally
- A large data reporting gap on marine debris



Some policy gaps and research needs

- The national marine resource policy to meet the future challenges related to sustainability of ocean resources
- No specific laws related to marine litter and plastic debris exists to address the emerging threat
- Private sectors role in waste management need to be strengthen
- No large scale programme on waste management and effluent treatment before release into the sea
- The coastal stakeholders lack capacities to tackle the issues like marine debris
- No satellite based monitoring system developed to monitor the marine litter issue at national level



Way Forward

The following short and long term steps required to overcome on the issue of safe waste disposal in Pakistan, such as:

- The provincial administrations of Sindh and Balochistan evolve a working strategy with municipalities, take stock of the situation and set priorities;
- PPP options can be explored for specialized domains such as hospital waste management;
- Research institutions, NGOs, and International agencies need to support in dissemination of best practices;
- Promote an integrated approach in dealing with different types of waste with particular focus on plastic debris;
- Launch marine pollution control programmes with adequate legal cover and policies;
- Develop strong and robust monitoring mechanism to deal with marine plastics debris;
- Encourage recycling to reduce the pressure of plastic debris releases into water bodies;



Specific Recommendations

- Establish national taskforce to formulate integrated national plan for marine litter monitoring
- Establish mechanism to address the issue of abandoned, lost, or otherwise discarded fishing gear
- Develop policies, regulatory frameworks and measures consistent with the waste management best practices
- Improve infrastructures for waste disposal, management and recycling for land and sea based sources of marine litter
- Improve and expand waste management SOPs for the public at famous beaches and coastal sporting events
- Launch periodic awareness campaigns on medical waste management issues for public health and safety



Specific Recommendations

- Existing legislations need to be strengthened by incorporating provisions of anti-litter regulations
- Involve stakeholders from the plastic, tourism and fishing industries in order to address environmental issues related to plastic pollution
- Introduce new rules and regulations at sea port facilities to tackle sea-based marine litter
- Long-term solutions requires improved governance at all levels as well as change in lifestyle
- Review existing institutional arrangements to address gaps nationally, sub-nationally and regionally
- involvement of private sector, use of best practices and best available technology may be instrumental in marine plastic pollution mitigation





Regional Workshop to Strengthen Capacity for Marine Litter Management in the South Asian Seas Region

Status of Marine Debris Management in Sri Lanka



A J M Gunasekara
Manager Operations

Marine Environment Protection Authority

Introduction

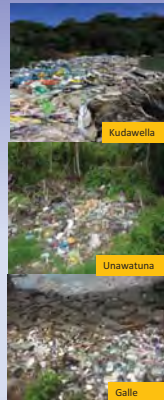
Item	Area (Sq.Km)
Land area	65610
Territorial Sea	21700
Contiguous Zone	22600
EEZ/PPZ	465800
Length of coastline	1700km



Waste management and marine debris issues in Sri Lanka

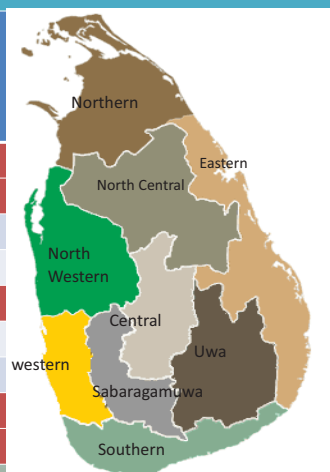
- The amount of waste generated has been increased significantly with the development of economic status and the population of the country during last two decades.
- The urban areas people generates the higher amount of waste than that of the rural areas people.
- The present urban population of the country is 19. 2% of the total population. The urban populations are expected to grow from 4 million to 6.5 million in 2030 as the annual rate of change of urbanization is 1.36%.

- Present municipal waste generation in Sri Lanka is around 6500 to 7000 Mt/per day
- Per capita waste generation is varying from 0.4 to 1kg per day based on the living status and areas of living.
- Present municipal solid waste collection of the country is 3500 Mt /d. The collection capacity is nearly 50 percent of the total waste generated.
- There are nine provinces in the country and the waste generated is varied in each province while the western province contributes 58 percent of the total waste generated.



Waste generation rate at provincial level

Province	Waste generation percentage
Western	58.58
Southern	6.99
Central	8.08
North central	6.00
North Western	2.61
Sabaragamuwa	2.23
Uwa	3.02
Eastern	8.20
Northern	3.29



Marine Debris Issue

- Marine Debris has become a one of the major threat to the marine environment of Sri Lanka. The five provinces of the country have coast line and these five provinces population is relatively higher than the other provinces.
- The 35 % of the total population is located in the coastal region while 65 % of organized industries are located in the coastal region.
- The tourism industry of the country, mainly concentrated in the coastal region. Nearly 80 percent of the tourism related infrastructures are located in the coastal region
- The fisheries industry is one of the main industry and which mainly rely on the coastal and marine environment.

Sources of Marine Litter in Sri Lanka

Sea-based Sources	Coastal-Based Sources	Inland-based Sources
Merchant ships, Ferries and Cruise liners	Tourist resort and hotels	Discharge of untreated municipal sewage and storm water, including occasional overflows
Fishing Vessels	Restaurants and boutiques along coastal belt	Riverine transport of waste from waste dumping sites, waste dump into illegally to river and waterways
Recreational activities (diving, boating and other water sport)	Domestic households along coastal belt	From indiscriminate dumping sites on marshy land and other low lying wetland areas
Drifting	Harbors fishery harbors, fish anchorages and fish landing sites Urban centers, boarding the coasts Illegal dumping of domestic waste along the shore	

Classification of marine litter based on the source as per the ICC data sheets.

Shoreline and Recreational Activities

Bags [plastic and paper], balloons, beverage bottles (plastic; 2L or less], beverage bottles [glass], beverage cans, caps and lids, clothing and shoes, eating utensils, cups and plates, food wrappers and containers, pull tabs, 6-pack holders, shotgun shells and wadding, straws and stirrers, toys

Ocean and Waterway Activities

Bait containers and packaging, bleach and cleaner bottles, buoys or floats, traps, crates, fishing line, fishing lures or light sticks, fishing nets, light bulbs or tubes, oil or lube bottles, pallets, plastic sheeting or tarps, rope, strapping bands

Smoking-related Activities

Cigarettes or cigarette filters, lighters, cigar tips, tobacco packaging or wrappers

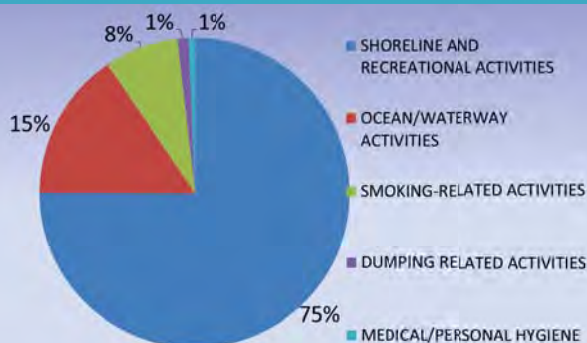
Dumping Activities

Appliances, batteries, building materials, car or car parts, 55-gallon drums, tires

Medical or Personal Hygiene Activities

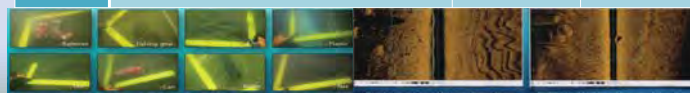
Condoms, diapers, syringes, tampons or tampon applicators

Types and sources of marine litter collected during the ICC programme from 2008 to 2013



Estimated amount of marine debris at Negombo lagoon

Location	Total Area (ha)	Survey Area (m ²)	Surveyed debris (Kg)	Marine Debris per Unit Area (kg/ha)	Total Marine Debris (ton)	Remarks
Negombo fishery harbor	10.0	100.00	7083	708	7	SSS Survey 2016
	2.4	508	1090	85554	30	Diving, Survey (2017)
	Total				37	



Types of marine litter found in Beaches of Sri Lanka

Category of litter	Types of litter
Polythene	Shopping bags, Packaging bags, Wrappers of soap, butter, toffee, chocolates
Plastics	Bottles, yogurt and ice cream cups, sachet of milk powder, milk, shampoo, hair gel, washing powder, plastic spoons, broken pieces of containers, pieces of plastic sheets, Parts of Plastic story books, torn Rexene covers, tooth paste tubes, medicine tubes, toys, broken plastic buckets, cargo strap bands
Polystyrene	Cups and plates, discarded food packaging boxes, rigid pieces, sponges.
Rubber	Used garden gloves, disposable medical gloves, damaged boots, used tires
Wood	Wastes from construction timbers, pieces of plywood materials, small decayed logs, broken pieces of chairs, tables and other furnishings
Metals	Beverage cans, used perfume aerosol containers, small pieces of scrap metal, old and corroded vehicle parts of various kinds, old car/lorry frames.
Discarded medical and sanitary equipment	Sanitary napkins, tampons, baby and adult diapers, condoms, baby soothers.

Category of litter	Types of litter
Paper and cardboard	Discarded exercise books, parts of school text and story books, packaging boxes of various products like mild food packs, perfume bottles, etc.
Glass	Empty/Broken beer bottles and other Liquor (mainly arrack) bottles, medicine bottles, light bulbs and tube lights, Discarded / broken jam bottles and cordial bottles.
Tins	Empty canned fish tins, Parts of drums from tar and chemical containers, Engine oil containers
Fishery sector	Fish offal from landing sites and way side fish markets, Discarded and torn fishing nets, fishing boxes, ropes, discarded buoys and other floating devices used in fishing crafts, fiberglass pieces
Tetra packs	Waxed milk carton, Fruit juice cartons.
Waste from households	Used torn cloth, hats and caps, cut the garment pieces, pieces of old PVC pipes and connections, parts of toilet cisterns, brooms and brushes, broken slippers, damaged shoes, aluminium cooking utensils, tooth brush, tooth paste containers, ferpuem and cream containers
Building materials	Discarded / demolished building materials – broken cement blocks and bricks, parts of brick and cement block wall
Pottery/Ceramic	Waxed milk carton/Tetra Pack
Used batteries	Pen torch batteries (AA and AAA size), Broken pieces of car battery.
Smoking related litter	Cigarettes, cigarette fibre, lighters, cigar tips, and other tobacco related packaging/wrappers

Top ten marine debris collected in ICC in Sri Lanka from 2012- 2014

No.	Item	Percentage
1	Plastic Grocery Bag	18.14
2	Plastic beverage Bottle	18.05
3	Food Wrappers	14.59
4	Straws, Stirrers	10.27
5	Plastic bottle caps	8.61
6	Other plastic bags	7.94
7	Glass beverage bottles	7.80
8	Form take away containers	5.05
9	Cigarette butts	4.95
10	Plastic lids	4.56

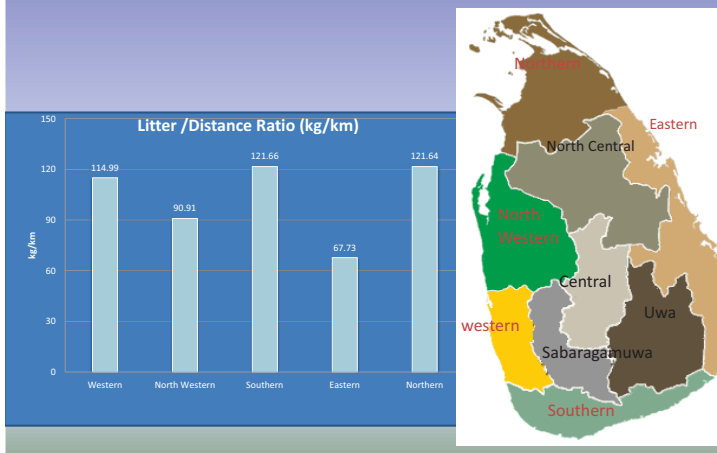


Top ten marine debris collected in ICC in Sri Lanka from 2015 and 2016

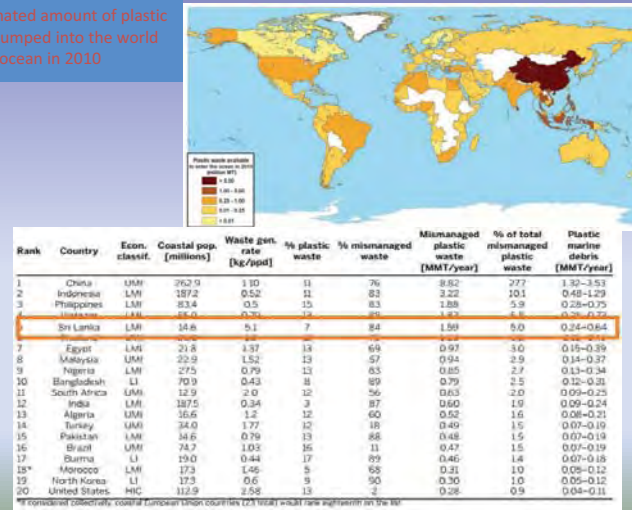
No.	Item	Percentage
1	Beverage Bottles (Plastic)	21.23
2	Grocery bags	18.12
3	Food wrappers	13.17
4	Cigarette Butts	11
5	Beverage Bottles (Glass)	7.92
6	Straws Stirrers	7.12
7	Bottle Caps (Plastic)	6.78
8	Cups and Plate (plastic)	5.86
9	Other plastic bags	5.38
10	Beverage Cans	3.42



Amount of marine debris in Sri Lanka beaches



The estimated amount of plastic debris dumped into the world ocean in 2010



Estimated future waste generation rates for the western province (Unit: g /person/day).

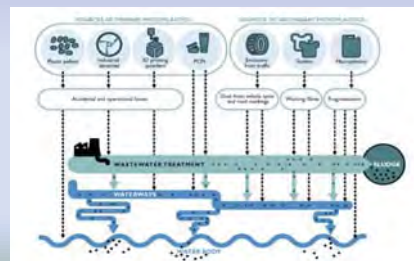
District	Colombo	Gampaha	Kalutara	Western
2015	708	480	452	565
2016	719	493	464	577
2017	730	507	477	589
2018	741	521	490	602
2019	753	535	503	615
2020	764	550	517	628
2021	778	565	531	642
2022	791	581	546	657
2023	805	597	561	672
2024	819	613	576	687

Waste Indicator	Value	Units
Generation per capita	215.4	Kg/yr
Municipal waste generation	4 494 139	T/yr
Environmental stress	71.70	T of MSW/km2

Micro plastic debris

The amount of waste water discharge to the sea by long sea outfall

Location	Discharge rate(CBM /S)
Wellawatta long sea outfall	2.2
Mutwall long sea outfall	2.9



institutions responsible for solid waste management

Ministry of Local Government and Provincial Councils (MoLGPC)
Ministry of Mahaweli Development and Environment (MoMDE)
Ministry of Mega polis and Western Development (MoMWD)
Ministry of Health, Nutrition and Indigenous Medicine (MoH)
National Solid Waste Management Support Center (NSWMSC)
Central Environmental Authority (CEA)
Coastal Conservation and Coastal Resources Management Department (CC& CRMD)
Marine Environment Protection Authority (MEPA)

Provincial and Local government agencies responsible for waste management

Related Agencies	Role and jurisdiction
Provincial Council (PC)	There are nine PCs across the country. They provide substantial administrative guidance to the District and LAs of the region. Their duty is to provide administrative services for the basic daily life of citizens and community such as waste management. financial assistance for waste management in LAs.
Local Authority (LA)	LAs, under the supervision of the PCs, are responsible for providing administrative services such as health and hygiene, waste disposal, regional environmental protection, and park management.

The National Level Policies and Strategies related Solid Waste Management

Year	Policy /Strategy	Description
2000	National Strategy for Solid Waste Management (NSSWM)	3-year action plan, Waste reduction, 3R implementation
2003	Caring for Environment Phase I (2003-2007) Phase II (2008-2012)	Funded by United Nations Development Program; UNDP ☑ National Environmental Action Plans
2005	Vision for A New Sri Lanka	A Ten Year Horizon Development Framework 2006-2016 formulated by the Ministry of Finance and Planning ☑ Solid waste and pollution management included in the investment plan

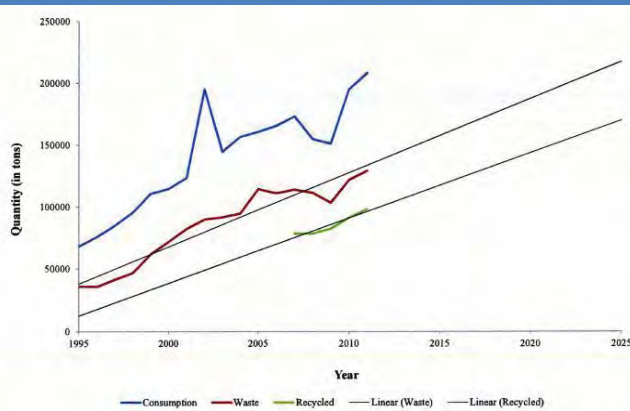
2006	Coastal Zone Management Plan	Policy Solid waste management within the Coastal Zone will be promoted to minimize coastal zone pollution. Solid waste management plan be prepared to reduce adverse impact on the coastal environment
2007	National Policy on Solid Waste Management	Waste reduction, 3R implementation, Sanitary landfills ☑ Capacity building, Research and development (Best Available Technologies (BAT), Best Environmental Practices (BEP
2008	Pilaru Program Phase I (Jan. 20 –Dec. 2013) Phase II (Jan. 2014–Dec. 2018)	☑ National level program for solid waste management under the chairmanship of Ministry of Environment, CEA, and others. ☑ Initial budget amount: 5.675 bill LKR. ☑ Target is to introduce small and medium waste treatment system in all local government authorities by year 2018 and to cover 50% by the year 2016.
2009	National Action Plan for Haritha Lanka Program	Establishment of National Council for Sustainable Development (NCSDD) ☑ Sustainable development: Haritha (Green) Lanka Program

Legal Frameworks related to Solid waste management

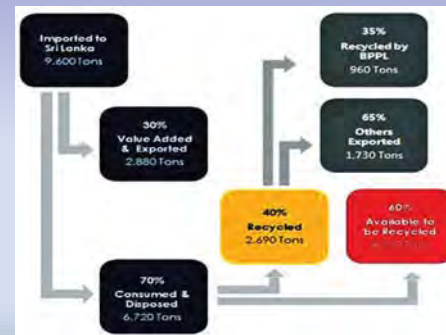
Year	Legislation and regulation	Description
1939	Urban Council Ordinance No 61 of 1939	Section 118, 119 and 120 specify waste management responsibilities of UCs
1946	Nuisance Ordinance No 62 of 1939 and No 57 of 1946	Section 1-12
1947	Municipal councils procedure Act No. 15 of 1979- Public Nuisances	Section 98
1987	Provincial Councils Act No 42 of 1987	Amended by by Act No. 56 of the 1988 LAs contains provisions for waste management
1987	Pradeshuya sabba Act No 15 of 1987	Sections 93 and 94. Specify waste management responsibilities of Pss
1980	National Environment Act No 47 of 1980	Section 12 and 26
2007	Prevention of Mosquitoes Breeding Act No 11 of 2007	Prohibition against creating conditions favorable to the breeding of mosquitoes

2008	National Thoroughfares Act No 40 of 2008	Section 64 (a) (b) and section 65
2009	Gazette No. 1627/19 National Environmental (Municipal Solid Waste) Regulations, No. 1 of 2009. ☑	General Rules on SWM discharge and collection of waste (Prohibition of waste dumping at national highway and at any place other than places designated for such purpose by the LA
2008	Marine Pollution Prevention Act no 35 of 20018	Section 21, section 26 and section 27
2012	Marine Environment Protection Sea Dumping Regulation 2103	Waste water discharge standards and issuance of sea dumping permit

The trend of plastic waste amount and recycling capacity



PET Bottle Recycling



National Impact of Marine Litter



Type of Ecosystem Service	Ecosystem services	Potential impact on ecosystem services by Marine Litter
Supporting services: The services that are necessary for the production of all other ecosystem services	Soil formation, photosynthesis, primary production, nutrient cycling and water cycling	Plastic sheeting on seabed reduces nutrient cycling and gas exchange between water column and seabed and can block sunlight restricting photosynthesis
Provisioning services: The products obtained from ecosystems	Food, fiber, fuel, genetic resources, biochemical, natural medicines, pharmaceuticals, ornamental resources and fresh water	Ghost gear has continued to indiscriminately catch marine organisms. Contamination of resources. Potential loss of new pharmaceuticals
Regulating services: The benefits obtained from the regulation of ecosystem processes,	Air quality regulation, climate regulation, water regulation, erosion regulation, water purification, disease regulation, pest regulation, pollination, natural hazard regulation;	Transportation and distribution of aliens, bacteria and viruses. Exacerbate erosion with the potential for larger marine litter items, colliding with the coast during storm activity. Collision and entanglement risk with vessels.
Cultural services: The non-material benefits people obtain from ecosystems	Spiritual enrichment, cognitive development, reflection, recreation and aesthetic experiences – thereby taking account of landscape value	Beach users and recreational water user experience can be diminished by the presence of significant levels of beach litter. Glass, metals and shards of rigid plastics can pose a danger to beach users. Entanglement with ghost gear could cause distress, and in extreme events, death for recreational water users.

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

- The management of solid waste is the primary responsibility of municipal councils, urban councils and other local authorities. Maintenance of clean beaches also falls within the purview of these local authorities.
- Marine Environment Protection Authority (MEPA)
- Coast Conservation and Coastal Resources Management Department (CC& CRMD).

Marine Environment Protection Authority (MEPA)

- One of the main function of the MEPA is to prepare schemes of work for the prevention, reduction and control of marine pollution.
- MEPA is responsible for the provision of waste reception facilities to ship generated waste and MEPA has provided waste reception facility to the ships through the service provides.
- The Marine Environment Protection (Sea dumping) regulations 2012 introduced by MEPA prohibits the sea dumping of waste and other matters without a valid permit

Coast Conservation and Coastal Resources Management Department

- Responsible for control of development activities and the implementation of National Coastal Zone Management Plan.
- Objective: - Improve the coastal environment by reducing the types and volume of solid waste disposed in the coastal zone.

Gaps, Research, Analysis Knowledge needs, and propose a basis for setting priorities

- Inadequate Institutional frameworks and Stakeholder Involvement.
- Policy and Legislation gaps
- Lack of infrastructure for waste collection, transport and recycle
- Unavailability national level marine debris monitoring program
- Education and Awareness



Recommendations

- Introduce integrated National Marine Debris Management policy, strategy and management plan
- Intensive management of marine debris sources
- Building of marine debris collection system
- Building of marine debris disposal and recycling
- Customized education and research
- Further strengthen public private partnership
- Use of market based instrument for reduce and manage marine debris
- Regional and international cooperation



Intensive Management of Marine Debris Sources	<ul style="list-style-type: none"> • Rigid enforcement of regulations on dumping waste at the beach, seashore, fishery harbor • Marine debris collecting box on beaches • Construction & Installation of Marine waste repository • Minimizing the inflow of the floating debris from Hamilton canal and rivers
Building of Marine Debris Collection Systems	<ul style="list-style-type: none"> • Cleaning the beach • Collecting Marine Debris in Fishery Harbor • Residential coastal clean-up • Collecting Waste Mangrove Forest Area • Collecting Marine Debris Coral Reef Area • Operation of Ships for Fishery Harbor Management
Building of Marine debris Disposal and Recycling	<ul style="list-style-type: none"> • Styrofoam compressor • Eco-friendly Utilization of Fishery By-products • Waste Treatment Facility (Incineration and Landfill facilities) • Disposal of abandoned ships
Customized Education and Research	<ul style="list-style-type: none"> • Public awareness programs • Education of the fishermen • Research and Development

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THE REGIONAL MARINE LITTER ACTION PLAN REPORT

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Regional Consultant

Contents of the Presentation

- Introduction
- Global challenge of Marine Litter
- South Asia Regional Status
- Solid waste Management Strategies
- Recommendations
- Conclusion

Introduction

- Knowledge on causes of marine litter and possible solutions offers a solid basis for effective management of the marine litters
- Origination and routes of marine litter are diverse and exact quantities and pathways are not fully known
- 83% of the 4.8–12.7 million tons of land based plastic waste end up in the ocean from the 192 coastal countries

Introduction Continue

- Of them majority countries are Asian
- Four of them are (Bangladesh, India, Pakistan, and Sri Lanka) South Asian
- Amount of plastic waste coming to the ocean mainly determined by the percentage of mismanaged waste
- Between 1.15 and 2.41 million tons of plastic waste flows from rivers into the ocean annually

Main Drivers for Marine Litters

- Population density
- mismanaged plastic waste
- Production per country

Three specific goals to reduce Marine Litter

- Reduced amount and impact of land based litter and solid waste introduced into the marine environment
- Reduced amount and impact of sea based sources of marine debris
- Reduced amount and impact of accumulated marine debris on shorelines, in benthic habitats, and in pelagic waters

Management Strategies used for Management of Marine Litters

- Formation of Management Polices, International Conventions, laws, regulations and treaties
- Implementation of Direct development activities
- Conducting Research and surveys
- Implementations of enforcement program
- Monitoring and evaluation
- Conducting Education and awareness programs
- Use Market and Economic Instruments

Marine Litter Quantity statuses in South Asian Seas (SAS) Region

Country	Quantity Data availability at area/region level	Quantities Data Availability at National level
Bangladesh	Litter classification information not available.	Total Quantity Data not available.
India	Status of marine litter indicated 14 segments/regions.	Quantity Data not available
Maldives	Regional data not available	Quantity Data not available
Pakistan	Regional level classification of marine litter is available.	Quantity Data not available
Sri Lanka	Regional level classification of marine litter is available.	Quantity Data not available

Estimated solid waste data and reduction activity data in SAS

Country	Total estimated solid waste Quantity per year	Availability of management system and quantity of reducing Data
Bangladesh	9.5 metric tons	Not available
India	56 metric tons per year	3360 mt per year recycled and balance 2240 mt per year remain uncontrolled.
Maldives	7398 metric tons of solid waste per year	Quantity of recycling or re use is not available
Pakistan	200.24 metric tons a year	Quantity of recycling or re use is not available
Sri Lanka	4308 metric tons per year	Quantity of recycling or re use is not available

Major management issues in Relation to the Marine litter

- Ecological
- Economic
- Social

Ecological Issues

- Entanglement
- Ingestion
- Toxicity
- Indirect disruptions of ecological functions

Social Impacts

- Human Health
- Reduced benefits from access to coastal environments
- Consumption of contaminated marine products

Economic Impacts

- Beach clean cost (United Kingdom report spending some 18 million euros per year, east coast of Sweden costs about 1,125,000 euros per year Tourism and Recreation)
- Shipping and Yachting
- Fisheries
- Aquaculture

Information availability in SAS countries on Ecological, Social and Economic Issues

Country	Ecological Issues	Social Issues	Economic Issues
Bangladesh	No site specific data available to indicate exact issues	General statements	Tourist areas have some impacts
India	No country specific information	General statements	General statements
Maldives	No country specific information	General statements	Economic impacts not available
Pakistan	No country specific information	General statements	Indicated Tourism is affecting
Sri Lanka	Little information indicated But not national level	General statements	Indicated that tourism gaining is very high

Management strategies implemented at the global level to mitigate the marine litter impacts

- a) Formation and declaration of Management Policies, International Conventions, laws, regulations and treaties
- b) Implementation of Direct development activities
- c) Conducting Research and surveys
- d) Implementations of enforcement program
- e) Monitoring and evaluation
- f) Conducting Education and awareness programs
- g) Use Market and Economic Instruments
-

International Conventions, laws, regulations and treaties

- **Agenda 21 and the Johannesburg Plan of Implementation**
- **FAO Code of Conduct for Responsible Fisheries**
- **Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection**
- **International Coastal Cleanup (ICC)**
- **UNCLOS**
- **Annex V of MARPOL 73/78**
- **London Protocol**

International Conventions, laws, regulations and treaties

- **UNEP Regional Sea Programme**
- **UNEP/IOC Guidelines on Surveying and Monitoring of Marine Litter**
- **UNEP Guidelines on the Use of Market-Based and Economic Instruments**
UNEP Global Partnership of Marine Litter
- **UNEP/FAO Abandoned, Lost or Otherwise Discarded Fishing Gear**
- **Honolulu Strategy**
- **UNEP Global Partnership of Marine Litter**

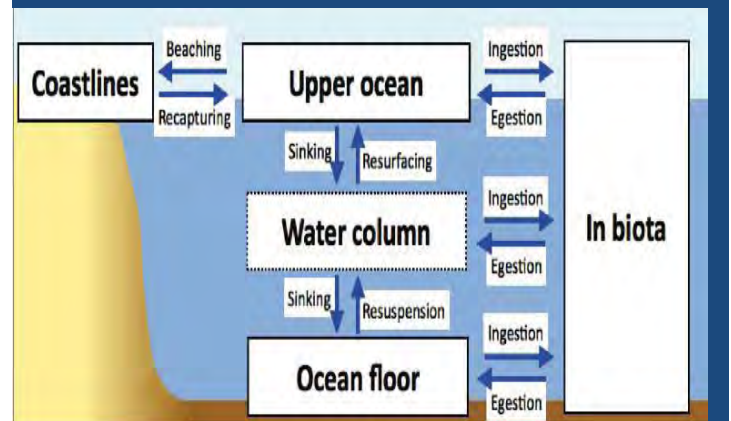
Regional Instruments

- **EU Port Reception Facility (PRF) Directive**
- **EU Marine Strategy Framework Directive**
- **EU Initiatives on Land-Based Waste Management**
- **Helsinki Convention and Its Associated Initiatives**
- **OSPAR Initiatives on Monitoring Marine Litter**
- **OSPAR Fishing for Litter**
- **Barcelona Convention**

National level Instruments

- US Marine Plastic Pollution Research and Control Act (MPPRCA)
- US National Marine Debris Monitoring Program
- UK Legislations on Garbage from Ships and PRFs
- UK Beach Cleanup and Awareness Campaigns
- Scotland Marine Litter Strategy and National Litter Strategy
- South Korea Initiatives on Marine Litter
- Taiwan Initiatives on Land-Based Waste Management

Marine Environment components



Implementation of International Polices, Conventions, laws, and treaties in SAS countries

Country	In the beach/Coastline	Coastal Sea floor	In the water column	On the water surface	Deep sea	In the water column at deep Sea
Bangladesh	None	None	None	None	None	None
India	Very few confined beach area	None	None	None	None	None
Maldives	Very few limited small areas	Marine protected areas	None	None	None	None
Pakistan	None	None	None	None	None	None
Sri Lanka	Certain polices	Certain areas	None	None	None	None

Direct Development Activities

- Source reduction
- Waste reuse and recycling
- Structure waste conversion to energy
- Reception facilities
- Development of gear marking facilities
- Debris contained at points of entry into receiving waters
- Various waste management initiatives on land.
- Product modification
- Development of packaging material that is made from sustainable resources

Direct Development Activities Implemented in the SAS Region

Country	In the beach/Coastline	Coastal Sea floor	In the water column	On the water surface	Deep sea	In the water column at deep Sea
Bangladesh	Several places beach cleaning activities	None	None	None	None	None
India	Several places beach cleaning activities	No information	Some state by NGO and Fishermen	None	None	None
Maldives	Very few cleaning programs	debris collection by Fishermen and private sector	None	Floating debris collection by Fishermen	None	None
Pakistan	Several Beach cleaning activities	Same removing activities by Fort Authority of Karachi	None	None	None	None
Sri Lanka	Many cleaning activities island wide	Certain coral reef ckening activities and sea floor ckening by NGO and Fishermen	Several activities to collect the floating debris by fishermen and NAVY	Several activities to collect the floating debris by fishermen and NAVY	None	None

Different activities implemented by SAS countries under Direct development strategies

Country	Source reduction	3Rs	Waste conversion to energy	Port Reception facilities	Entry prevention Structure	gear marking facilities and others
Bangladesh	Data not Available	Data not Available	Data not Available	Data not Available	Data not Available	Beach cleaning
India	Municipal level	State and municipal level	Data not Available	Data not Available	Data not Available	Beach cleaning
Maldives	Data not Available	Separation system introduced	Data not Available	Data not Available	Data not Available	Beach cleaning
Pakistan	Data not Available	Data not Available	Data not Available	Data not Available	Data not Available	Beach cleaning
Sri Lanka	Available	Available	Under construction			Beach cleaning

Regulation development and enforcement

- Mitigate the impacts of marine litter and reducing the waste generation.
- Strategy need to prepare guidelines, regulations and enforcement plan
- largely command and control method
- overlapping with direct development strategy
- prohibition of certain types of litter discharged into seas or to coastal landfills,
- dumping regulations if dumping is allowed
- prohibition of certain types of wastes discharged into ecologically sensitive areas,
- specifications of the distances from the land and of waste status for disposal

Statuses regarding the enforcement programs implementing by SAS countries

Country	Availability of Separate Act for Marine Litter	Availability of Separate Agency for Marine Litter	Availability of Separate Regulations for Marine Litter	Availability of Separate team for Regulation Marine Litter
Bangladesh	No	No	No	No
India	No	No	No	No
Maldives	No	No	No	No
Pakistan	No	No	No	No
Sri Lanka	Yes	Yes	Yes	No

Monitoring and Evaluation

- One of the issue in the SAS region has not been given priority for the monitoring and evaluation strategy
- Another issue for monitoring and evaluation of the marine litter in the SAS region is that lack of proper scientific baseline data and information on marine litter.

Status of monitoring and evaluation strategy in the SAS countries

Country	In the beach/Coastline	Coastal Sea floor	In the water column	On the water surface	Deep sea	In the water column at deep Sea
Bangladesh	No base line data	No base line data	No base line data	No base line data	No base line data	No base line data
India	Same monitoring data available	No base line data	No base line data	No base line data	No base line data	No base line data
Maldives	Same monitoring data available	Same monitoring data available	Same monitoring data available	Same monitoring data available	No base line data	No base line data
Pakistan	No base line data	No base line data	No base line data	No base line data	No base line data	No base line data
Sri Lanka	Same monitoring data available	Same monitoring data available	Same monitoring data available	No base line data	No base line data	No base line data

Research and Studies

- Preparation of policies for marine litter management more scientific researchers are required
- Research and studies needed to be done all segments of the marine environment components
- research and studies in SAS region are limited to beaches/shorelines but very few on ingestion by other marine organisms, entanglement rates of marine organisms, ecological impact, and Socio-economic

Status of research in SAS region

Country	3Rs & Land base generation	Ecological Impacts	Social Impacts	Economic Impacts	Ocean circulation	Compartment of the marine environment
Bangladesh	No	No	No	Certain areas	No	No
India	Yes	Yes	Certain States	Very few	Yes	Certain component
Maldives	Yes	Up to certain areas	Certain Island	No	No	Certain component
Pakistan	No	No	No	No		Certain component
Sri Lanka	Yes	Yes	Yes	No	No	Certain component

Education and Awareness

- Mainly use for changing the behavior of people
- Strategy is crosscutting and assist to develop and implement of the other strategies also
- Litter management efforts are most likely to succeed if they are accepted as necessary and fair by large segments of the stakeholders

Well-designed, education and awareness program lead to

- Increased public awareness and appreciation for coastal resources its habitats and values;
- Informed coastal residents and users that are more likely to understand how voluntary compliance to laws and regulations can be to their long-term benefit; and
- Increased public participation and support in marine litter management, including organizations with renewed motivation to undertake projects or activities that compliment national policies on marine litter

Status of the Environment Education and Awareness programs implemented by the SAS countries

Country	Availability of National program	Identification of goal and objectives	Identification of Target groups	Priorities of education messages	Identification of education media
Bangladesh	No	No	General Public	No	No
India	No	No	General Public	No	No
Maldives	No	No	General Public	No	No
Pakistan	No	No	General Public	No	No
Sri Lanka	No	No	General Public	No	No

Economic Incentives Strategies

- Incentivize industries to use less plastic (packaging) either through economic disincentives/subsidies (internalizing external cost);
- Target waste arising generally—such as with a landfill tax;
- Target specific types of waste—such as plastic bags;
- Target sources of waste most problematic for marine litter—such as shipping;
- Target individual types of marine litter—such as to reduce ghost fishing;
- Pay for the collection of litter;
- Target the toxicity of litter;
- Discourage polluting behavior.

Economic Incentives Strategy Status in SAS Region

Bangladesh	No	Yes	Yes	No	No	No	No
India	No	Yes	Yes	No	No	No	Yes
Maldives	No	No	No	No	No	No	No
Pakistan	No	No	No	No	Yes	Yes	No
Sri Lanka	No	Yes	Yes	Yes	Yes	Yes	Yes

Identified Gaps in Marine Litter Management in SAS Region

- Lack of Institutional system for management of Marine litter
- Unavailability of Country level legal instruments for marine litter management in SAS region
- Poor and insufficient implementation of international Conventions, Agreements, laws, regulations and treaties
- Unavailability of Marine litter Quantity in the SAS Region Countries

Identified Gaps in Marine Litter Management in SAS Region

- **Limited Implementation of Direct development activities**
- **Lack of Research and surveys on Marine Litter**
- Poor Regulation development and enforcement
- Lack of Proper Education and Awareness Program

Recommendations

- Establishment of new Institutional system SAS region level as well as country level to tackle the marine litter problem
- **Assist to enact specific separate law or Act for each SAS countries to properly manage the marine litter**
- **Establish Regional Level legal Institutional Structure to facilitate implementation of international Conventions, Agreements, laws, regulations and treaties**
- **Introduce urgent project to collect Marine litter data to Quantity the marine litter in the SAS Region Countries**

Recommendation Continue

- **Preparation and Implementation of the Proper Direct development activities plan to minimize Coastal and Marine litter in the SAS region**
- **Preparation of Research and survey program to study all aspect of Marine Litter in SAS region**
- **Preparation Regulations and enforcement program for each SAS countries to manage the marine litter**
- **Preparation of Country specific Education and Awareness Program to manage the Marine litter issues in the SAS Region and Countries**

Recomendations

- Amending existing instruments to narrow exceptions and clarify enforcement standards
- Establishment of comprehensive national marine litter programmes
- Strengthening management measures on fishing vessels

Thanks You

Table 1: Marine Litter quantity availability statuses in South Asian Seas (SAS) Region

Country	Quantity Data availability at area/region level	Quantities of marine litter Data availability at National level
Bangladesh		
India		
Maldives		
Pakistan		
Sri Lanka		

Table 2 : The estimated Marine litter solid waste data and solid waste reduction activity data

Country	Total estimated solid waste Quantity per year	Availability of management system and quantity of reducing
Bangladesh		
India		
Maldives		
Pakistan		
Sri Lanka		

Table 3: Information availability In SAS countries on Ecological, Social and Economic Issues

Country	Ecological Issues	Social Issues	Economic Issues
Bangladesh			
India			
Maldives			
Pakistan			
Sri Lanka			

Table 4: Status of the implementation of the Strategy on International Conventions, laws, regulations and treaties in the different marine environment component of the SAS region

Country	In the beach/Coastline	Coastal Sea floor	In the water column	On the water surface	Deep sea	In the water column at deep Sea
Bangladesh						
India						
Maldives						
Pakistan						
Sri Lanka						

Table 5: Activities implemented within the marine environment component areas under the direct development strategies by SAS countries

Country	In the beach/Coastline	Coastal Sea floor	In the water column	On the water surface	Deep sea	In the water column at deep Sea
Bangladesh						
India						
Maldives						
Pakistan						
Sri Lanka						

Table 6: Different activities implemented by SAS countries under the direct development strategies.

Country	Source reduction	3Rs	Waste conversion to energy	Port Reception facilities	Entry prevention Structure	Gear marking facilities and others
Bangladesh						
India						
Maldives						
Pakistan						
Sri Lanka						

Table 7: Present statuses regarding the enforcement programs implementing by SAS countries

Country	Availability of Separate Act for Marine Litter	Availability of Separate Agency for Marine Litter	Availability of Separate Regulations for Marine Litter	Availability of Separate team for Regulation Marine Litter
Bangladesh				
India				
Maldives				
Pakistan				
Sri Lanka				

Table 8: Status of monitoring and evaluation strategy in the SAS countries

Country	In the beach/Coastline	Coastal Sea floor	In the water column	On the water surface	Deep sea	In the water column at deep Sea
Bangladesh						
India						
Maldives						
Pakistan						
Sri Lanka						

Table 9: Status of research in SAS region

Country	3Rs & Land base generation	Ecological Impacts	Social Impacts	Economic Impacts	Ocean circulation	Compartments of the marine environment
Bangladesh						
India						
Maldives						
Pakistan						
Sri Lanka						

Table 10: Status of the Environment Education and Awareness programs implemented by the SAS countries

Country	Availability of National program	Identification of goal and objectives	Identification of Target groups	Priorities of education messages	Identification of education media
Bangladesh					
India					
Maldives					
Pakistan					
Sri Lanka					

Table 11: Status of marketing instruments used by the SAS countries as a strategy to mitigate the marine litters in the region

Country	landfill taxes	Product taxes or ban	Infrastructure charges	Deposit-refund schemes	Direct investment in infrastructure	High fees and fines
Bangladesh						
India						
Maldives						
Pakistan						
Sri Lanka						

Table12: Status of Economic instruments used by the SAS countries as a strategy to mitigate the marine litters in the region

Country	Incentivize industries	Target waste arising	Target specific types of waste	Target sources of waste	Target individual types of marine litter	Pay for the collection	Discourage polluting behavior
Bangladesh							
India							
Maldives							
Pakistan							
Sri Lanka							

- END -