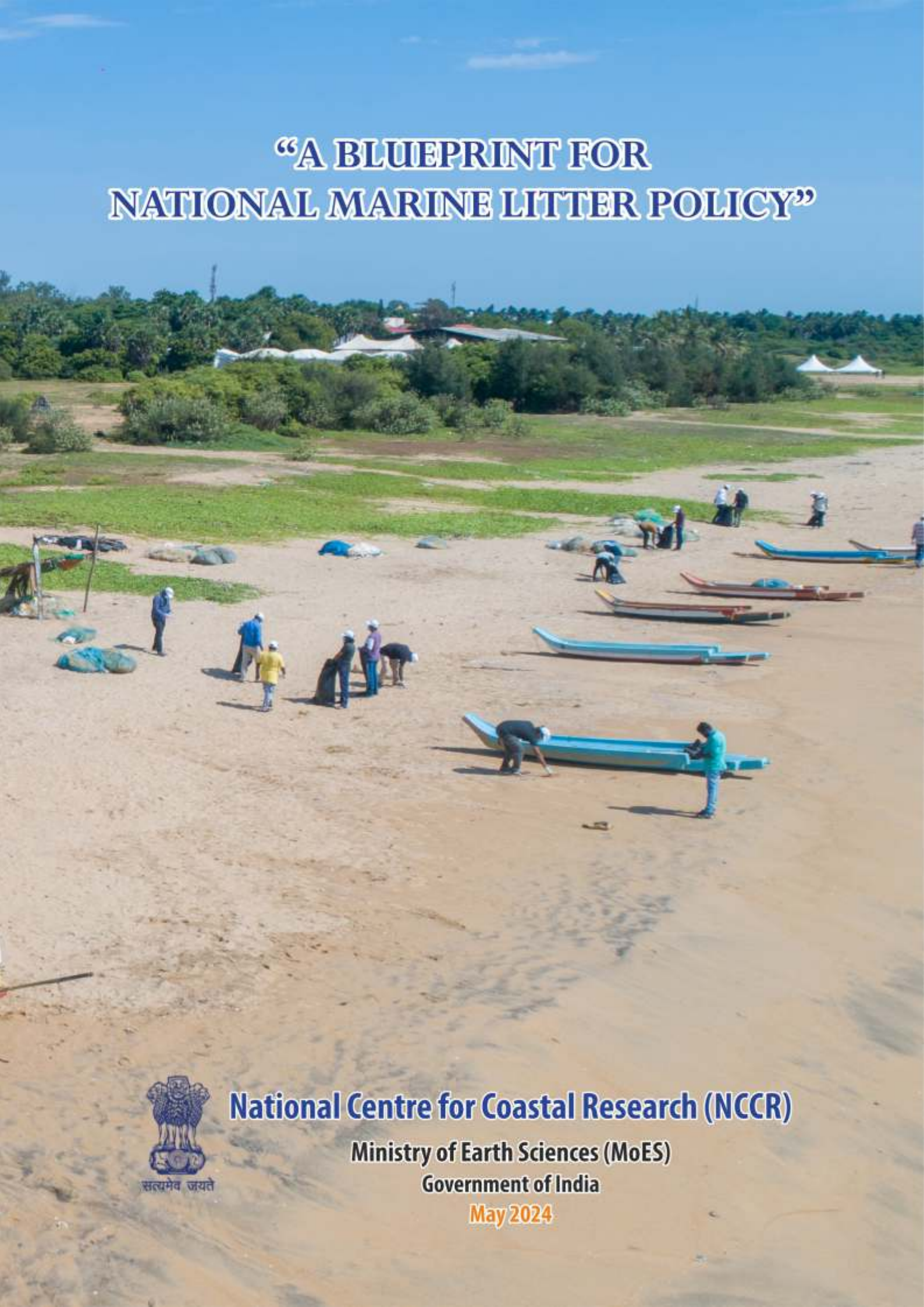
"A BLUEPRINT FOR NATIONAL MARINE LITTER POLICY"



सत्यमेव जयते

National Centre for Coastal Research (NCCR)

Ministry of Earth Sciences (MoES)

Government of India

May 2024

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FOREWORD

Marine litter and Microplastics (MLMP) have emerged as a significant environmental challenge, adversely impacting marine ecosystems, biodiversity, and human health. Recognizing the urgency to address these issues, the National Centre for Coastal Research (NCCR), Ministry of Earth Sciences (MoES), India, was assigned as the nodal agency to prepare a road map for formulating a National Marine Litter Policy based on scientific data. The primary goals of the program are to understand the spatiotemporal variability of litter and plastics in coastal waters, sediments, and biota, and to map their distribution patterns and pathways from source to sink. This information is vital for developing effective marine litter policies and management strategies in India, aimed at reducing plastic waste at its source.

The program focuses on several key areas:

Assessment and Monitoring: Employing standardized methodologies for the quantification and characterization of marine litter and microplastics across various coastal zones.

Research and Development: Steering comprehensive research to understand the sources, pathways, and impacts of marine litter and microplastics on marine life and human communities.

Awareness and Education: Engaging with fishing and local communities, and other stakeholders through awareness campaigns and outreach programs to foster a collective responsibility toward a clean sea.

Policy and Regulation: Providing scientific data and insights to inform policy decisions and regulatory frameworks aimed at reducing marine pollution and enhancing coastal conservation efforts.

The Clean Coast Index (CCI), a vital component of this program, serves as a robust tool for evaluating beach cleanliness and guiding remediation efforts. By classifying beaches based on their cleanliness levels, the CCI helps to prioritize actions, allocate resources effectively, and track progress over time.

Through this initiative, the MoES is committed to safeguarding India's coastal environments, promoting sustainable practices, and contributing to global efforts in marine conservation. We envision a future where our beaches and oceans are free from pollution, supporting vibrant ecosystems and thriving coastal communities.

(M.Ravichandran)

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EXECUTIVE SUMMARY

The mismanagement of plastic waste is an increasingly global issue, with significant concern for the Indian Ocean Region (IOR). Land-based debris comprised mainly of plastics is discarded deliberately or accidentally into the marine and coastal environments referred to as marine litter. Of the 6.3 billion metric tons of plastic waste produced annually, 79% ends up in landfills. By 2050, this would reach 12 billion metric tons. Annually, 4.8–12.7 million metric tons of plastic enter the ocean from land-based sources, affecting the marine environment.

Microplastics (Mps), smaller than 5 mm in size, have gained attention due to their widespread presence, persistence, and impact on various trophic levels. First reported in the early 1970s, lately they become a scientific focus. MPs are classified into small (<1 mm), medium (1–2.5 mm), and large (2.5–5 mm) sizes, with lower size limits set by sampling and analytical techniques. The transfer of microplastics (MPs) through food webs can threaten aquatic ecosystem health and, consequently, human health due to direct or indirect exposure to MPs and their associated pollutants.

To substantially reduce MLMP, it is imperative to develop a National Marine Litter Policy (NMLP) that encompasses several key strategies, through quantifying marine litter and microplastics in the marine environments along the Indian coast, viz., coastal waters, sediments, biota, beaches, estuaries, lagoons, and mangroves.

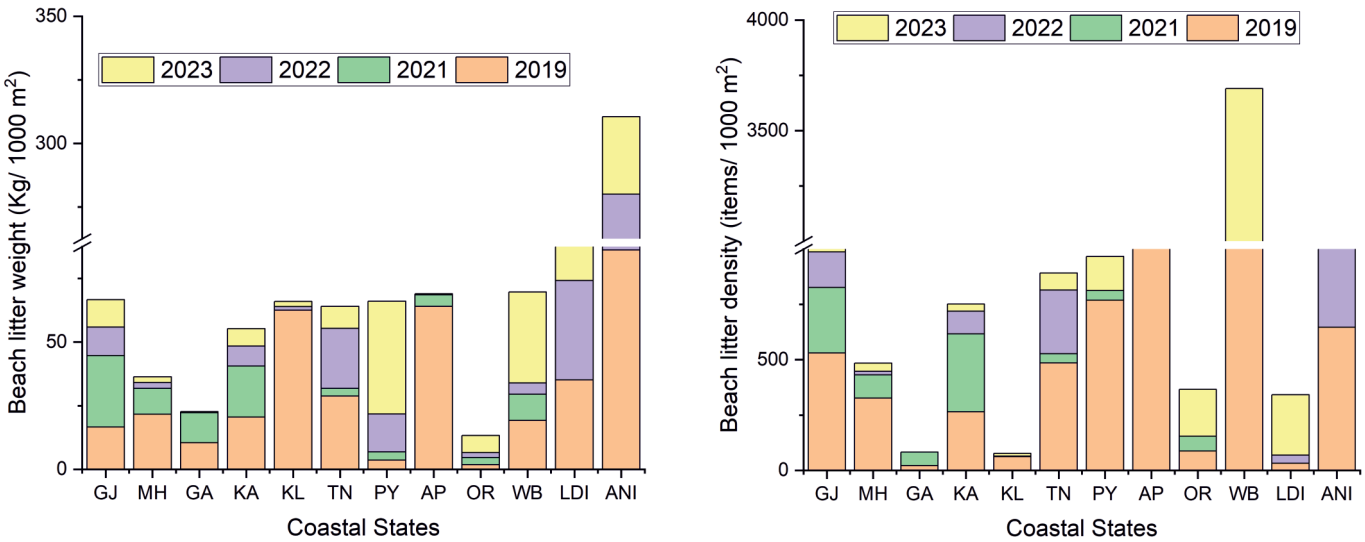
Litter data from three beaches in the Lakshadweep Islands, namely Kadmat, Suheli Par, and Minicoy was collected. Kadmat had the highest average abundance of marine litter, followed by Suheli Par, and Minicoy. The Clean Coast Index (CCI) indicated that Minicoy Island had a clean beach (CCI 3.15), while Suheli Par (CCI 8) and Kadmat (CCI 10) were moderately clean. The main sources were fishing activities (45%) and public littering (34%). To quantify and characterize the macro (2.5 cm to 1m), meso (5 mm to 2.5 cm), and micro litter (≤5 mm) in the intertidal and backshore areas, six sandy beaches utilized for various activities along the southeast coast of India were selected. The concentration was higher in backshore areas than in the intertidal zones, with urban beaches showing more litter than remote ones. The CCI classified Neelankarai, Kovalam, Auroville, and Paradise beaches as moderately clean, while Nemmeli and Palar were clean and very clean, respectively.

To understand the distribution of MP contamination in the Indian coastal environment, quantification of MPs in various marine matrices was carried out. As rivers are the principal conduit for litter, comprehensive data was collected offshore adjacent to the river mouths along the Indian coast. Locations near river mouths had higher MP abundance, especially during the post-monsoon months. High MP abundance at stations near the Krishna, Penna River, Chilika Lake, and Adyar River indicated rivers as primary sources. Filaments and fragments were common in nearshore water and sediment samples, originating from

fishing activities, washing machine effluents, and disposed packaging materials. The surface water and sediment from the shelf region revealed moderate microplastic contamination levels with most MPs being fibers or fragments smaller than 1 mm, predominantly blue, and made of polyolefins. The comprehensive study on the MP pollution in the Chilika revealed the presence of higher levels of MPs (>3 folds) in the sediment during the dry season (September 2022) when compared to the wet period (January 2023). The Northern sector and the outer channels of the Lake contained more MP abundance and the polymer tests revealed that laundry and fishing activities are the major sources of pollution. From this study, it is evident that the Chilika Lagoon acts as a sink (from rivers) and source (to the ocean). Research in the deep-sea sediments of the Krishna-Godavari (KG) basin, Bay of Bengal, revealed substantial MP quantities, primarily from riverine discharge and human activities. The deep-sea floor acts as a potential sink for marine plastic debris.

MPs were also found in commercially important finfish, shellfish, and barnacles from Chennai's highly anthropogenic coastal waters. Barnacles (*Amphibalanus amphitrite*) had the highest average MP ingestion, followed by bivalves (*Siliqua radiata, Perna viridis*), and fishes (*Rastrelliger kanagurta, Lutjanus sangunieus, Saurida pseudotumbil, Sphyraena sp., Scoliodon laticaudus, L. Fulviflamma,* and *L. Johnii*). MPs were more prevalent in the gastrointestinal tracts of fish than in their gills, and shellfish ingested more MPs than finfish.

The Coastal Clean Seas program (2018) has highlighted that engaging local bodies and the public through a citizen science approach is the best method to curb marine litter. Plastic was the dominant litter particularly single-use plastics (SUPs), originating primarily from recreation and tourism. The decline in average beach litter weight from 2019 to 2023 suggests positive outcomes from the legislative ban on SUPs, and constant clean-up efforts.



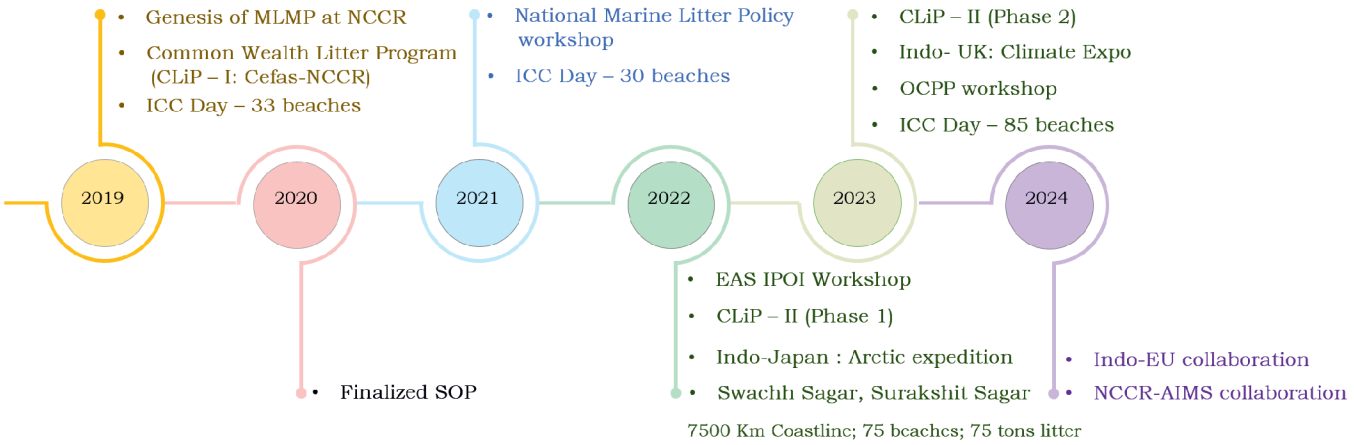
Beach litter study across various Indian states from 2018 to 2023.

The dataset depicts a wide range of patterns throughout time across various states. While some states' ratings continually fall, others fluctuate or increase slightly. This could indicate various factors such as improved management practices, and policy changes impacting the indicators represented by the data.

The Remote Sensing and GIS techniques are used to study the macro litter detection spatially. Satellite data and drone images are used for litter quantification through artificial intelligence and machine learning techniques in the coastal landscape.

Workshops held at the National Centre for Coastal Research (NCCR) played a pivotal role in fostering comprehensive discussions aimed at crafting policy recommendations and strategies to tackle marine litter pollution. Scientists from central and state pollution control boards, different federal ministries, research organizations i.e., NIOT, CSIR- IITR, and NCSCM, NPC, experts from industries and academic institutions e.g., IITs and state universities, NGOs, and coastal stakeholders participated in addressing the feasible solutions for litter pollution. All the invaluable inputs garnered from various workshops were included in drafting the proposed “National Marine Litter Policy”.

MAJOR MILESTONES



The initial study documenting the presence of plastics in India's marine environment was conducted by Nigam in 1982. Between that time and 2011, there were only a handful of publications on the subject. However, there has been a noticeable increase in marine litter research since 2011, peaking in 2023 and this trend is expected to continue.

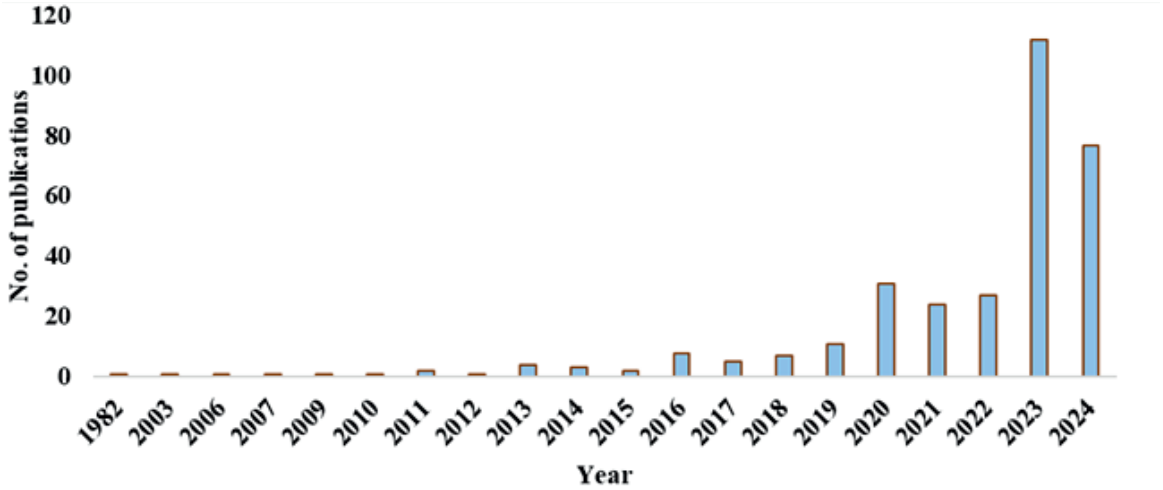
Insights

- ✓ Tamil Nadu (East Coast) & Kerala (West Coast) have the highest number of publications.
- ✓ Intertidal > Coastal > Estuaries > Deep sea.
- ✓ Microplastics > Litter.
- ✓ Sediment > Biota > Water.
- ✓ Fibres and Fragments are dominant.
- ✓ Smaller-sized MPs (<1mm) dominate water and sediment.
- ✓ Polyethylene and Polypropylene are the main observed polymers.

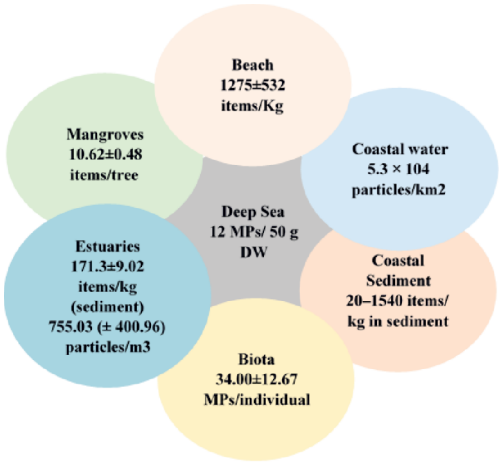
Major Sources

- ✓ Tourism; local littering (Beach litter)
- ✓ Sewage treatment plant; river runoff; and fishing activities. (Microplastics)
- ✓ Land-based > Ocean-based

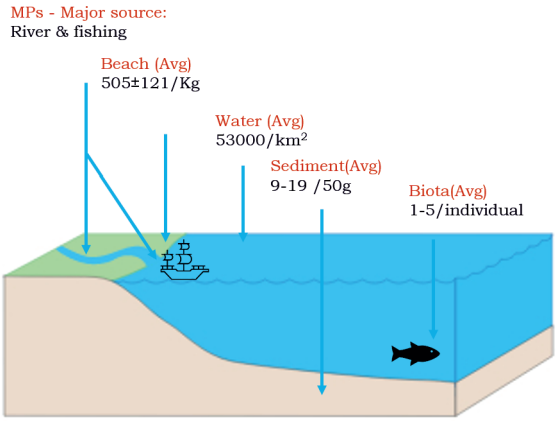
MLMP RESEARCH IN INDIA



Number of Publications on MLMP Research in India (till April 2024)



Maximum MPs abundance reported in various coastal environmental matrices in India.



Average concentration of MPs in Indian coastal environmental matrices (NCCR Study).

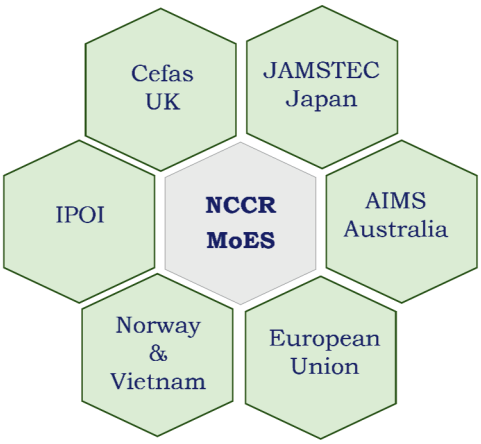
INTERNATIONAL COLLABORATIONS

Commonwealth Litter Programme

- MLMP Quantification
- Awareness – education packs
- Management

Indo-Pacific Oceans Initiative

- Marine plastic debris mitigation
- Application of RS/AI/ML



Indo – Japan collaboration

- MPs Monitoring
- Application of AI/ML

Indo -EU TTC WG-2

- Eco-toxicology, citizen science
- Development of efficient technologies

LEGAL FRAMEWORK

STRATEGIES TO COMBAT MARINE LITTER

MARINE LITTER POLICY

Target I: Land-based sources

Strategy 1 - Measures for addressing input through water bodies

(I) Deploy booms/ traps in the major rivers, coarse screens in minor tributaries, and stormwater drains.

(ii) Increased cleaning frequency of the traps and data collection.

(iii) Strengthening solid waste management system, comprising effective source segregation, waste collection, and recycling.

(iv) Plasticulture - Promoting recycling, researching alternatives, and educating farmers on plastic handling targeting irrigation tubing, mulch films, and crop covers.

(v) Clean-up of the existing garbage dumped in the terrestrial environment. E.g., Hotspot areas such as river banks, and waterways.

(vi) Organizing dive-based cleanup operations targeting plastics in ecologically sensitive habitats such as coral reefs and seagrass beds.

(vii) Litter netting / Chain-link fencing the river banks adjacent to the slum areas.

Strategy 2 - Reduce input through outfalls or untreated municipal sewerage

(i) Enhancing the capacity of wastewater treatment facilities (STPs/ETPs) to meet the actual demand and treatment standards is crucial.

(ii) Immediate closure of illegal outfalls into the Rivers, and Oceans.

(iii) Quarterly survey to identify violations, with suspension or cancellation of licenses and imposition of significant penalties on violators.

Target II: Beaches – a source and sink for litter

Based on the national beach litter assessment studies in India, tourism and public littering are considered the principal sources (60%).

In General,

i. It is recommended to implement spatial planning and zoning of beaches on their intended usage priority.

ii. Installation of chain fencing along the backshore area with controlled entry and exit points may be considered to regulate access to designated beaches.

iii. Beach adoption, clean-up, and public awareness programs by government agencies, NGOs, private organizations through CSR activities, and educational institutions.

Strategy 3.0 - Tourism and Recreational Activity Beaches

(i) Establish basic infrastructure: closed dustbins, drinking water, maintained washrooms with sewage treatment, designated smoking area, and monitoring office with a patrol officer.

(ii) Ban balloon shooting within the beach area, demarcation of food stalls, and other shops away from the backshore area to facilitate beach management.

(iii) Smoking ban on beaches (except the beaches with designated smoking areas) for mitigating passive smoking and reducing the litter of non-biodegradable cigarette butts.

(iv) Mandatory sale and usage of eco-friendly products in all the beach stalls.

(v) Ban on sale and restricted entry of identified plastics and liquor bottles inside the beaches.

Strategy 3.1 - Religious activity beaches

In India, litter such as cloth, garlands, and idols were frequently reported on the beaches adjacent to the religious sites.

(i) All regulations applicable to tourism and recreational beaches shall also extend to this category of beaches.

(ii) Streamlining material entry by sharing the list of permitted (e.g., natural flowers, organic items) and prohibited materials (e.g., mixed plastics, styrofoam decoratives).

(iii) Stringent implementation of idol immersion practices in waterbodies following the revised guidelines for idol immersion by CPCB.

Strategy 3.2 - Fishing-related activity beaches

The fishing industry is widely recognized as a significant contributor to marine litter at both global and regional scales.

(i) Strengthening waste management infrastructure near fishing hamlets and boat docking areas of beaches.

(ii) Allocating an exclusive area away from the backshore to facilitate other fishing-related activities of the fishermen. E.g., Net weaving, drying and storing fish, bait preparation, etc.

(iii) Demarcation of boat docking based on the Fisher's Association to manage litter.

(iv) Manual cleaning at a regular frequency is necessary for the docking areas as they cannot be accessed by mechanized cleaning machines.

(v) Creating awareness and encouraging the Fisher's Association to participate in maintaining cleaner beaches.

Strategy 3.3 - Restricted activity beaches

Plastic pollution on the nesting beaches may impact the turtle habitats by altering the nest properties such as temperature and soil permeability.

(i) Sub-zoning can be made for

- (a) Eco-sensitive beaches – Nesting and hatching of marine organisms,
- (b) Beach maintained by resorts, hotels, etc
- (c) Access restricted beaches

(ii) These restricted beaches shall be maintained by the earmarked department or agency and all kinds of activities that could generate litter at the beaches should be prohibited.

(iii) Private access beaches shall be subjected to inspection for their cleanliness. The grant on renewal of licenses shall be based on the inspection report.

Strategy 4 - Measures for addressing the Beached litter

The litter gets washed onto the beaches: (i) Through current after extreme weather events, (ii) Leftover after swash and backwash.

(i) Clean-up of the litter from the strand line of the beaches after the high tide times. Recommended frequency: (a) Daily - beaches for tourism, recreational, and religious activity (b) Weekly/ fortnightly - restricted and fishing activity beaches.

(ii) Expanding the use of mechanical beach cleaning machines in the beach clean-up activities of tier-II and tier-III cities.

(iii) Creating “Beach Waste Diversion Programs” to divert organic waste from beaches and coastal areas to composting facilities.

(iv) Establishing a wing in the local government body dedicated to working for beach clean-up at a particular frequency in their respective control limits.

Target III - Sea-based sources

Strategy 5 - Fishing and aquaculture activities

'Abandoned, Lost, or Discarded Fishing Gear' (ALDFG) or 'Ghost gear' makes up 10% of ocean debris and significantly threatens marine life and navigation.

(i) Establishing a legal framework for the recovery and responsible disposal of fishing gear.

(ii) ALDFG retrieval programs through incentivization.

(iii) Upcycling of fishing gears/ ALDFG.

(iv) Initiating research on alternative materials.

(v) Introducing tracking systems and gear marking to locate and retrieve lost gear.

(vi) Mandate the return of old or damaged gear when purchasing new gear, combined with incentive and disincentive schemes.

(vii) Establishing a recycling facility at the fishing harbour for ALDFG.

Strategy 6 - Shipping, offshore oil and gas extraction activities

i. Measures have to be taken to address the illegal dumping of ship-generated wastes into the ocean, preventing accidental and unintentional leakage into the ocean.

ii. Other measures include:

(a) Eliminating SUPs and minimizing the usage of plastics in offshore activities.

(b) Efficient management of offshore rigs and ship-generated wastes.

(c) Inclusion of port reception facilities (PRF), and Waste Reception and Handling Plans.

(d) Verification of materials at the time of entry and exit using the bar code scanning, while restraining the entry of identified plastic materials.

(e) Training on waste management for crew members.

(f) Quarterly or half-yearly waste audits by professional environmental managers.

Target IV - Source mitigation measures

Strategy 7 - Public participatory approach

(i) Implementing effective waste segregation, door-to-door inspections with spot fines, CCTV monitoring, NGO awareness campaigns, and collection of waste management fees.

(ii) Improving collection efficiency through store drop-off program and installation of smart bins in community living.

(iii) Public reporting platforms (dashboard and mobile app) for hotspot mapping of litter.

(iv) CEPA (Communication, Education & Public Awareness) and Outreach

a) Education for awareness and behaviour change, such as using colour-coded dustbins in educational institutes. Including "Litter literacy" and "Marine pollution & conservation" in NCERT and other school syllabi to nurture young minds.

b) Scaling up the public participation in the International Coastal Clean-up Day & involving academic institutions in coastal cleanup campaigns.

c) Raising awareness among the fishers on ALDFG.

d) Disseminating government initiatives toward the management of plastic waste.

Strategy 8 - Sustainable production and consumption

(i) Design considerations on multi-use potential and end-of-life management of products.

(ii) Production ban on non-recyclable, single-use potential and difficult-to-recover materials.

(iii) Ban on avoidable or auxiliary usage of plastic products. E.g., Brand labelling in plastic.

(iv) Promoting and mandating the usage of available eco-friendly alternatives to SUPs.

(v) Preventing the leakage of plastic pellets, powder, and flakes from industrial processes through good housekeeping and containment practices.

(vi) Snipping off the tip or small piece apart from any plastic pouch leads to difficulty in collection and recycling. Linear tear design for not snipping off the tip in all the products.

(vii) The following are the difficulties observed related to milk pouches EPR compliance in India:

(a) Soiled or contaminated pouches are difficult to segregate and recycle.

(b) Consumers fail to follow best practices of washing, drying, and storing in carton boxes.

(c) Higher cost associated with the recollecting of the used pouches.

(viii) PET bottles and pouch packaging (brick carton – higher fibre content with low poly aluminium) with tethered caps for milk supply instead of traditional milk pouches can be an alternate better option for the milk supply.

(ix) Advantages of using PET bottles in milk supply: Higher recycling rate in India (~80%), resalable value, ease of handling, shock resistance, and transparency.

Disadvantages of using PET bottles in milk supply: Uneconomical shipping impact, and the problem associated with cleaning of bottles.

Strategy 9 - Tax differentiation based on environmental factors

(i) Eco-friendly alternatives face consumer resistance due to higher costs. Incentivizing and promoting sustainable products could drive down prices through economies of scale.

(ii) Unsustainable products should be priced higher than their eco-friendly counterparts by inclusion of the environmental costs.

(iii) A higher tax rate on unsustainable goods will reduce the profitability of producers and increase the cost to consumers, influencing both to shift towards sustainable alternatives.

(iv) It is recommended to ensure that the environmental levies correspond to the scale of

environmental damage caused by the product and remain aligned with inflationary trends.

(v) To promote recycling and reuse, the cost of virgin materials and associated taxes should be set sufficiently higher than that of the collection and recycling of used materials.

(vi) Currently, the recycling industry in India focusing on plastic waste, parings, and scrap falls under the 5% tax regime and this shall be incentivized to promote recycling.

(vii) Implementing an environmental tax on tourists can help manage the waste generated by tourism and promote eco-tourism initiatives.

(viii) It is essential to ensure that these measures are strictly and transparently implemented, and rigorously monitored to achieve the desired environmental outcomes.

Strategy 10 - Green Procurement Policies

Green procurement policies prioritize the purchase of products and materials with minimal environmental impact.

(i) Public procurement accounts for 20-22% of India's GDP, yet lacks guidelines mandating organizations to include environmental criteria in such procurements.

(ii) Market incentives for sustainable alternatives, along with products certified with ECO Mark by the BIS, can promote environmentally conscious procurement practices.

(iii) Incorporating environmental incentives into the structure of existing product taxes can drive consumer and producer behaviour toward more sustainable choices.

Strategy 11 - Extended Producer Responsibility (EPR)

EPR promotes Design for Environment (DfE) products, prioritizing recycling and end-of-life management. This could reduce landfills and open dumping. India's current EPR framework is exemplary for addressing waste management challenges.

(i) Successive amendments to the EPR framework have the potential to further harness its effectiveness for managing other types of wastes (e.g., plastic water and beverage bottles, styrofoam, tyres, plastic composites, rice, and cement bags made of polypropylene and polyethylene).

(ii) Incorporating of modulated fee structure as per the environmental performance of the product can incentivize producers to improve the sustainability of their products.

Strategy 12 - Deposit refund and waste depository scheme

The effective implementation of DRS has proven challenging for products with high production rates, low costs, and shorter life cycles (SUPs and milk pouches) compared to products with lower production, higher costs, and longer life cycles (batteries and other electronic goods).

(i) The refund cost will be the key driver in the effectiveness of the DRS which should be sufficiently high.

(ii) The initial deposit serves as an environmental cost borne by the consumers who do not intend to return the product for deposit redemption.

(iii) The discarded bottles may be collected and returned by rag pickers or individuals motivated by refund incentives.

(iv) For the effective implementation of DRS, several key aspects need to be addressed.

a) *Scope Definition:* Well-defined scope of DRS, including a channelization chart that outlines the flow of products from consumers to recycling facilities.

b) *Product and Brand Inclusion:* List the specific products or brands covered by the DRS. Consider including provisions for cross-brand collection to ensure comprehensive coverage.

c) *Deposit Refund Locations:* Designate specific deposit locations for consumer refund redemption, including mandatory recollection from retailers selling applicable products. Ensure clarity on conditions for recollection and deposit refund, including any physical condition requirements for returnable items.

d) *Collection Options:* The possible options for collection include (i) the automatic refund machines established by the government or authorized entities, (ii) digital DRS, and (iii) collaboration with Producer Responsibility Organization (PRO) for collection and recycling.

DRS could fail to achieve the intended outcome and can have regressive impacts E.g., prices of plastic water bottles may skyrocket due to the inclusion of DRS, while recollection efforts suffer due to inadequate channelization, ultimately affecting the lower-income group. Placing the operational burden on producers, distributors or retailers may eventually result in higher product prices for consumers.

(v) Waste depository schemes such as the plastic-for-schooling program (E.g., Akshar Green School in Assam) demonstrate promising alternatives to improve the collection rate and raise awareness in rural regions or towns.

Strategy 13 - Incentivisation

(i) Setting up reverse vending machines at mass gathering places could amplify the collection efficiency.

(ii) Other measures include:

a) Damaged gear buyback incentivization,

b) Engaging fishers in clean-up programs and fishing for litter during the times of ban on fishing,

c) Rewarding fishermen for collecting ALDFG,

d) Marine litter during fishing activities and handing over at the harbor,

e) Award-based incentives for coastal stakeholders,

f) Providing incentives for local artisans who create products from marine litter for their recycling and repurposing efforts,

g) Incentivize consumers to purchase sustainable products.

Strategy 14 - Control of packaging waste

In India, the packaging sector contributes to the highest share (24%) of consumption.

(i) Control packaging waste by banning packaging for fruits and vegetables, increasing shrink wrap thickness for recycling, and limiting unnecessary shrink wrap usage in secondary or tertiary packaging.

(ii) Biodegradable protective packaging such as paper cushions, paper bubble wraps, and molded pulps can be used as an alternative to dunnages such as bubble wrap, or air pillows.

(iii) In India, the market value of packaged drinking water exceeds 221 billion INR, with expected double-digit growth. Low-volume variants (below 1 Litre) hold a higher market share and are widely used in public functions and business gatherings, posing higher pollution potential.

(iv) Phasing out low-volume water bottle variants immediately at eco-sensitive sites and coastal states. Provide free potable water at mass gatherings and ensure its proper management.

(v) Establishing annual targets to reduce grocery packaging waste by X%, maximizing recycled content usage, and enhancing packaging recyclability are vital mitigation strategies.

(vi) Implementing refill models like brand-owned and consumer-owned packaging can reduce consumption. However, brand owners may resist due to concerns about adulteration and retail market supply burdens.

(vii) Stainless steel and other metallic materials can be used as an alternative to plastics. E.g., sprinkler boxes for powder forms, and sturdy boxes for flour, dal, rice, etc. can be used.

(viii) Establishing refill stations at offices, supermarkets, shopping malls, and a dedicated place will boost its usage.

(ix) Implementing the mandatory use of recyclable materials (paper, cardboard, tape) in e-commerce packaging is vital.

(x) Improving the collection efficiency through incentives or loyalty schemes such as “Return from home” for returning old packages while receiving consecutive orders.

(xi) To enable proper plastic waste inventory, packaging should prominently display durable barcodes or markings, including tare weight and polymer type, on the material or label.

(xii) Guidelines or limitations on design criteria such as product-to-package ratio should be provided to minimize excessive packaging.

(xiii) High taxes on packaging materials can encourage reduction and selective taxation targeting non-recyclable composite materials, which would encourage a switch to recyclable and eco-friendly packaging.

Strategy 15 - Plastics- value chain management and Circular economy

(i) Shifting from linear economy (Take-make-use-dispose) to circular economy (Take-make-use-remake) emphasizes redesigning products during production to extend their lifespan.

(ii) Value retention processes such as refurbishment, repair, and reuse help to increase both economic and environmental sustainability.

(iii) The Ministry of Consumer Affairs is developing a 'Right to Repair' framework to streamline the repair and spare parts market, making repairs more accessible and affordable for consumers.

(iv) Low-density plastics like styrofoam present challenges for informal waste collectors in India due to:

a) Lower weight affecting the cost-benefit ratio of collection.

b) Bulky volume requiring significant storage and transportation space.

(v) Increasing the recollection cost along with the usage of combined economic instruments will boost their circularity.

Strategy 16 - Discrete directives on marine litter and microplastic management

(i) The establishment of standardized protocols and quality assurance measures can help improve the comparability and reliability of MP abundance data across different studies.

(ii) Developing drinking water standards based on human health risk assessments for microplastic concentration and establishing effluent discharge standards for safe microplastic disposal in various environments are crucial evolutions.

(iii) Incorporating the Extended Producer Responsibility for products (such as fishing nets, and ropes) prone to degrade into microplastics, is essential.

(iv) Implementing source containment measures is crucial to minimize microplastic pollution. This includes installing fiber holder bags or laundry nets in all washing machines used in India and microplastic filters to arrest leakage from artificial turfs.

Strategy 17 - Fostering Research & Innovation

Strategy 17.1 - Scientific research and monitoring of marine litter and microplastics

(i) Integrating marine litter and microplastic monitoring into the National Water Quality Monitoring Program is crucial in assessing pollution and the effectiveness of mitigation measures.

(ii) Hotspot mapping with AI, ML, Remote Sensing, and GIS can significantly enhance litter monitoring and identification.

(iii) Integrate technology and AI into marine litter monitoring, such as installing solar-powered 24/7 monitoring cameras at river mouths to estimate plastic waste leakage.

(iv) Promoting the research to examine the effects of marine litter on marine life, ecosystems, and biodiversity

Strategy 17.2 - Research on Eco-Friendly and alternative materials

(i) Allocate funding for research into eco-friendly materials such as biodegradable materials and innovative packaging solutions.

(ii) Invest in research to develop plastic alternatives for industries like packaging, agriculture, healthcare, textiles, and horticulture, which significantly contribute to litter.

(iii) Research is essential for chemical hazard reduction, including producing BPA and phthalate-free materials, and using safer, non-carcinogenic, and non-toxic alternatives.

Strategy 18 - Certifications

(i) Blue flag beaches create an opportunity for an improved environment and employment by boosting the local economy. Focus on increasing the number of blue flag beaches in India.

(ii) Encourage corporate responsibility by establishing a certification system for businesses and introducing ocean-friendly certification for beachside resorts, hotels, and restaurants committed to reducing plastic waste. E.g., replacing complimentary SUP self-care kits with eco-products.

Strategy 19 - Enhancing existing legislative measures

(i) Widespread use of banned SUPs persists due to a lack of economical alternatives. Beyond promoting sustainable alternatives, stringent enforcement and compliance monitoring of waste management laws are crucial.

(ii) Dilation of the ban to other pollution potential SUPs and phasing out difficult-to-recover plastic items

(iii) The labels of SUPs should contain information on reuse hazards on human health to promote awareness.

(iv) Enforcing the ban on low-usage, high-littering single-use items with existing alternatives (e.g., polymer wet wipes, cellulose acetate adhesive tape) is essential.

(v) Adhering to landfill site selection criteria and using chain-link fencing or litter netting at landfill perimeters can help contain plastic waste and prevent environmental contamination.

(vi) It is recommended to develop guidelines for establishing plastic waste storage facilities in flood-prone areas, ensuring they consider other factors like fire safety and litter netting.

Strategy 20 - Environmental principles

(i) The free rider problem hinders the circular economy by restraining the reuse of many products (e.g. carry bags). As part of this action, complimentary carry bags (excluding eco-friendly products such as cloth, and paper bags), free supplementary use and throw items (e.g., plastic spoons for powder-form products) should be banned.

(ii) Imposing severe penalties and legal action against individuals or companies relative to the level of damage caused through the Polluter Pays Principle.

(iii) The severity of the penalty should match the damage caused by unsustainable products, with accountability starting from manufacturers, distributors, retailers, and finally consumers.

(iv) The manufacturers or producers of banned plastic products should face legal action and significant fines.

Key performance indicators (KPI) and review of policy

(i) Recommended to devise a framework to gauge the effectiveness of enforcement.

(ii) Resource availability (KPI 1) including infrastructure, human resources, and finances, is crucial for successful implementation and enforcement of legislation.

(iii) KPI 2 (Enforcement) and KPI 3 (Management) should have an inverse relationship. If targets for KPI 3 cannot be met for any reason, KPI 2 should reflect positive outcomes.

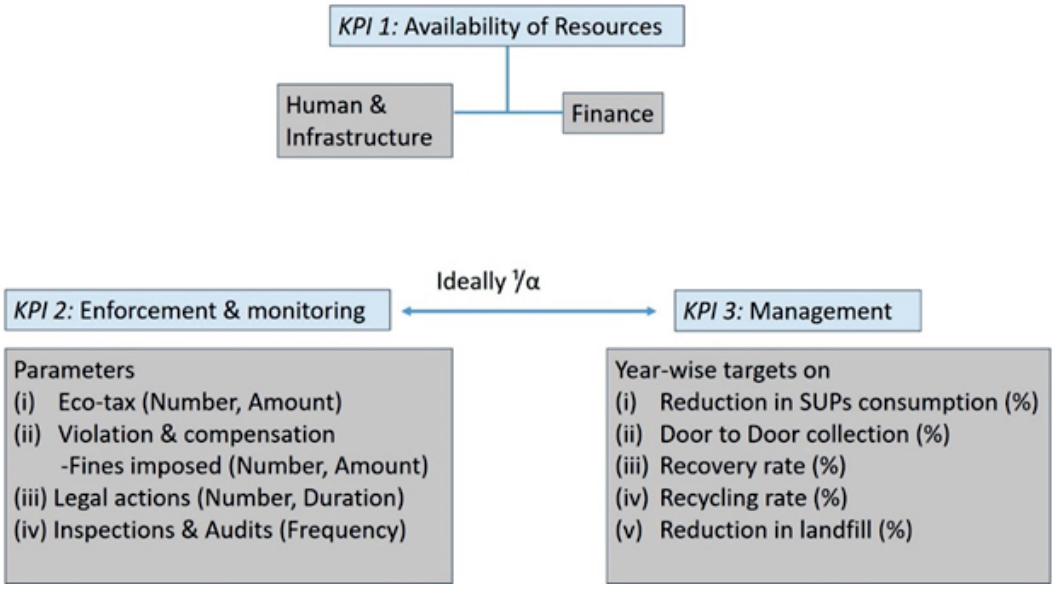
(iv) Levies collected through effective enforcement (KPI 2) could be used to finance the waste management system.

(v) Compliance with inventories of plastic waste (Rule 17(3) of PWM Rules, 2016) is crucial for mass budgeting, facilitating accountability in recycling and disposal rates, and mapping the sources of waste generation.

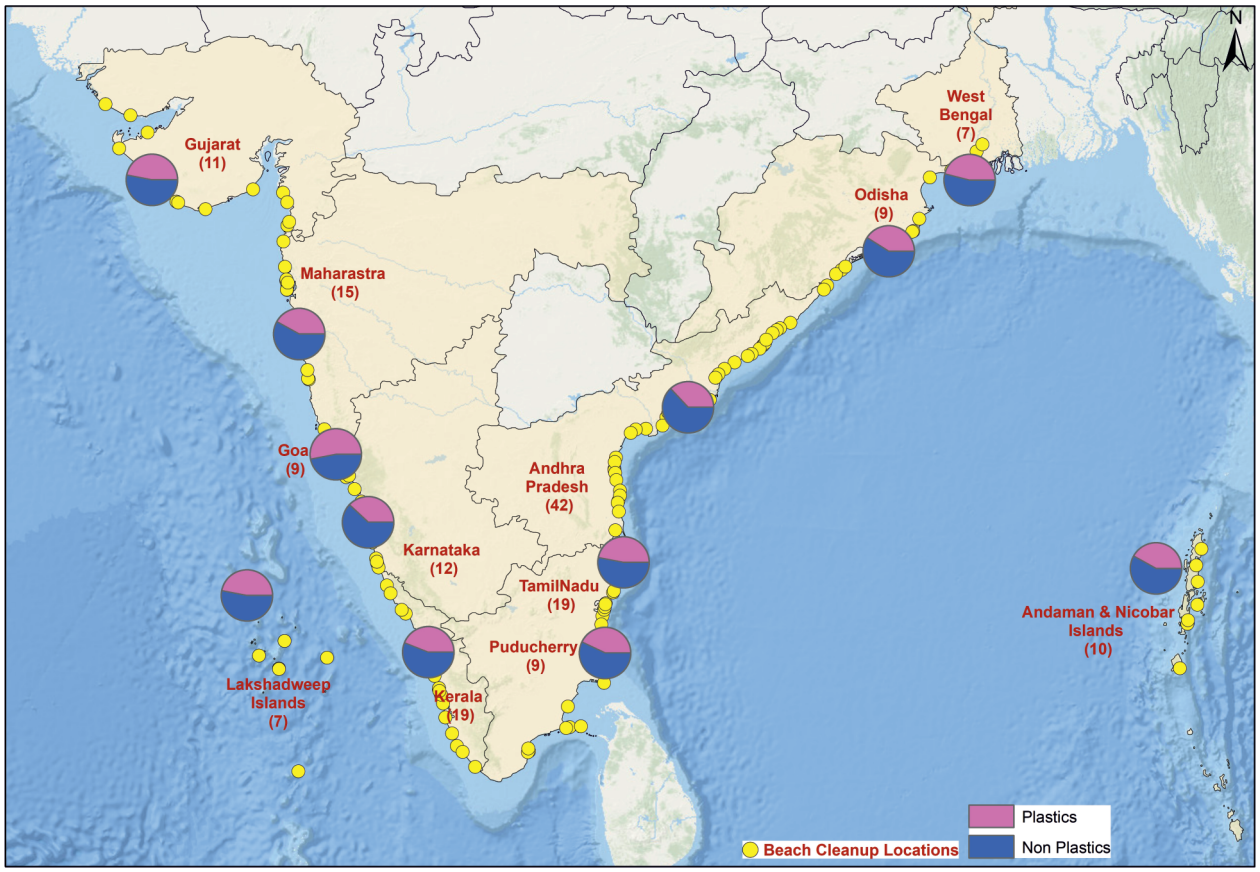
(vi) Implementing a landfill monitoring program can identify violations of banned products, while a waste auditing program assesses the major composition of unsustainable products.

(vii) Recommended to monitor the effect of the SUPs ban on the beaches. Such monitoring systems are necessary to gauge the effectiveness of the policy.

(viii) Setting up specific goals for targeted reduction of plastic waste, increasing recycling rates, and remediation frequencies will help measure the progress.



International Coastal Clean-up Activities (2018-2023)

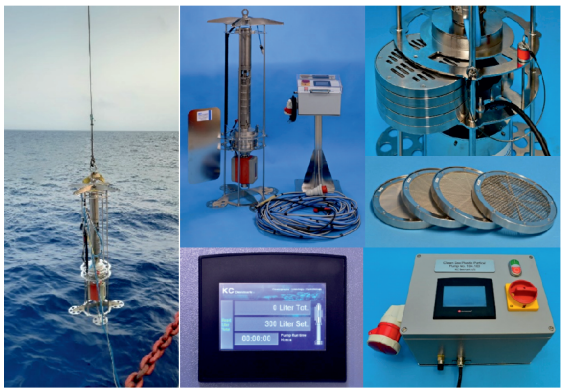


Average percentage of plastics and non-plastics litter over 5 year period in Indian coastal state beaches.

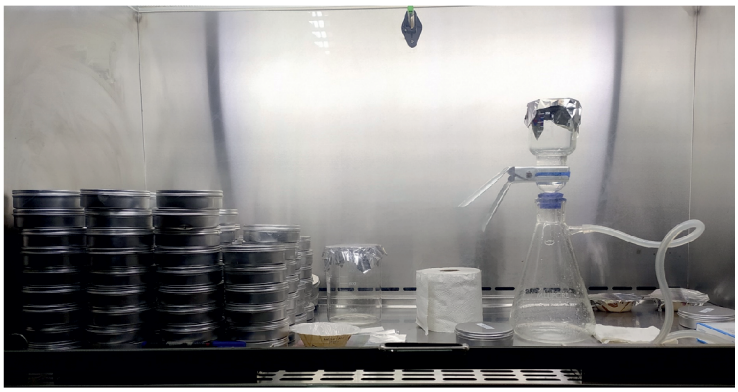
Coastal States/Islands	Plastics (%)	Non-plastics (%)
Gujarat (GJ)	47	53
Maharashtra (MH)	42	58
Goa (GA)	53	47
Karnataka (KA)	38	62
Kerala (KL)	44	56
Tamil Nadu (TN)	47	53
Puducherry (PY)	43	57
Andhra Pradesh (AP)	37	63
Odisha (OD)	41	59
West Bengal (WB)	46	54
Lakshadweep Islands (LDI)	47	53
Andaman & Nicobar Islands (ANI)	42	58

Data and Methods

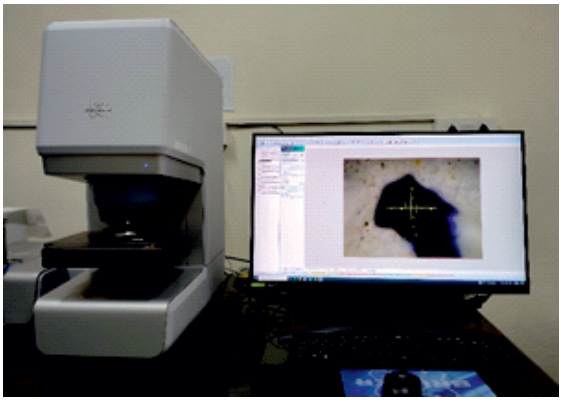
(a) Manta net (b) MP Particle Pump (c) Van Veen Grab (d) Core sampler (e) Meso & Microplastics



Microplastics Particle Pump



MPs isolation at Laminar Air Flow Chamber



Fourier Transform Infrared Spectroscopy (FTIR)

Micro and Mesoplastics

Coastal Clean-up Activities


Don't Litter !
It Makes World Better
Think Blue
Protect our Oceans
to protect our Future


REDUCE — REUSE — RECYCLE
Clean Beach ! Our Pride
GO Green Plastic is Obscene
Save Our Coast, Conserve the Future
16/09/2023 09:21


Clean Beach ! Our Pride
Clean Beach ! A Paradise on Earth
Vulnerable Coasts, Seek attention
Save Our Coast, Conserve the Future
Fighting for Trash Free Seas
Don't Litter ! It makes World better

List of Publications

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