

Plastic Waste Management of Coastal Cities Affecting Marine Environment

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Abstract

The coastal area has experienced critical changes of waste issues throughout recent years. Hence, this study means to review individuals' points of view on the elements of waste in coastal regions and our goal is to make an essential that intend to manage the plastic contamination that addresses a major test for beach front urban areas, and to diminish the utilization of plastics in the public area to make urban areas liberated from plastic. Plastic marine litter is a worldwide natural issue with things of floating in water and affecting environments. Plastic has unfortunate results for untamed life, for economies and more on to human well-being. Plastic requests for earnest requirement for activity on a worldwide scale as it influences the marine climate. Fumble of strong waste is a grave concern whenever observed can assist with lessening plastic marine litter. Beachfront urban communities are situated on the connection point or change regions among land and ocean, including huge inland lakes. The marine climate incorporates the waters of oceans and estuaries, the seabed and its soils, and all marine natural life and its ocean and waterfront territories. The marine climate is an indispensable asset for life on earth. Marine environments play out various key natural capacities - they manage the environment, forestall disintegration, and circulate sunlight based energy, assimilate carbon dioxide, and keep up with organic control. The recognizable proof of the beginning of the plastics that arrive at the coast is by all accounts of vital significance. This article plans to safeguard the climate and advance asset effectiveness, can go past the issues of beach front zones, for example, distinguishing areas of action subject to a critical utilization of plastics and the objective that is being given. Making successful metropolitan waste administration frameworks is quite possibly the main activity to forestall plastic contamination. Deficient and overpowered seepage frameworks, open unloading, littering, and flood/overflow at assortment focuses and landfills are the fundamental drivers of land-based plastics spilling into waterways and marine conditions. In this review, future drives are worked to framework for assortment, decrease and isolation of waste at the source should zero in on sea shores. To resolve the issue of plastic contamination in the marine climate, legislatures should initially assume a functioning part in resolving the issue of plastic waste by acquainting regulation with control the wellsprings of plastic trash and the utilization of plastic added substances.

Keywords: Plastic Marine litter; Marine Environment; Microplastics and macro plastics; Mismanagement of solid waste; Coastal cities; land-based plastics, coastal community

Introduction

Waste problem in the sea is a very complex problem and solution. Waste in the sea can be from direct marine disposal waste from fishing industries, waste from fishermen, or waste from travellers. Cities are a key actor for mobilizing peers and the public sector, along with citizens, third sector and also the local private sector [1]: *Niti Aayog- Refer to UNDP Handbook on Sustainable Urban Plastic Waste Management*. Its influence is critical for changing behaviors, for educating for recycling and reuse, for decreasing the consumption and the demand, and for giving best practices on how to value alternatives to plastic, without endangering jobs, but by developing a new circular plastics economy. The aim of the study is to measure and manage marine plastic waste from land-based sources of coastal cities and the relationship between waste and coastal cities.

Coastal City

Seaside urban communities are situated on the point of interaction or change regions among land and ocean, including enormous inland lakes. Generally, seaside urban communities approach the ocean or bigger lakes through ports as well as significant waterways.

How does plastics affect the coastal city and marine environment?

The plastic garbage arrives at beach front and marine conditions as their definitive sink and is amassing all over the planet, even in the remote and uninhabited seaside conditions. The marine living beings are confronting the risk of conceivable trap, ingestion, environment annihilation and bio-intrusion. Marine waste is for the most part characterized as material squandered, disposed of, or left in the marine and beach front climate because of human and regular exercises that don't have a financial worth yet. The marine waste found generally incorporates plastic waste (plastic bundling, plastic sacks, straws, bottle covers, ropes, diapers, froth), fishing gear (nets, snares, fishing lines), metals (canned jars, paints, bottle covers), cigarette butts and cigarette lighters, glass cups (lights, glass bottles), handled wood, elastic, material, and electronic waste. The majority of the marine junk entering the ocean comes from land squander conveyed by overflow waterways, deficient sewerage and waste administration, floods, storms, ocean side guests, modern exercises, development, and unlawful garbage removal [2].

Cities are highly concentrated in the coastal zone and around river systems. More than 40% of the worldwide populace living inside 100km of the coast and in the Asia Pacific area populaces lives on normal inside 3km of a surface freshwater body: *MOHUA- Refer to Plastic Waste Management (Issues, Solutions and Case-Studies)*. Marine waste is for the most part characterized as material squandered, disposed of, or left in the marine and seaside climate because of human and regular exercises that don't have a financial worth yet. Ocean garbage is found on the coast, which is nearest to the focal point of human movement. The marine waste found for the most part incorporates plastic waste (plastic bundling, plastic packs, straws, bottle covers, ropes, diapers, froth), fishing gear (nets, snares, fishing lines), metals (canned jars, paints, bottle covers), cigarette butts and cigarette lighters, glass cups (lights, glass bottles), handled wood, elastic, fabric, and electronic waste. The greater part of the marine junk entering the ocean comes from land squander conveyed by spillover waterways, deficient sewerage and waste administration, floods, storms, ocean side guests, modern exercises, development, and illicit garbage removal. Asia's metropolitan surroundings are assorted, mind boggling and dynamic frameworks and the locale is quickly urbanizing. The Asia Pacific progressed to a larger part metropolitan populace in 2019 and represents roughly 54% of all urbanites in the world. By 2050 there will be an extra 1.2 billion city inhabitants in the district [3].

Urban population growth is driven by natural population growth, rural-urban migration and the expansion of urban development into rural areas: *Refer to Case studies of macro- and microplastics pollution in coastal waters and rivers: Is there a solution with new removal technologies and policy actions?* Urban communities stay significant motors of monetary development and social and social change and are fundamental for neediness decrease and maintainable turn of events. No nation has accomplished centre pay status without urbanizing and somewhere around 80% of Asia-Pacific's GDP is gotten from metropolitan regions (ADB). Be that as it may, metropolitan frameworks can be earth shady and urban areas are destinations of obvious financial and spatial disparities [4].

Making compelling metropolitan waste administration frameworks is quite possibly the main activity to forestall plastic contamina-

tion. Lacking and overpowered seepage frameworks, open unloading, littering, and flood/overflow at assortment focuses and landfills are the primary drivers of land-based plastics spilling into streams and marine conditions. Streams, particularly enormous waterways are a significant pathway for plastic contamination to arrive at the sea from inland. Ten waterways on the planet are answerable for shipping up to 95% of stream rivulet plastic contamination, and eight of them are in Asia: Yellow, Hai, Pearl, Amur, Mekong, Yangtze, Indus and Ganges Delta [5].

Plastic waste & impacts

Plastics are exceptional materials. They are synthetic carbon-based polymers and are commonly derived from fossil fuels such as oil and gas. Their high durability and versatility coupled with a low cost-of-production has allowed plastic products to proliferate through every industry and country: Plastic Waste: Ecological and Human Health Impacts (Science for Environment Policy- European Commission).

Types of plastics:

1. Macro-plastics: Plastics, which are greater than 200 mm and can be spotted easily, e.g. plastic bags, plastic sheets, fishing nets, etc.
2. Meso-plastics: Plastics between 5 mm and 200 mm are known as meso-plastics. They often originate from land sources and are usually in the form of discarded plastic bottles, packaging materials, household items, toys etc.
3. Micro-plastics: Plastics which are smaller than 5 mm are known as micro-plastics. These are smaller and are hard to detect.
 - Primary micro-plastics which are made to carry out certain functions (e.g. toothpaste, skin cleansers and cosmetics) and micro-plastic pellets (MPPs) used for the manufacturing of plastic material.
 - Secondary micro-plastics, which are generated when macro-plastics in the marine environment are physically (through wind, wave and current), chemically (UV radiation) and biologically (microbial activity) degraded and fragmented into micro-sized (<5 mm) particles.

Waste management is defined as the system of collection, transportation, treatment and disposal of garbage, sewage and other waste products. The most basic level of waste management system collects waste in a designated location called a landfill: The environmental impacts of plastics and micro-plastics use, waste and pollution: EU and national measures. This is a suboptimal solution to waste management and should be complemented / phased out with more sustainable management measures such as recycling. The abundance of plastic coupled with poor waste management systems has contributed to a growing environmental crisis in ocean and freshwater systems. Over 11 million tons of new plastic enters the ocean every year, equivalent to dumping a garbage truck of plastic into the ocean every minute. The circular economy is defined as an alternative to the linear 'take-make-waste'. It seeks to design out waste, regenerate natural ecosystems and keep materials and products in use for as long as possible. To this end, resources are not consumed and discarded, destroying their value. Rather, their value is retained by reusing, repairing, remanufacturing or recycling [6].

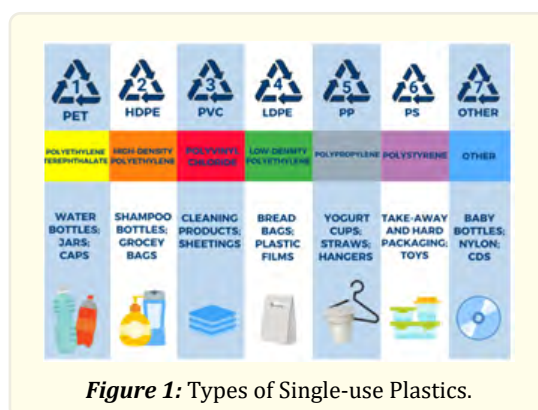


Figure 1: Types of Single-use Plastics.

SDGs linkage

Plastic waste management brings a unique cross-cutting opportunity to contribute towards 14 of the 17 SDGs; bring more integration of various stakeholders to mutually invest for the cost to environment and natural capital: *Solid waste management in coastal cities Where are the gaps Case study of the North Coast of Sao Paulo Brazil*.



Figure 2: SDG Goals and Plastic Waste Management Relationship.

Most bountiful are plastic used to make bundling, sacks, compartment, and bottles for sodas bottles for soda pops, water, mouth-wash, cleanser, cover, home devices, and electronic items. While 35% of plastic materials sink and settle on the seafloor, most of them float and get transported long distances due to the influence of winds, currents and waves : *Impacts of Marine Plastic Pollution from Continental Coasts to Subtropical Gyres—Fish, Seabirds, and Other Vertebrates in the SE Pacific*.

Source of Marine Plastic

Consistently, huge loads of plastic and other waste are discarded into our water bodies. The litter ruins the landscape as well as is unsafe to the normal environment, including individuals and natural life. Additionally, the debris thrown into marine bodies can last a very long time, affecting marine life for years to come: <https://www.indiawaterportal.org/articles/garbage-siege-our-coasts>.

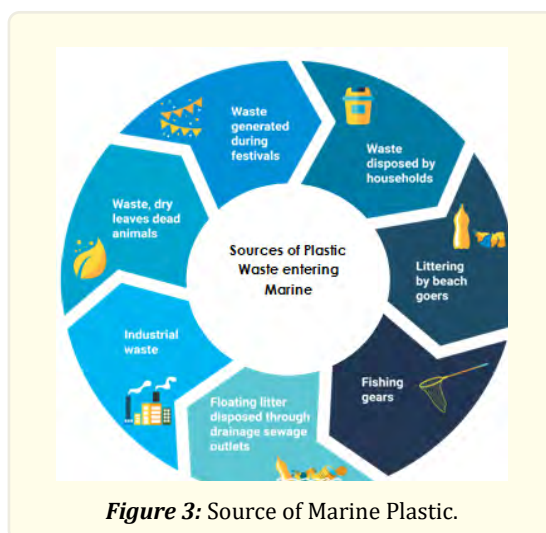


Figure 3: Source of Marine Plastic.

Impacts of Plastic on Marine Environment

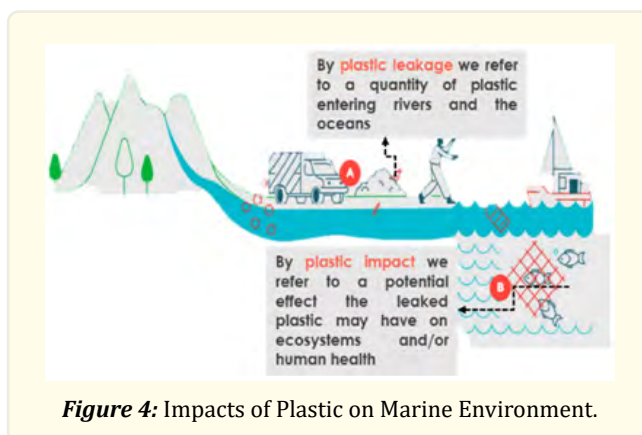


Figure 4: Impacts of Plastic on Marine Environment.

Impacts on food and human health

Microplastics have been found in regular water, lager, salt and are available in all examples gathered on the planet's seas, including the arctic. A few synthetic compounds utilized in the creation of plastic materials are known to be cancer-causing and to slow down the body's endocrine framework, causing formative, regenerative, neurological, and resistant problems in the two people and untamed life. As of late, microplastics were found in human placentas however more examination is expected to decide whether this is a far reaching issue.

Impacts on tourism

Plastic waste damages the aesthetic value of tourist destinations, leading to decreased income from tourism. It additionally creates major financial costs connected with the cleaning and upkeep of the destinations. The development of plastic litter on sea shores can contrarily affect a nation's economy, natural life, and the physical and mental prosperity of individuals: <https://www.unep.org/beat-pollution/forms-pollution/marine-and-coastal>.

Plastic pollution is the most widespread problem affecting the marine environment: <https://www.safewater.org/factsheets-1/2017/1/23/marine-dumping>. It likewise undermines sea wellbeing, sanitation and quality, human wellbeing, seaside the travel industry, and adds to environment changeling, has fostered a comprehensive bundle of answers for address marine plastic contamination - focused on take-up of information, strategy changes, roundabout economy and business commitment, and limit building.

Country	Coastal population [millions]	Waste gen. rate [kg/ppd]	% plastic waste	% mismanaged waste	Mismanaged plastic waste [MMT/year]	% of total mismanaged plastic waste	Plastic marine debris [MMT/year]
China	262.9	1.10	11	76	8.82	27.7	1.32-3.53
Indonesia	187.2	0.52	11	83	3.22	10.1	0.48-1.29
Philippines	83.4	0.5	15	83	1.88	5.9	0.28-0.75
Viet Nam	55.9	0.79	13	88	1.83	5.8	0.28-0.73
Sri Lanka	14.6	5.1	7	84	1.59	5.0	0.24-0.64
Thailand	26.0	1.2	12	75	1.03	3.2	0.15-0.41
Egypt	21.8	1.37	13	69	0.97	3.0	0.15-0.39
Malaysia	22.9	1.52	13	57	0.94	2.9	0.14-0.37
Nigeria	27.5	0.79	13	83	0.85	2.7	0.13-0.34
Bangladesh	70.9	0.43	8	89	0.79	2.5	0.12-0.31

Table 1: Mismanaged plastic waste quantities by country.

Threats to marine life due to plastic litter and marine (Global & India)

Global

The Ocean has turned into a worldwide store for a significant part of the waste we produce. Marine trash incorporates wood, glass, metal and plastic from various sources. Marine debris, and in particular the accumulation of plastic debris has been identified as a global problem alongside other key issues of our time including climate change, ocean acidification and loss of biodiversity: <https://www.statista.com/statistics/726724/weight-of-most-common-items-found-in-global-oceans/>. Litter type or use, rope and netting account for 57% of encounters followed by fragments (11%), packaging (10%), other fishing related (8%) and micro-particles (6%). More than 260 species are already known to be affected by marine debris through entanglement or ingestion. Ingestion by birds, turtles, fish and marine mammals is well documented and can be fatal: <https://environmental-conscience.com/causes-effects-solutions-for-ocean-dumping/>.

India and Plastic litter to marine in coastal areas

India has a long coastline of more than 7500 km. Its marine resources are spread over the Indian Ocean, Arabian Sea and Bay of Bengal. Major industrial cities and towns of the country such as Mumbai, Surat, Kochi, Chennai, Visakhapatnam and Kolkata are situated on or near the coastline. Mumbai city releases around 2200 (million liters each day) MLD of waste into the waterfront waters.

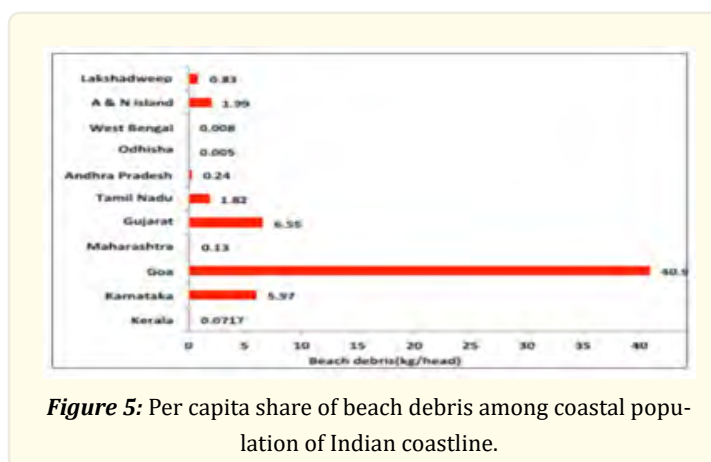


Figure 5: Per capita share of beach debris among coastal population of Indian coastline.

Mumbai squander age has been on a steady increment, from 3200 tons each day. The Indian shoreline has 13 significant ports and 181 minor to middle of the road ports, of which 139 are functional and are under the locale of the particular state legislatures: https://www.researchgate.net/figure/Global-distribution-of-produced-and-mismanaged-plastic-waste-modified-from-Pravettoni_fig2_328520912. These regions are wellsprings of marine garbage because of amounts of strong squanders took care of in these ports.

Plastic waste damages the aesthetic value of tourist destinations, prompting diminished the travel industry related livelihoods and major financial costs connected with the cleaning and upkeep of the destinations: <https://ourworldindata.org/grapher/plastic-waste-generated>. Something like 8 million tons of plastic end up in our seas consistently, and make up 80% of all marine flotsam and jetsam from surface waters to remote ocean residue. Marine species ingest or are entrapped by plastic trash, which causes serious wounds and passing. Explore the use of existing legally binding international agreements to address marine plastic pollution: <https://timesofindia.indiatimes.com/city/chennai/coastal-waters-still-a-cesspool-of-plastic-debris/articleshow/83662223.cms>. Reusing and reuse of plastic items, and backing for examination and advancement to foster new items to supplant single-use plastics are additionally important to forestall and diminish plastic contamination.

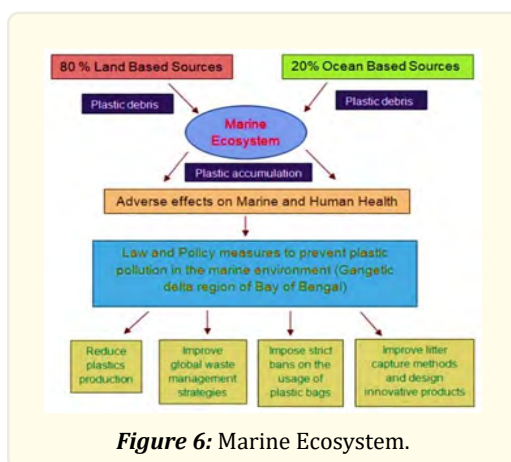


Figure 6: Marine Ecosystem.

Interlinkages between Plastic Pollution, Waste Management, and Sustainable Development Goals

After the thousand year's advancement objectives, the United Nations sent off the economic improvement objectives (SDGs) in September 2015, which have been generally executed by different countries to accomplish supportability. The targets of the SDGs are to take the aggregate ruling against the most basic multi-faceted financial natural worldwide dangers. There are 17 SDGs and 169 targets; out of them, just a single objective is straightforwardly connected with plastic contamination, i.e., SDG 14: Life below Water with its objective 14.1.b, as a pointer, centres around decreasing marine (micro)plastic trash stacks especially from the land exercises by 2025: *Reducing Waste in Coastal Cities through Inclusive Recycling*: <https://www.wiego.org/rwcc>. SDG markers portray difficulties for every country at public, sub-public, or supra-public levels to seek after the nature and conduct of plastics in the climate, including MPs contamination observing and the board. Thusly, the Interlinkages between plastics contamination and waste administration with every one of the SDGs are examined in the accompanying subsections and are featured in Figure 12.



Figure 7: Interlinkages between Plastic, Waste and SDG.

Community Participation to tackle the Plastic Waste Management affecting marine environment

Communities in coastal areas have made efforts to deal with waste problems; yet, the endeavors made are as yet incapable in beating these issues. That issue happens on the grounds that there is an absence of information on the local area and absence of framework in beach front regions. Local area interest in squander the board has its own arrangement of difficulties: absence of readiness or feeling of obligation toward squander; absence of financial motivations for local area; low eagerness to keep public places clean: https://www.researchgate.net/publication/340862782_Assessing_Marine_Plastic_Pollution_in_India_Saudamini_Das_Prabhakar_Jha_Arch

ana_Chatterjee_2_Assessing_Marine_Plastic_Pollution_in_India. Local area investment can be energized in an assortment of ways: Community Participation to handle the Plastic Waste Management influencing marine climate: At isolation level through occupants enthusiastically doing it at source; as cloth pickers doing it at dumpsites or isolation through squander sellers as volunteers helping metropolitan neighborhood bodies (ULBs); business humans by reusing or up cycling waste; as arbiters among residents and nearby government. Local area cooperation has ended up being a significant achievement in squander the executives. Local area partners can be occupied with forming activity plan as this will assist with outlining plans which will be near the ground circumstance and will actually want to address the issues of the help clients. A successful waste administration requires union among different partners like NGOs, neighborhood government, residents, squander business visionaries, cloth pickers, local area based associations, and so forth. Plastics in the marine environment have become a major concern because of their persistence at sea, and adverse consequences to marine life and potentially human health: https://www.researchgate.net/publication/349365918_Maritime_ports_and_beach_management_as_sources_of_coastal_macro-meso-and-microplastic-pollution.

River plastic mass inputs to oceans

1.15 and 2.41 million tons of plastic waste right now enters the sea consistently from Rivers, with more than 74% of emanations happening among May and October. The main 20 contaminating streams, generally situated in Asia, represent 67% of the worldwide aggregate. The arrival of plastics into the marine climate happens through an assortment of pathways, including stream and air transport, ocean side littering and straightforwardly adrift by means of hydroponics, transportation and fishing exercises. The majority of the plastic waste in the seas, Earth's last sink, streams from land. Rubbish is likewise conveyed to the ocean by significant streams, which go about as transport lines, getting increasingly more waste as they move downstream. Once adrift, a large part of the plastic waste remaining parts in beach front waters. Yet, when gotten up to speed in sea flows, it tends to be shipped all over the planet.

Approaches to tackle Marine Plastic Waste Management in India and its Recommendations

- Future initiatives to build infrastructure for collection, reduction and segregation of waste at the source should focus on beaches: https://www.researchgate.net/publication/349365918_Maritime_ports_and_beach_management_as_sources_of_coastal_macro-meso-and-microplastic-pollution. Treatment plants need to be equipped for recycling of different types of plastics and wastes.
- Dependable specialists need to foster long haul procedures and focuses as well as plainly appropriate jobs and obligations that permit separating public and state arrangements to the neighborhood level and give direction on requirement and execution. Limit building programs should be laid out.
- Administrative bodies need to make provincial and worldwide participation with the private area including plastic makers, makers of quick products along with partners from the transportation and the travel industry and fisheries.
- Public subsidizing for marine litter counteraction drives ought to be expanded. Legislative bodies ought to hence make a strategy instrument that joins inspiration through remunerations and punishments and participates in isolation or reusing measures.
- In an EPR scheme, assets might be gathered from makers to take care of the expenses of assortment, handling and safe removal of waste.
- Since marine litter is never only a public test, collaboration with worldwide associations and drives as well as among various ventures to battle marine litter ought to be fortified.

Case Studies

Kochi, Kerala

Kerala is situated on the south western coast of the Indian peninsula with an area of about 38,863 square km and a coastline of 588 km spread across 9 districts, forming 10% of India's total coastline. Kerala has 44 waterways, 49 repositories, 9 new water lakes, as well as numerous lakes and streams: Sustainable Development Goals_ The Periyar Lifeline of Kerala. The fishing area makes up 3% of the state's incomes from commodities and 13% of the public marine fish creation. This area gives vocation to around 800,000 individ-

uals in the 222 fishing towns arranged along the shoreline of the state. Long shore, marine and ocean side littering influences Kerala. The travel industry, transportation and fishery are the fundamental supporters of the event of marine flotsam and jetsam. The amount, arrangement and occasional variety of fishing-related flotsam and jetsam shows that plastic things, like fishing stuff or nets, are the most predominant sort of waste comprising 73.8% by number and 59.9% by weight. The all out garbage recorded, 36% were fishing related waste, underlining the job of fishing exercises in the age of marine litter.



Figure 8: Dark, pungent colour of Periyar River.

The Periyar – Lifeline of Kerala

Being 244 km long with a catchment area of 5396 sq.km, the Periyar is Kerala's longest river. It starts from the Sivagiri pinnacles of Sundaramala in Tamil Nadu. Periyar assumes a significant part in the existence of Kerala, as it is the locale's wellspring of drinking water (day by day siphoning 290 million liters each day) and the waterway is additionally utilized for other homegrown purposes: Sustainable Development Goals_ The Periyar Lifeline of Kerala.

Sewage and Garbage

- Waste coliform level in Periyar from the sewage observing station was above and beyond the admissible furthest reaches of 500mpn/100mL, with a normal of 113,000mpn/100 m.
- The waterway straightforwardly gets metro effluents from municipalities like Vandiperiyar, Munnar, Malayattor, Perumbavoor, Kalamassery, Aluva, and Paravur.
- Idukki segment of the Periyar is battling with tainting from homegrown sewage; Angamaly to Kochi is the most industrialized zone of the Periyar stream bowl.
- The ventures situated in Edayar - Eloor region drink around 189,343 measurement block of water each day and release around 75% of it as wastewater alongside an enormous amount of effluents and toxins.
- There are more than 30 unauthorized effluent pipes spewing toxins straight into the river from the industry.

Administrative Initiative

- The Periyar contamination and social issues connected with it has consistently stood out and impact from the majority.
- The organization of Kerala alongside the region organization has made a high level contamination checking board alongside community bodies. The council comprises of specialists, agents of neighborhood bodies and industrial facilities, and NGOs.
- Periyar River Action Plan has been drafted by the Kerala State Pollution Control Board (KSPCB) to resolve the persevering issue of the Kochi city's foul drinking water source.
- The National Green Tribunal (NGT) had ordered the drafting of an action plan to deal with the solid waste and septage polluting the Aluva-Eloor-Kalamassery stretch of the Periyar.
- The Pollution Control Board has sent notices to the companies with directives to install treatment plants or close down the facto-

ries. The Total Ecosystem Restoration Project for Periyar was one of the finest projects built so far.

- A 24-hour water quality monitoring system for the Periyar was set up by the Pollution Control Board. The results of the water quality from the Eloor-Edayar stretch of the river will be displayed live on the display board set up at Eloor



Parameter	Measured	Limit
SO ₂ (µg/m ³)	25.78	50
NI 13 (µg/m ³)	24.67	100
NO ₂ (µg/m ³)	9.38	50

Figure 9: Pollution Control Board air quality at Eloor.

Community Initiative

- In 1992, Prof. S. Sitaraman an environmentalist started the Aluva Environmental Protection Forum and played an important role in the prevention of illegal sand mining and water pollution by afforestation programs.
- The different local authorities and communities with the help of student organizations conducted PUNARJANI- a cleaning process of the Periyar river and Tiger Reserves. 400 volunteers divided into six zones collected 700 bundles of waste.



Figure 10: Community Initiative: Kochi.

Lakshadweep

The Lakshadweep Sea is a part of the Indian ocean between India, the Maldives and Sri Lanka. The area comprises about 786,000 km² and is named after the Lakshadweep islands, which are a group of 36 small islands, 220-440 km away from the coast of Kerala. Beaches are remote and touristic access to the islands is restricted, beach litter is a pressing problem in the area with 45% stemming from fishing activities, 34% being related to tourism and 87% of all litter being comprised of plastics. The Lakshadweep Islands in India are threat of Beach Pollution mainly from plastic. Past evaluation of beach litter at three islands of the Lakshadweep—Kadmat, Suheli Par, and Minicoy. It found that majority of litter was hard plastic (nearly 87 percent), followed by rubber (5 percent), glass (3 percent), foamed plastic and metal (2 percent), and others (1 percent) in these islands. Plastic litter comprised of items such as bottle caps, rope,

and pieces. The highest average abundance of marine litter was found in Kadmat, followed by Suheli Par and Minicoy. Based on these results, Kadmat and Suheli Par were categorized as moderately polluted and Minicoy was listed as clean: <https://vigyanprasar.gov.in/isw/Plastic-pollution-threatens-Lakshadweep-islands> (Prevention of Marine Litter In The Lakshadweep Sea – PROMISE).



Figure 11: Lakshadweep beaches.

The presence of plastics in Lakshadweep islands is of concern as these are turtle nesting grounds. It can impact turtle rookeries by altering the temperature and sediment permeability.

Litter collection, segregation, and counting from the transects on Kadmat Island beach. (L) A pie-chart showing the type of litter material with their percentage composition in the three study sites in the Lakshadweep islands. (R)



Figure 12: Litter collection, segregation and counting on Kadmat Island beach.

Prevention of Marine Litter in The Lakshadweep Sea

- It focuses explicitly on **small and medium-sized enterprises** contributing to the tourism sector to support them in waste minimization, thus enhancing the attractiveness of tourism industries, avoiding further deterioration of marine ecosystems and improving people's living conditions: <https://mpcb.gov.in/waste-management/plastic-waste>.
- Establish a knowledge base for the status quo of marine littering in touristic areas along Lakshadweep shorelines.
- Support small and medium-sized enterprises from tourism clusters in the Maldives, Sri Lanka and India in implementing establish a knowledge base for the status quo of marine littering in touristic areas along Lakshadweep shorelines.
- Systems for producing less waste in their business operations and strategies.
- Conceptualization and initiation of "Lakshadweep Zero Waste Alliance".
- Enable access to finance for small and medium-sized enterprises to implement more costly waste minimization options.
- Strengthen regional policy frameworks for waste management in coastal areas and contribute to reduced waste generation and littering in the three target countries.
- Inform wider stakeholder network about the approaches to waste prevention.

Mumbai, Maharashtra

Mumbai is one of the largest metros in India with an estimated population of 1.6 to 1.8 million. It has a coastal stretch of 603 sq.km. Mumbai can be divided into three sections, namely, the island city, the western suburbs and the eastern suburbs. There are three main dumping grounds namely, Deonar (132 hectares), Kanjurmarg (143 hectares), Mulund (25 hectares).

Water quality of Mumbai

Spatial-temporal study revealed that there is a dire need of suggestive measures to mitigate coastal and creeks water pollution and improvement in water quality: <https://www.hindustantimes.com/cities/mumbai-news/plastic-pollution-a-crisis-in-mumbai-s-beaches-and-the-arabian-sea-101636309809709.html>

- At Seafronts and beaches: pH values of coastal water ranges between 7-8 satisfying the SW II standards indicating neither pollution threat for biological life nor eye-skin irritation problems during contact water sports
- West Coast: pH is within the prescribed limit of standards. The SW II standard for turbidity of 30 NTU exceeded only in limited samples in the impact zone of Marve creek during high tide.

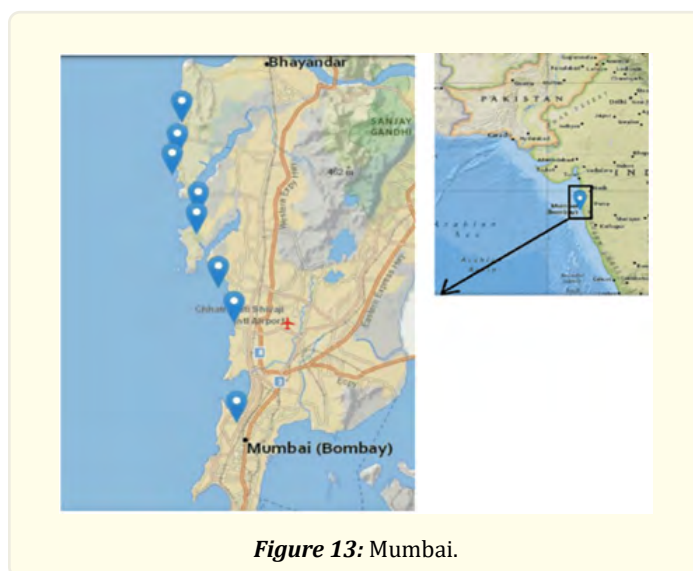


Figure 13: Mumbai.

Beaches in proper Mumbai contained much more litter than beaches in the outskirts of Mumbai such as beaches in Madh Island. Plastic was the major type of litter in all the beaches, and the most common (30% of the total litter). Food wrappers, glass bottles and fishing nets were also some of the major types of litter found in the beaches.

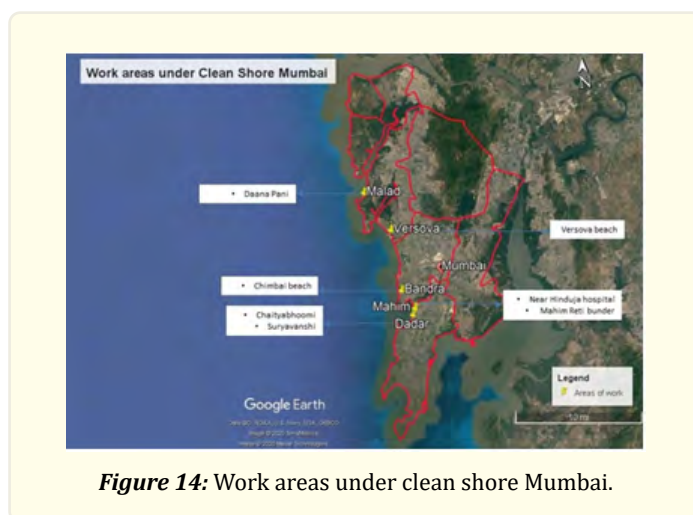


Figure 14: Work areas under clean shore Mumbai.

Mumbai city discharges around 2200 (million litres per day) MLD of waste into the coastal waters.

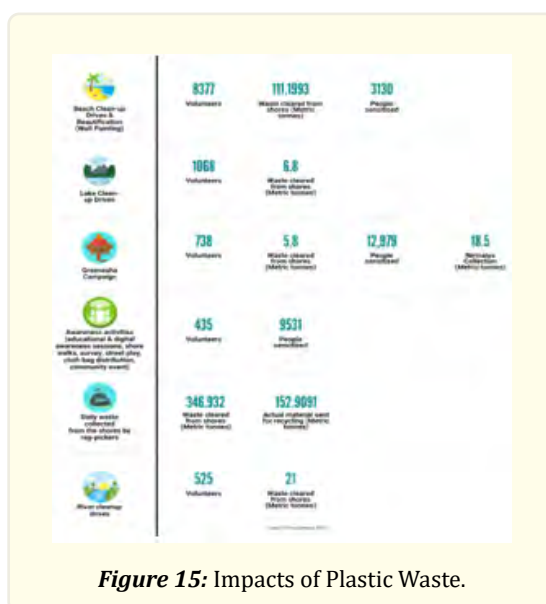


Figure 15: Impacts of Plastic Waste.

Marine pollution in Mumbai

- Plastic debris on beaches in Mumbai, on an average, 68.83 items are littered per square meter at four beaches—Juhu, Versova, Dadar and Aksa.
- About 41.85 per cent of the litter comprises microplastics ranging in size from 1m to 5m.
- The highest quantity of microplastics was seen in Juhu beach (55.33 per cent) followed by Versova, Dadar and Aksa.
- Recreational and religious activities are major contributing factors for the abundance of plastics in these beaches.
- Mumbai's sea will have more plastic than fish in a few years.

Shanghai, China

China is the largest emitter of CO₂ in the world, and is suspected of being the largest contributor to marine plastic waste pollution.

Due to the mismanagement of plastic waste, a significant amount of it ends up in the oceans via inland waterways, wastewater outflows, and transport by wind or tides, thus threatening the marine wildlife that ingests it or becomes entangled in plastic debris. China generated 1.32–3.53 million metric tons (MMT) of marine plastic debris and was considered the largest contributor to such pollution: China's plastic import ban increases prospects of environmental impact mitigation of plastic waste trade flow worldwide.

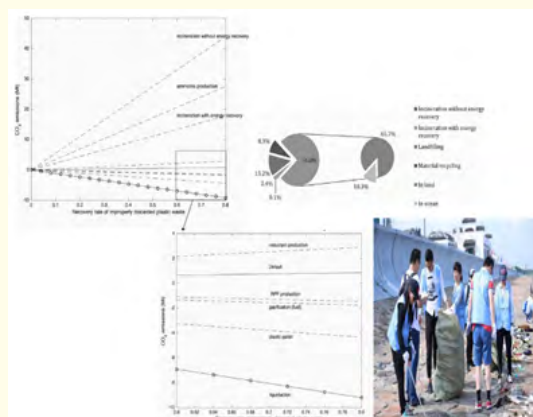


Figure 16: Approaches to solving China's marine plastic pollution and CO₂ emission problems.



Figure 17: China: Plastic Waste Management.

Along Shanghai's coastline, a group of volunteers pick up trash, filling countless nylon bags with the bottles, straws, paper, and plastic that carpet the narrow beaches and paths. Rendu's coastal cleanups have also turned into citizen science data collection activities. Rendu reported in its 2018 annual Beach Litter Brand Audit that 2,527 volunteers across 12 coastal cities identified and recorded brands and materials of collected waste. The 13th Five Year Plan (FYP) marks the first time Chinese policymakers developed category-specific plans with clear benchmarks for waste. The plan aims to hit a 73 percent reuse rate for industrial solid waste and a 90 percent treatment rate for domestic waste in rural areas by 2020. The Ministry of Ecology and Environment's ambitious Zero-Waste City plan released in late 2018 champions extended producer responsibility, reduction of all forms of urban waste, and a 100 percent recycling rate in 10 pilot cities.

Academia, policymakers, industry leaders, activists from civil society organizations, in partnership with international and UN or-

ganizations, explore various approaches to combat plastic waste pollution. The East China Normal University and the United Nations Educational, Scientific and Cultural Organization (UNESCO), acting in partnership, brought together vital stakeholders to a forum titled “Combating Marine Plastic Waste” in November 2019 in Shanghai, China. Approaches to monitor marine debris effectively, and to actualize waste management practices: ways to drastically reduce plastic pollution. Practitioners in China anticipated reducing by more than 100,000 tons the plastic waste entering the ocean every year, due to the improved regulations and measures.

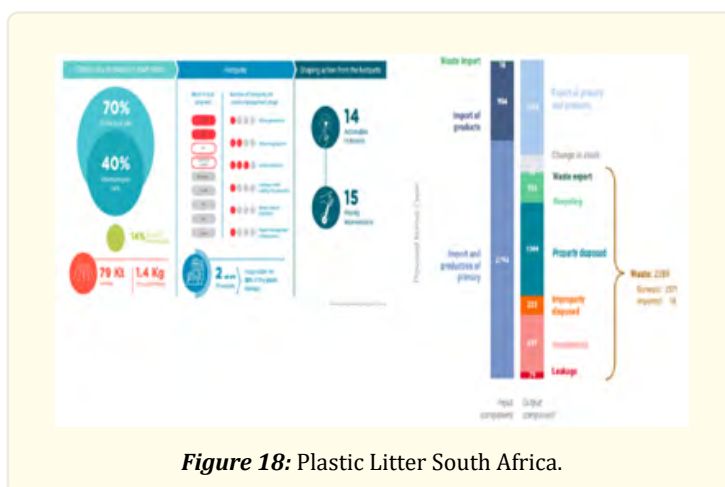
The total amount of plastic pollution to be decreased is expected to reach about 200,000 tons a year by 2020.

China aims to increase the portion of degradable packaging material by 50 percent by 2020, instead of incinerating plastic waste, which is currently mostly the case in China; we could reuse plastic waste to produce refuse plastic fuel.

Cape Town, South Africa

South Africa is home to more than 55.6 million people which on average, use between 30kg to 50kg of plastic per person per year. It generates more than 1000 tonnes of plastic waste per day, the country is home to three of the 50 largest dumpsites in the world. 90% of 59 million tonnes of waste generated by South Africa ended up in landfills with only 10% of it being recycled. Illegal dumpsites are common throughout the country and it is a typical to see large amounts of litter blowing through even the cleanest and wealthiest neighborhoods on a windy day. Plastic litter is so prolific in South Africa that plastic bags are locally referred to as the new “national flower” of the country: National guidance for plastic pollution hot spotting and shaping action- Final report for South Africa.

- LDPE is the top contributor in absolute leakage (17 kt), with a leakage rate of 4%.
- PP and PET follow with 16 kt and 13 kt of leakage respectively. PET has a leakage rate of 4%.
- Although synthetic rubber ranks lower in absolute leakage (8 kt), it has the highest leakage rate with 6% of its generated waste leaks into the oceans and waterways. Micro-plastics from tyre abrasion are an important driver of leakage for this polymer
- Annual leakage of mismanaged waste: 71'801 tonnes.
- Annual leakage from mismanaged/lost at sea fishing gears and from overboard litter: 379 tonnes.



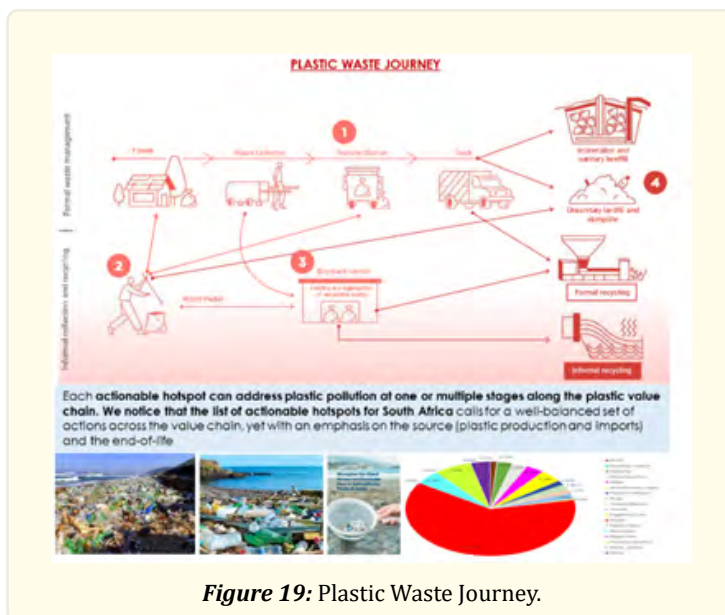


Figure 19: Plastic Waste Journey.

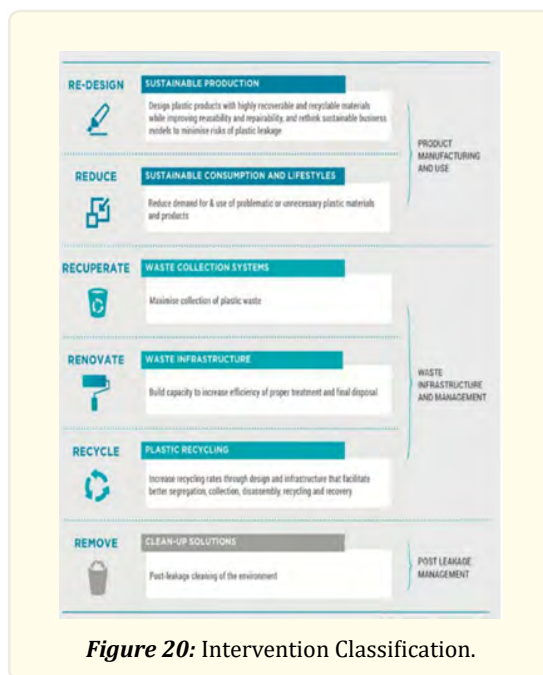


Figure 20: Intervention Classification.

Impact

- Waste management in South Africa is still highly dependent on landfilling.
- Combination with the magnitude of mismanaged plastic waste in the country means that a large portion of it is destined to end up in the ocean. It is estimated that as much as 250 000 tonnes of plastic enter the seas of South Africa as marine litter every year, making South Africa one of the top ocean polluters globally.
- Marine litter has been known to affect a wide variety of marine animals such as sea birds, cetaceans, whales and turtles, which are often at risk of entanglement or may ingest marine litter.

Ambon City, Indonesia

The island of Ambon, in which the city of Ambon located, is part of the Maluku islands, which are arc volcanic islands, so in general, the city of Ambon has a region that mostly large consists of hilly and sloping steep areas. The state topography of Ambon City:

- Within 300 m of the coastline, the topography is relatively flat with a height of 0–100 m and slope of 0–10%.
- Within 100 m toward the mainland, the topography is sloping up with a height of 0–100 m and slope of 10–20%.
- In the hills area, the topography is undulating, rocky, and steep with a height of 0–100 m and slope of 20–30%.
- In the mountains area, the topography is steep with a height of >100 m and slope of >30%.

The Ambon City climate is strongly influenced by the ocean and takes place simultaneously with the seasonal climate, namely the west or north season and the east or southeast season: Coastal Community Perspective, Waste Density, and Spatial Area toward Sustainable Waste Management (Case Study: Ambon Bay, Indonesia).

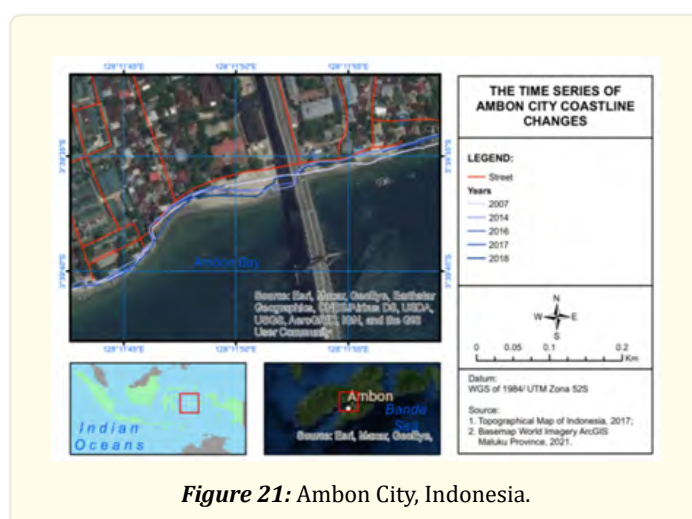


Figure 21: Ambon City, Indonesia.

Waste Management Developed in Ambon City

Several factors influence the performance of waste management:

- The number of personnel and infrastructure is still limited.
- Transportation operations are not optimal.
- There is low retribution income, so it needs subsidies for operations.
- Operational costs are minimal.
- The community has not adequately supported waste management.
- There is a lack of enforcement for violating waste management regulations.

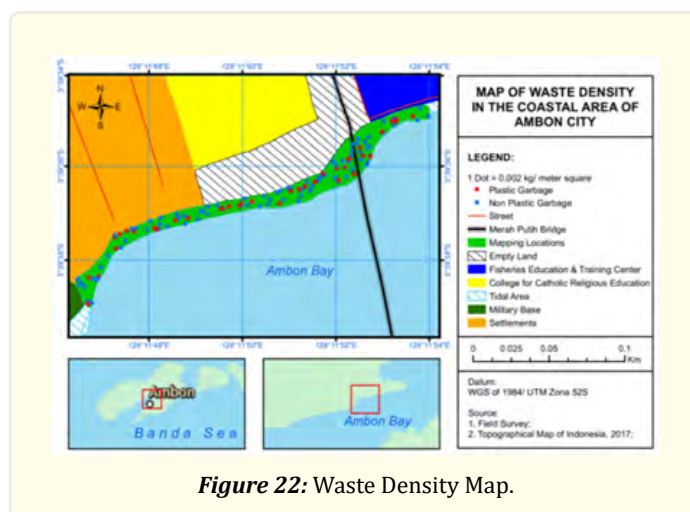


Figure 22: Waste Density Map.

Sustainable development goal (SDG)	SDG target related to plastic waste dumped in the marine
SDG 6 Clean water and sanitation - Ensure availability and sustainable management of water and sanitation for all.	Focus on untreated wastewater
SDG 11 Sustainable cities and communities - Make cities and human settlements inclusive, safe, resilient and sustainable.	Focus on municipal and other waste management
SDG 12 Responsible consumption and production - Ensure sustainable consumption and production patterns.	Focus on environmentally sound management of chemicals and all wastes throughout their life cycle -
SDG 14 Life below water - Conserve and sustainably use the oceans, seas and marine resources for sustainable development.	Focus on waste generation reduction Focus on sustainable management Conservation and sustainable use of oceans

Table 2: Sustainable Development Goals related to Plastic Waste to Marine.

Conclusion

Building connections and acquiring responsibilities to handle plastic waste from partners in each area is foremost to endeavours to diminish plastic contamination. Every area plays a vital part to play in the plastic waste chain and can add to the insurance of marine and beach front conditions and vocations. Urban communities are the fundamental partners in the natural change and impact, on account of their closeness, residents, youngsters, financial areas and friend urban areas also. By and large, urban communities hold a significant job in squander the board, reusing and squander decrease and valorisation. Consequently, the organization will chip away

at practical and incorporated strategies to best shield urban communities, nature and individuals from plastic, and elective ways of dominating catch esteem from it, initiating the maximum capacity of urban communities in such manner. This study perceives that there is local area interest in dealing with the loss in seaside networks in India. All things considered, insufficient frameworks, financial circumstances, and absence of information put forth the current attempts ineffectual at defeating the waste issue. Given the possibility to determine the waste administration issue, particularly to expand local area cooperation, the public authority needs to build the range of waste administrations, staff, gear, and give data on squander the board. One more arrangement that should be done in squander the board in the seaside region India is to build public familiarity with squander the executives and the significance of safeguarding the climate. Such mindfulness should be possessed by the more youthful age.

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