# Maldives Marine Litter Action Plan

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SACEP

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# Foreword

The Maldives is surrounded entirely by the sea and is highly vulnerable to the impacts of marine litter. The marine litter accumulates in the Maldives locally from community islands, tourist resorts, marine vessels and debris blown into the sea from landfill islands. Additionally, fishery industries from other countries also contribute to this growing problem through abandoned equipment which becomes "ghost gear."

The health of the sea is vital to the existence of the nation as its economy and sustenance depend on the sea. The growing population and development continue to add to the increasing problem of marine litter which is further deteriorating the condition of the marine environment. The Government of Maldives recognizes the critical role of the environment in national development and continues to make every effort to address the problem of waste. Taking this and other member countries' concerns into account, South Asia Co-operative Environment Programme (SACEP) works towards promoting and supporting the protection and enhancement of the South Asian environment. To this end, SACEP has instigated and supported the development of country-level Marine Litter Action Plans with the financial aid of UNEP-6PA.

This report mainly consists of information collated from government reports, academic publications on Maldives, and institutions operating within the country. The report also attempts to demonstrate impacts, gaps in knowledge and the way forward for the Maldives to sustainably manage the marine litter problem in its territorial waters. Herefore, this report will act as a baseline to illustrate the current status of marine litter in the Maldives and add value to future research and much-needed development in this area.

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# 1.Introduction and background

The Maldives is located in the Indian Ocean at a latitude between 7° 6' 35" N to 0° 42' 24"S and a longitude of 72° 33' 19" E to 73° 46' 13"E, approximately 340 km southwest of southern India. The country comprises a chain of 1,192 coral islands, spanning a maritime area of 859,000 km2, with a total land area estimated to be 300 km2 (National Bureau of Statistics, 2017). The country's population of approximately 352,795 people lives on 187 of the 1192 islands in the Maldives. An additional 126 islands have private tourist resorts (National Bureau of Statistics, 2017). About 70% of the inhabited islands have a resident population of less than 1,000 people. Male', the capital city of the country, had, as of 2014, an estimated population of 153,379, or 45% of the country's residents (National Bureau of Statistics, 2015).

Amongst the many challenges the country is facing, marine litter is one of the biggest environmental challenges in the Maldives. Marine litter, sometimes referred to as marine debris, is commonly defined as "any persistent, manufactured or processed solid material that is discarded, disposed of, or abandoned in the marine or coastal environment" (United Nations Environmental Programme [UNEP], 2009). In recent years, there has been a significant increase in the magnitude of the problem in the country due to the rapid growth in population, changing consumption patterns, logistical difficulties of waste disposal and limited availability of proper waste management facilities. While it is difficult to determine the total quantity of solid waste generated in the country, it is estimated that the largest proportion of the waste is generated in the urban regions (51%), particularly Male' region, followed by island communities (28%) and tourist resorts and safari boats (21%) (Ministry of Environment and Energy [MEE], 2017). The estimated amount of per capita solid waste generation in the Maldives is between 1.7 - 3.5 kg a day, and is predicted to increase by 4% per annum (MEE, 2017). The waste generation pattern in Maldives indicates an increasing trend, with an increase of 155% in Male' and 57.4% in other community islands over the past ten years (MEE, 2017). These figures account to all the solid waste generated in the country. Of this, the amount entering the ocean is unknown.

No formal studies or records have been published about the typology and pathways of marine litter in the Maldives, except for ghost nets. The Olive Ridley project, an international organization researching and identifying the impact of ghost nets in the Indian Ocean, has collected a considerable amount of data on the number of ghost nets found in the Maldives marine ecosystem. Between July 2013 and June 2017, they removed 732 nets and reported 426 turtles being entangled in these nets (Olive Ridley Project, 2017a). It is noteworthy that, given that Maldivian fishers use pole and line except for bait fishery, majority of these ghost nets are most likely drifted into the Maldivian waters from other countries - it is hard to pinpoint an exact origin due to the transboundary nature of ghost nets (IUCN, 2015).

Waste is generally not segregated at household levels, although a few islands do. Moreover, due to the limited space and funding availability, many islands do not have a proper waste management facility. Hence waste is dumped in to the island foreshore, which is piled in a long row parallel to the sea and periodically burned at low combustion temperatures to reduce the volume of discards. 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 (Ministry of Tourism [MoT], 2015). However, often these wastes are dumped in the ocean together with the plastic bag which the waste is contained in, and EPA receives reports of such cases where waste ends up on the shorelines of the islands. Waste from Male' region and some resorts are transported to Thilafushi, the landfill island, where they are stored under unfavourable conditions that allows transportation of litter from inland to the ocean.

In addition to the land-based sources, sea-based sources also contribute to the litter found in Maldivian waters. Although formal records have not been maintained, informal reports indicate that marine vessels (resort boats and safaris) dump their waste into the ocean at a close proximity to community islands.

Much like in other places around the globe, plastics are estimated to be the predominant type found amongst the marine litter in Maldives. Based on observations and informal reports, main types of litter found in the marine environment of Maldives are:

- Plastics (fragments, bags, sheets, containers, bottles, fishing gear, large items such as washing machine, sandbag material)
- Polystyrene (cups, packaging, buoys)
- Rubber (gloves, boots, tyres)
- Wood (pallets, furniture, fragments)
- Metals (cans, aerosol containers, scrap)
- Sanitary or sewerage related debris (feminine hygiene materials, diapers)
- Paper and cardboard
- Cloth (clothing, shoes)
- Glass (bottles, light bulbs, fragments, sheets)
- Building materials (cement, bricks)
- Ceramic materials (bathroom fixtures, tiles)

In attempts to address this issue, a number of strategies have been put in place at various levels – nationally by the Government as well as corporations, and locally by NGOs and councils. The Government of Maldives made a voluntary pledge at the Oceans Conference 2017 to significantly and progressively reduce the use of non-biodegradable plastics in the Maldives (UNEP, 2017), and in support of this, launched a campaign 'Stopping plastics in the ocean – reducing plastic waste' to mark the World Environment Day 2017. The Government also announced a campaign to intercept and collect ocean plastics from the country's exclusive economic zone in collaboration with Maldivian fishing vessels. The plastics intercepted by fishers and collected at designated collection points are handed over to Parley for the Oceans, who Maldives has been closely working with to recycle and reuse plastic wastes.

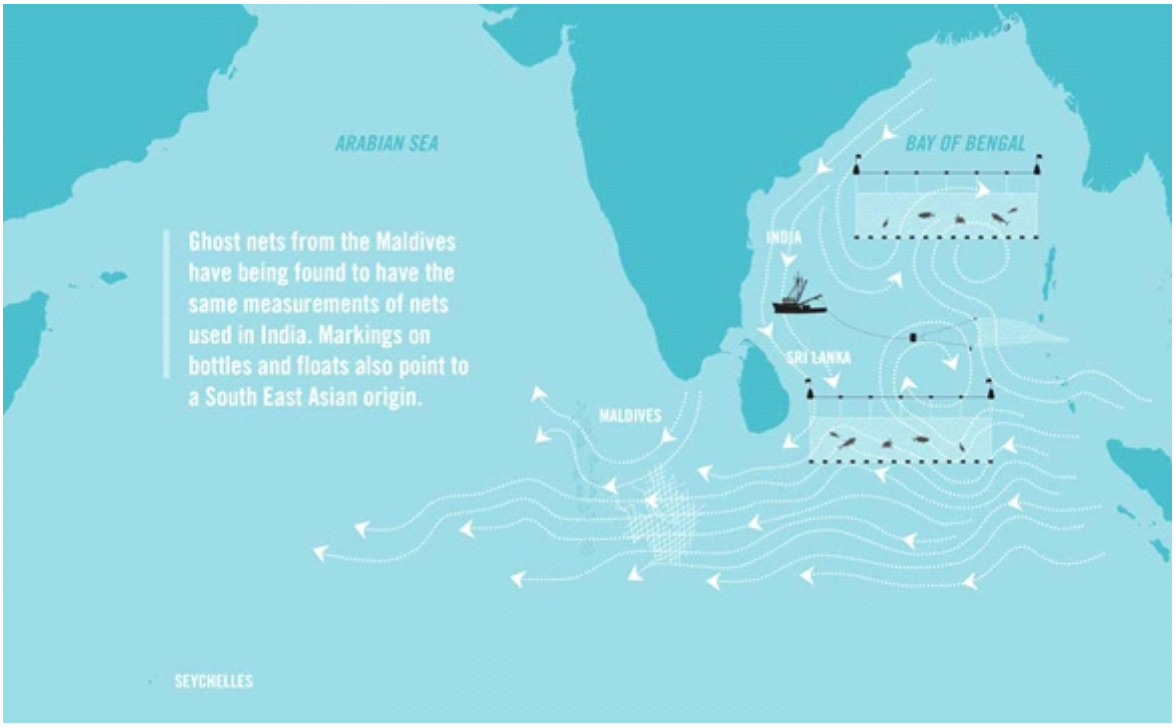
To date, over 800 tons of plastic, including those disposed at Thilafushi and sourced by the private sector, has been exported by Parley for the Oceans over a period of 16 months (personal communications with Parley Maldives, 2018). In addition, some resorts manage their own waste through recycling and composting on their islands. At the local level, three islands have banned single-use plastic bags from their islands and NGOs organize occasional beach and ocean clean-ups. Last year, with the assistance of South Asian Co-operative Environment Programme (SACEP), the International coastal clean-up day was celebrated in the Maldives to raise public awareness on marine pollution and to encourage coastal stakeholders to take care of their environment.

This action plan assesses the status of marine litter in the Maldives and outlines the key gaps in marine litter prevention and management. The report also proposes recommendations to bridge these knowledge gaps and improve the overall issue of marine litter in the country.

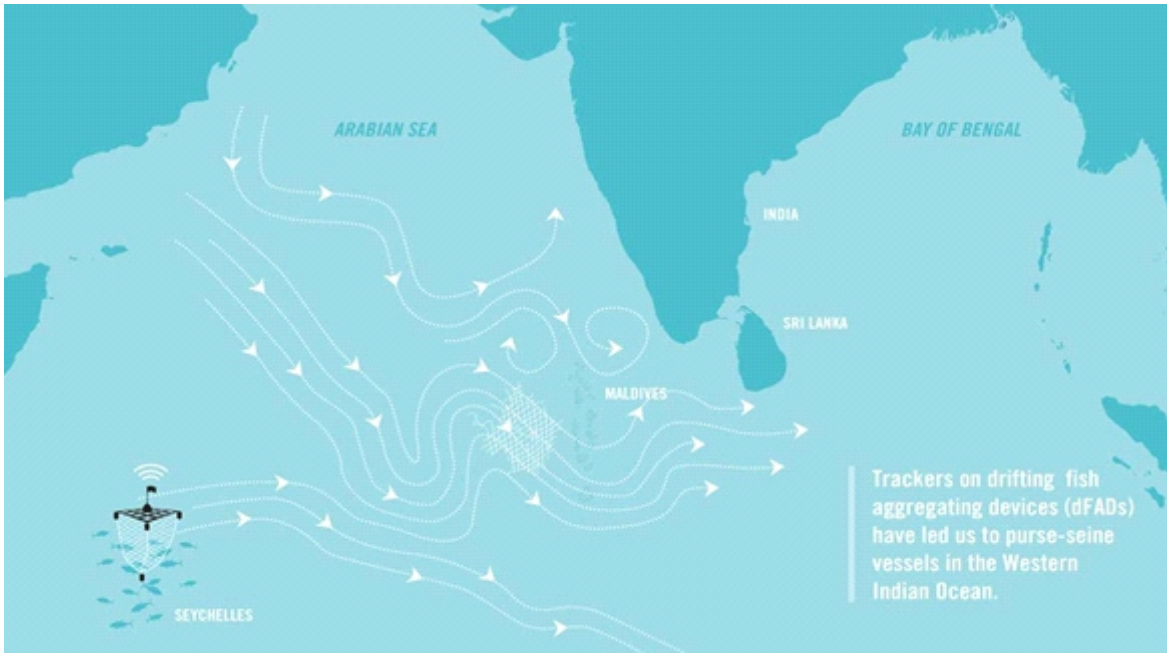
# 2.Sources and Circulation of Marine Litter

Marine debris such as plastic when immersed in sea water, can both float or sink based on factors such as entrapped air, water currents and turbulence which can affect its density. Lighter thermoplastics such as polyethylene and polypropylene have densities estimated to be approximately between 0.90-0.095 (kg m-3) and heavier thermoplastics such as polyvinyl chloride, polyamide, polystyrenes, polyester resins and cellulose acetate have densities ranging from 1.01-1.39 (kg m-3) (UNEP, 2016). As the density of seawater is approximately 1.027(kg m-3) (UNEP, 2016), the lighter thermoplastics are likely to float on the ocean surface and the heavier plastics may sink to the bottom of the seafloor or be suspended within the water columns unless there are other external factors influencing its behaviour in the environment. Floating marine debris found in the Maldives can accumulate from both international and local origins.

The oceanic marine debris that floats on the surface of the ocean has a high chance of being transported over long-distances to the territorial waters of Maldives by the South Western winds and surface currents. Stelfox, Hudgins, Ali, & Anderson, (2013) presume that the ghost nets found in the Maldives are likely arriving from the Somalian and Eastern African regions as the oceanic currents do not flow directly from India, Sri Lanka or other Eastern Indian or Bay of Bengal nations during the South Western monsoons unless they have circulated in the ocean during the North Eastern monsoon and remained in circulation for long periods of time.




*The data collected so far suggest that ghost nets may be coming to the Maldivian waters from Southeast Asian countries such as India, Sri Lanka, and Thailand during the Northeast Monsoon (Olive Ridley Project, 2017b).*




*During the Southwest Monsoon, pieces of fish aggregating devices (FADs) indicate that the ghost nets are coming from the western Indian Ocean and the Arabian Sea (Olive Ridley Project, 2017b).*

Other marine debris from local sources can originate from local community islands, tourist resorts, marine vessels and debris blown into the sea from landfill islands. According to surveys conducted by NBS (2014) and MEE (2016) respectively report that 4.4% of nation's households dispose garbage into the seaside/beach and that their most common method of kitchen waste disposal is to dump into the sea/beach (63%). Tourist resorts and safari vessels also dump food wastes into the sea and transports recyclables such as metals and plastics and residual waste to Thilafushi, the main landfill island in Maldives (MoT, 2015). According to MoT(2015) approximately 96 boats arrive to Thilafushi weekly, each carrying about a half to a full lorry's load of waste in an uncovered state. There is a high likelihood of waste seeping and blowing into the sea during the transport to Thilafushi.

The marine debris introduced to the ocean is generated both from land based sectors and sea based sectors both in the form of microplastic ( 1-5mm), mesoplastic (5-25mm) and macroplastic (>25mm)(Imhof et al., 2017). To date, no formal large-scale litter audit has been done to determine exact marine litter by kind and volume. However, according to a litter audit report which was done in Malé region by Save the Beach (2016), waste was generated from both land-based sectors and sea based sectors in the Maldives and comprised of the following types of waste in the below table.

| *Item* | *KGs* | *Grams* |
|---|---|---|
| | | |
| Paper & Cardboard | 0.57 | 574.50 |
| Organics | 0.46 | 463 |
| Glass | 0.68 | 681 |
| Plastics | 5.66 | 5655 |
| Ferrous metals | 2.38 | 2379 |
| Non ferrous | 0.98 | 981 |
| Chemicals & Haz | 0.20 | 204 |
| Packaging/Boxes composite | 0.17 | 166 |
| Supari wrappers | 0.04 | 42 |
| Ceramic | 0.19 | 188 |
| Textiles/fabrics | 0.95 | 950 |

| | | |
|---|---|---|
| Footware (mixed) | 0.95 | 954 |
| Wood | 12.48 | 12482 |
| Sand/dust/dirt/ash | 3.33 | 3326 |
| Ropes/pieces/fishing lines | 0.73 | 733 |
| Cig Butts | 0.06 | 57 |
| Decorative flowers/plastic | 0.07 | 65 |
| Construction blocks | 8.00 | 8000 |
| | *37.90* | *37,900.50* |

*Litter Collected Over 7 Day Period (Save the Beach Maldives, 2016)*

Waste from land based sectors from this audit belonged to retail, food and drink, households, tourism industry, plastic recyclers and construction with fisheries likely being the only sea based sector (UNEP, 2016).

Recorded comprehensive information about sea based waste generation sectors in the Maldives is very limited at this time with the exception of ghost nets. The Olive Ridley Project (2017a) has reported removal of "ghost nets and ghost gear fragments such as ropes, bags, buoys, bottles and other debris" but their monitoring protocol only retains information about the ghost nets. However, these ghost nets have not been found to have originated from the Maldives despite there being a slim chance of bait fishery nets becoming ghost nets (Stelfox, Balson, & Hudgins 2014).

# 3.National Impact of Marine Litter

The insufficient waste management situation in the Maldives is generating significant marine pollution problems in the country (MEE, 2017) and yet the precise extent of the problem regarding the impact of marine litter on the Maldives has not been assessed. Given that Maldives is heavily reliant on marine environment for its existence and is predominantly a marine biodiversity based economy, this prevalence of litter in the marine environment is a cause of concern as it has the potential of causing detrimental social, ecological and economic impacts (MEE, 2017).

## 3.1 Social impacts

Although the social impacts of marine litter have not been formally identified and quantified in the Maldives, unofficial reports and current trends in the country indicate the potential negative implication of marine litter can have on human health and food safety and intrinsic and social values associated with marine environments.

Marine debris can have direct negative implication on human health and safety in both in-water and onshore. In terms of human safety in in-water situation, marine litter can become a threat to snorkelers/divers as people may get entangled in submerged marine debris (Cheshire et al. 2009). It also can become a navigational hazard and implicate accidents, posing a significant threat to human safety by damaging vessels which can lead to stranding the occupants and requiring rescues (Cheshire et al. 2009). In regards to human health and safety on shore, marine litter such as rope, brittle plastic fragments, broken glass, metal on beaches and shallow water can cause abrasions and cuts to beach users and risk possible infection through contact with medical and sanitary waste (Mouat et al. 2010).

Additionally, studies have found that plastic contains chemical additives and synthetic substances like phthalates and parabens which do not completely break down and end up accumulating in the marine ecosystem (Moore, 2008). Ingested microplastics and chemical substances have the potential to disrupt cellular processes and damage tissue in organisms (Rochman et al. 2013) which may concentrate toxins across the food chain, resulting in biomagnification (Wright et al. 2013). Humans are mainly exposed to micro and nano-plastics through the consumption of marine food sources, and thus the presence of these various particles in marine organisms pose a risk to human food safety (Bouwmeester et al. 2015).

Marine litter tends to diminish the intrinsic and social values associated with marine environment. There is an intangible cost to communities with the presence and impact of marine debris by affecting the ability to use coastal environments, decreasing the quality of marine ecosystems and the associated aesthetic value (Mouat et al. 2010). Marine litter is an eyesore, and it diminishes the naturalness and attractiveness of marine environments (Mouat et al. 2010). For example, beaches are a free amenity and enjoyed by people of different age groups alike, locals and tourists. With increasing solid waste issue in the Maldives, much like many other countries, marine debris is found on many beaches in the Maldives. Even though, there is no formal record on this, observations and informal communication with the community members highlight that people tend to avoid degraded beaches and other coastal areas with marine litter as it reduces user enjoyment. This poses significant social consequences to those whose leisure pursuits depend on the marine and coastal environments.

## 3.2 Economic impacts

The magnitude of the economic impacts that marine litter has on Maldivian economy is not currently well understood. Nevertheless, global research indicates that marine debris can cause a wide range of economic implications that decrease the economic benefits obtained from marine and coastal activities and or increase the associated cost (UNEP & NOAA, 2012). Thus, Maldives' high reliance on marine resources through tourism and fisheries make the country extremely vulnerable to marine litter.

Most of the tourism-related activities in Maldives consist of snorkelling, diving, beach use, watersports and megafauna watching tours. Marine litter may result in lower revenues from tourism in the country with increasing incidence of debris on beaches, shallow coastal areas and other marine environments. Presence of marine debris leads to degradation of the aesthetic quality of the marine biodiversity and marine ecosystems, and this may deter visitors (Balance et al. 2000), leading to a considerable adverse effect on the revenues from the tourism industry. For example, research shows that in Sweden, marine litter inhibits tourism by between one and five percent causing a loss of approximately USD 30.3 million in revenue (Ten Brink et al. 2009). Additionally, for the economic viability of tourism industry in the country, it is essential to maintain the marine environment clean and safe for tourists. Marine litter is costly to remove (Balance et al. 2000), and regular mechanical clean-ups incur immense economic costs, further affecting the revenue generated from the tourism industry.

Much of what is known about the economic impacts of marine debris on fishing activities in the country is based on anecdotal evidences suggesting direct and indirect costs associated with damaged fishing gears and vessels. Costs arise directly through collision, entanglement, and indirectly through loss in production time. Research conducted with Scottish vessels showed that around 86% had experienced a decline in catch due to marine debris along with higher costs associated with replacing their fishing gear which is approximately a cost of USD 16 million (Mouat, Lozano & Bateson, 2010). Additionally, at least one annual incident per vessel was reported to have experienced blocked pipes or marine debris stuck in propellers of the boats and the cost for lost time at sea and repairs approximate to about 5% of their total revenue (Mouat, Lopez Lozano & Bateson, 2010). Another noticeable impact from marine debris on the fishing in the Maldives comes from the potential of discarded fishing nets (ghost nets) smothering benthos. All lost and discarded gears can continue to capture economically critical marine species and affect fish stocks. This can lead to economic losses for commercial fishers and a decrease in recreational fishing opportunities (Macfadyen et al. 2009). Thus, with the increase in reports of similar incidences by fishers in the country, litter in the marine environment may lead to reduced revenues from the fishing industry.

## 3.3 Ecological /Environmental impacts

Marine litter pose significant threats to marine wildlife through entanglement and ingestion. Marine organisms, from small fish to megafauna such as turtles, dolphins and whale sharks can become entangled in lost or discarded fishing gears such as ropes, monofilament line and ghost nets. The effects of entanglement range from direct mortality through drowning to progressive injuries, starvation and suffocation (Stelfox et al., 2013). The issue of ghost net is an increasing concern in the Maldives and entanglement threat level for turtles have been categorised as extremely high (Stelfox et al., 2013). Between July 2013 and June 2017, Olive Ridley Project has removed 732 ghost nets from Maldivian waters and among these, 426 were cases of entangled turtles in ghost nets. These include 358 Olive ridley turtles, 20 hawksbill turtles, 7 Green turtles, 1 Leatherback turtle, 1 Loggerhead turtle and 3 turtles of unknown species (Olive Ridley Project, 2017a). Often, many of the species affected go unrecorded, and so the impact of discarded fishing gears on other marine species is poorly understood in the Maldives. Nevertheless, it is clear that a significant amount of marine organisms are continuing to suffer from entanglement in lost or discarded fishing gears.

Additionally, marine litter can be mistaken for food sources and be ingested by a variety of marine organisms (UNEP & NOAA, 2012 and Galgni et al. 2010). For example, many species of marine mammals and marine turtles have been reported to consume marine litter as they mistake plastic debris for food items, floating plastics bags for jellyfish, plastic nurdles for fish eggs which block and damage their digestive system, leading to starvation and death (Galgni et al. 2010). In the Maldives, there is no official assessment of the impacts of marine litter ingestion; however, social media and unofficial reports have highlighted few incidences of plastic particles in fish stomachs.

Another potential environmental impact of marine litter is it can alter marine habitats through physical interference such as smothering, obstruction of sunlight, abrasion and entanglement. Although in Maldives, Biodiversity Hotspots have not been formally identified, there are internationally recognised sites such as Hanifaru Bay for its high aggregation of Manta Rays, South Ari Marine Protected Area for its all year round Whale Shark sightings and Madivaru for its rich biodiversity and ecosystem services. Solid waste disposed of in the ocean sinks to the bottom of the sea and may become entangled in the coral reef, interfering with mobility and natural foraging of marine organisms (Hammer et al., 2012). This may pose an immense threat to a coral reef nation whose economy and livelihood depend on these marine ecosystems.

# 4.Management Agencies, Policies, Strategies and Activities Taken to Minimize Marine Litter

## 4.1 National legal instruments that govern the management of marine litter in the Maldives

Much like many other countries, in the Maldives, the issue of marine litter is addressed across a variety of laws and regulations governing solid waste more broadly and by regulating activities that may contribute to waste generation. There is no specific legislation or frameworks governing marine litter per se.

The main regulation governing solid waste management in the Maldives is the National Solid Waste Management regulation (Regulation No:2013/R-58 )enacted under the Environmental Protection and Preservation Act of Maldives (Law No:4/93) This regulation dictates all aspects of solid waste. Below are the parts that make specific references to marine pollution:

Clause 11b – This clause forbids disposing of waste in to the following marine and coastal areas:

- Marine Protected Areas
- Mangroves and other wetlands
- Lagoons
- Reefs
- Sandbanks
- Beaches (beachline)
- Shoreline
- Harbours

Clause 13 – This clause specifies the rules that all sea vessels have to follow in collecting, storing and managing waste that is generated while at sea. Sea vessels not allowed to dump waste in any of the above-mentioned locations, however, the article allows for them to dispose of organic waste in these places. The captain or the person in charge of the vessel is responsible for the disposition of all waste stored on the vessel as soon as they dock (at a designated place where disposal is allowed).

Clause 16 - This clause requires any party interested in storing, managing, or treating waste (including transporting waste by sea) to seek special permits from EPA.

Clause 26 – This clause outlines rules to be followed by those who have received the above mentioned special permits. Permit holders are required to report on the type and quantity of waste that they transport/dump, and are obliged to ensure that the loaded waste does not overflow or get carried by wind or tide. If they have a permit to store waste, they are obliged to ensure that the waste site has proper infrastructure to fence off the waste materials and to ensure that they are not carried away by wind.

Clause 28 – This clause requires parties carrying toxic waste across the border of the country to abide by all the transboundary agreements and international treaties signed by the government of Maldives.

The regulation states to refer to the tourism regulation for ways to store, manage, and dispose of waste generated within resorts. The 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. This regulation requires resorts, picnic islands, and marinas operating in the Maldives to ensure that, if they are to dump biodegradable waste into the sea, it should be dumped outside the atoll, taking into account the wind and ocean currents so that it would not get washed ashore on to any islands. The regulation also prohibits tourist vessels to pump any sewer or waste into the lagoon or in any marine protected area.

## 4.2 Management agencies and their responsibilities

Currently, roles and responsibilities in waste management is split across a number of ministries and agencies. The National Solid Waste Management Regulation prescribes the Environmental Protection Agency to be the implementing body of the waste regulation (MEE, 2013), although the waste management policy introduced in 2015 specifies that all policies, strategies and activities related to solid waste will be governed and overseen by MEE (MEE, 2015). However, since the Regulation on the Protection and Conservation of Environment in the Tourism Industry is made pursuant to the Maldives Tourism Act, the implementation of this regulation falls under the mandate of Ministry of Tourism. The overlapping nature of these responsibilities causes lack of clarity on whom to report on misconduct. Moreover, monitoring and enforcement of these legislation is weak, hence the regulations have not shown to be very effective at a national level. At a local scale, the island and city councils have the authority to implement and enforce waste disposal and management within their region, including the lagoon area.

## 4.3 Ongoing campaigns and strategies at the national and provincial levels

Most campaigns, strategies, and activities in place attempt to reduce land-based sources of litter, presumably with the assumption that marine litter can be minimised to a large extent by adequate and effective solid waste management. Below is a summary of main strategies and activities in place.

**A. Saafu Raajje campaign:** A waste management campaign that was launched in 2015 by the Ministry of Environment and Energy to promote awareness and education on proper waste management practices and to reduce the amount of waste thrown into public places as well as in to the sea (Ministry of Environment and Energy, 2015).

**B. National Solid Waste Management Policy (Saafu Raajje initative):** A policy document developed in 2015 to streamline all the existing initiatives, and to strengthen the waste management infrastructure and administrative capacity across the country. The document outlines 10 key strategies and 16 goals, underlying principles as well as agency responsibilities and financing mechanisms to implement the national plan (MEE, 2015).

**C. National Biodiversity Strategy and Action Plan 2016-2025:** Although the primary purpose of this action plan is to conserve and sustainably use biodiversity and ecosystem services, it includes strategies that would contribute to minimise marine debris. Some of these include actions such as introduction of extended producer responsibility schemes, certification of industries that have sustainable production enforced, better enforcement of national waste regulation, strengthening enforcement of sewerage and waste water regulation, and increase public awareness on effects of pollution and waste (Ministry of Environment and Energy, 2015).

**D. Pledge to reduce the use of non-biodegradable plastics:** The government made a voluntary pledge at the Oceans Conference 2017 to significantly and progressively reduce the use of non-biodegradable plastics in the Maldives (UNEP, 2017).

**E. Waste Management Corporation Limited (WAMCO):** In attempt to address the problem of the lack of an effective and coordinated waste collection and management system in the country, the Government of Maldives began the operations of WAMCO on 1st January 2016. WAMCO is a fully government owned entity that collects waste from households, businesses, resorts, and islands and transports them from transfer points to the nearest waste management facility.

**F. Partnership with Parley for the Oceans:** Maldives formed a long-term partnership with Parley to implement Parley's creative, multi-disciplinary approach to collection of plastic from the sea and recycling them to create yarn or fabric. So far, over 800 tons of plastic collected from Maldivian waters over a period of 16 months has been exported by Parley, part of which has been turned into 100 handmade shoes and other sportswear (Maldives Insider, 2017).

**G. Collaboration with fishers to collect drifting plastics:** The government has begun an initiative in collaboration with the fishing industry whereby fishers collect and bring back drifting plastics they encounter within the country's EEZ. The collected plastics are to be handed over to the closest designated collection point, which will then be delivered to Parley for the Oceans for recycling (Permanent Mission of the Republic of Maldives to the United Nations, 2017).

**H. Establishing waste management programmes and facilities in various islands:** The Government of Maldives is working on developing waste management facilities in various islands under different donor funded projects. For example, they are working with UNDP to establish a waste management programme in 11 islands of Laamu Atoll, including the setting up of waste management centres and educational activities.

**I. Banning single-use plastic bags:** Some community islands (AA. Bodufolhudhoo, AA. Ukulhas, V. Keyodhoo) have taken the initiative to ban single-use plastic bags in their islands. However, these are voluntary gestures and are not legally supported (UNDP Maldives, 2017).

**J. Ocean clean-ups and waste audits:** Some local NGOs and organisations arrange regular ocean-clean ups to remove marine debris. They also organise waste audits to identify the typology and quantity of marine litter found in Maldivian waters, and work towards raising community awareness on the issue of marine pollution (Save the Beach 2016). In 2017, the Government of Maldives celebrated International Coastal Clean-up Day by organising a clean-up in Hulhumalé with kind assistance from SACEP.

# 5.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 attributessuch as - length between two knots, net construction, type of twine, number of strands, type of material, diameter of twine, colour, floatation attachments and writing on attachments, photos, entangled species of turtle, carapace length, gender, and photos are collected through the citizen science protocol. | Abundance of ghost nets and their points of origin identification. |
| Korallion Lab | Lhaviyani, Vavvaru Island- six sites in natural accumulation zones | Method 1: Quantification of long term accumulation of plastic debris within a grid of 1m2 (1× 1 m)<br><br>Method 2: daily abundance of plastic particles within a grid of 0.5 × 0.5m(0.25m2) 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<br><br>Detection of various types of polymers and noted prevalence of polystyrene of all sizes. |

*Adapted from Olive Ridley Project (n.d.) Report a ghost net and Imhof et al.,(2017) Spatial and temporal variation of macro-, meso- and microplastic abundance on a remote coral island of the Maldives, Indian Ocean.*

It is noteworthy that Olive Ridley Project is the only organisation with an active monitoring programme at this time with regionally coordinated efforts within the Indian Ocean. The present continuity of the monitoring efforts by Korallion Lab is unknown. Additionally, other organisations such as Save the Beach Maldives, Project Damage Control, Good Riddance Project, the Salvage Project and Muhyiddin Eco Club do frequently organise collaborative beach clean-up events.

# 6.Gaps, Research and Analysis Knowledge Needs

**A. Insufficient data on the extent of marine litter in the Maldives:** Despite the increasing issue of marine litter in the country, there is no official assessment on the quantity, composition, trends, sources and sinks of marine litter at a national level.

**B. Degradation of marine litter in the environment and its potential physical and chemical impacts on marine systems are unknown:** There is also a knowledge gap in terms of the ecological implications of marine litter exposure, social and economic consequences of marine litter at a national scale.

**C. Lack of a marine litter monitoring programme in the country:** Currently, NGOs and volunteers undertake occasional waste audits in specific locations such as Male' and Vilimale', but there is no platform to consolidate these monitoring efforts.

**D. Absence of a specific policy for marine litter and overlapping of agency responsibilities:** Currently, there is no specific policy that addresses the issue of marine litter. Moreover, the overlapping nature of agency responsibilities and weak coordination in management efforts have proven not to be very effective.

**E. Limited awareness and outreach on the issue of marine litter:** There is no large-scale education and outreach strategy to raise awareness on the issue and impacts of marine litter in the country.

**F. Weak waste prevention and management mechanisms:** Waste management facilities have been developed in various islands around the country. However, most of these facilities are inadequate and even in places where physical infrastructure exists, many islands do not have the technical capacity to operate the systems in place. Therefore, a lot of the time, even in the presence of incinerators and other machinery, waste is dumped into the island foreshore or openly burnt. Moreover, usually, there is no mechanism for transportation of non-biodegradable waste for proper disposal or recycling, hence these materials are stored in the facility over long periods of time under unfavourable conditions, leading to leakage and transportation into the sea by wind.

# 7.Proposed Way forward

**A. Conduct baseline studies on the status of marine litter in Maldives:** There is only sparse data available on marine litter but these data sources on the content and quantity of litter are not always sufficiently comprehensive, making it difficult to accurately assess the problem. In order to address the issue and to implement an informed policy, it is important that reliable and sufficient data is collected and maintained at a national scale, especially the composition, quantity and sources. Also, identify hot spots where marine litter accumulation is observed or predicted to improve target removal efforts.

**B. Assess impacts of marine litter at a national level:** In order to prioritise marine litter management efforts and also assess the effectiveness of implemented management measures, it is essential to assess social, economic and environmental impacts of marine litter at a national level.

**C. Synergise monitoring efforts:** It is important to establish a coordinated national marine litter monitoring programme in order to provide a unified monitoring platform and establish long term data sets to potentially interpret trends in the composition and abundance of litter over time in the country. Also, develop national marine litter monitoring guidelines and standardise methodologies to monitor marine litter on shorelines, in benthic habitats and pelagic waters to maintain consistency in data collected.

**D. Implement a marine litter policy:** It is recommended that all the current efforts to be reassessed and a mechanism is developed for better synergise efforts to address the issue of marine litter. This can be done by implementing a national marine litter policy that outlines specific strategies, targets, and responsibilities of different agencies. It is also important that this policy is governed by existing overarching waste regulations and that enforcement is strengthened in order to ensure compliance and accountability. For the successful implementation of this national marine litter policy, it is essential to improve administrative coordination and strengthen technical capacity within agencies to enhance enforcement.

**E. 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:** Marine vessels have difficulty locating and accessing waste management facilities. They have to travel long distances to dispose of their waste. For proper management of solid waste at sea, it is essential to develop convenient, low cost options of waste disposal in established regional waste management facilities to decrease the incidences of ocean dumping. Additionally, establishing port reception facilities throughout the country is required.

**F. Develop, strengthen and implement laws and policies to support solid waste prevention, minimisation and management:** Laws and policies that implement measures to reduce or ban single use plastics or most frequently found items as marine litter are required to prevent solid waste. Single-use plastics, such as bottles, bags, packaging and cups are frequently found on beaches and in the marine environment. Thus, it is essential to introduce legal frameworks that allow reduction of single-use items and promote the use of biodegradable or reusable items to decrease marine pollution in the country.

**G. Build technical capacity to monitor and enforce compliance with legislation and polices on litter and solid waste management:** Strengthening the technical capacity to monitor and enforce laws would reduce littering, dumping and solid waste management violations. Improved enforcement would lead to increasing reporting of violators, thus deterring violators and increased user compliance, in turn reducing the overall marine litter in the ocean.

**H. Remove marine litter from shorelines, benthic habitats and pelagic water:** Marine litter has been accumulating in the ocean for decades. Marine litter removal is the only strategy to reduce historical accumulation and also minimise new introductions of marine litter. Thus, regular clean-ups and remediation measures should be in place to prevent further impacts to sensitive species and habitats.

**I. 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:** This is essential to raise awareness of the implications of litter on marine ecosystems, economic viability and social well-being and to strengthen public participation in marine litter prevention and management efforts. Thus, in parallel to national marine litter management efforts in policy level, it is essential to develop and implement a nationwide educational campaign, and a series of outreach and clean-up events to ensure public awareness and mobilisation on the issue. This will also help to increase public compliance with laws and policies on marine litter prevention and management. This programme can be a part of the national curriculum.

**J. Establish an integrated water management system with a strong communication strategy:** Even though the tap water quality is in accordance to WHO standards, current practice of water distribution involves single-use plastics as majority of the population presume that the available tap water is unsafe to drink. This is consistently increasing the consumption of bottled water in the country, generating more solid waste. To promote a behavioural change, it is essential to establish a proper integrated water management system in the country with a strong communication strategy which addresses consumer's concerns and improve their knowledge and trust on tap water.

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**Annex 1 Status of Marine litter at Regional Level.**

**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 |
|---|---|---|
| Maldives | Waste management regulations and Island waste management plan has a mechanism in place to, but so far quantitative data is unavailable | Quantitative data specific to marine litter is not available. solid waste generation statistics for some regions are available |

**Table 1.6 : 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 |
|---|---|---|
| Maldives | Marine litter estimates are not available at a national level<br>Solid waste quantity projections based on 2008 household waste audit are available<br>Per capita waste generation (1.1kg/day for Male' and 0.7 kg/day for atolls). | Quantity of recycling or re-use is not available |

**Table 2.0: Information availability In SAS countries on Ecological, Social and Economic Issues**

| Country | Ecological Issues | Social Issues | Economic Issues |
|---|---|---|---|
| Maldives | Local data available in different regions, but not enough to represent nationwide status | General statement indicates it is an emerging issue, but data isn't site specific | General statement indicates it is an emerging issue, but data isn't site specific. The impacts are not well understood. |

**Table 2.3: Status of the implementation of the Strategy on International Conventions, laws, regulations and treaties in the deferent 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 |
|---|---|---|---|---|---|---|
| Maldives | Nationwide implementation quite well under waste management regulations (WMR 2013/R-58) as it falls under island island waste management plans. | Marine protected areas. Green fins and some private parties (for localised regions) | Falls under WMR 2013/R-58, but weak implementation | Falls under WMR 2013/R-58, but weak implementation | Falls under WMR 2013/R-58, but weak implementation | Falls under WMR 2013/R-58, but weak implementation |

**Table 2.4** 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 |
|---|---|---|---|---|---|---|
| Maldives | National Waste Management Policy (NWMP) 2015 includes activities to reduce and manage waste in general. Not specific to marine environment | NWMP 2015 includes activities to reduce and manage waste in general. Not specific to marine environment | NWMP 2015 includes activities to reduce and manage waste in general. Not specific to marine environment | NWMP 2015 includes activities to reduce and manage waste in general. Not specific to marine environment | NWMP 2015 includes activities to reduce and manage waste in general. Not specific to marine environment | NWMP 2015 includes activities to reduce and manage waste in general. Not specific to marine environment |

**Table 2.5 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 |
|---|---|---|---|---|---|---|
| Maldives | Falls under NWMP 2015, weak implementation | Falls under NWMP 2015, weak implementation | Falls under NWMP 2015, weak implementation | Currently unavailable | Currently unavailable | Currently unavailable |

**Table 3.7 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 |
|---|---|---|---|---|
| Maldives | No | No | No | No |

**Table 3.8: 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 |
|---|---|---|---|---|---|---|
| Maldives | Weak enforcement | Weak enforcement | Weak enforcement | Weak enforcement | Weak enforcement | Weak enforcement |

**Table 3.9 Status of research in SAS region**

| Country | 3Rs & Land base generation | Ecological Impacts | Social Impacts | Economic Impacts | Ocean circulation | Compartments of the marine environment |
|---|---|---|---|---|---|---|
| **Maldives** | Household level in Male' (2008), Resort level-tourism sector (2010). Waste audits in few individual islands | No comprehensive studies | No comprehensive studies | No comprehensive studies | No comprehensive studies | No comprehensive studies |

**Table 3.10: 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 massages | Identification of education media |
|---|---|---|---|---|---|
| **Maldives** | Available.<br>"Saafu Raajje" (clean Maldives) National campaign | Identified.<br>Eliminate public littering by developing willingness of the individuals to act in reducing or eliminating public littering | Identified.<br>Schools,<br>Colleges<br>General public<br>Expatriates<br>Food distributors and Service providers<br>Retail Shops<br>Metals, wood works and Automobile shops | Reduce and eliminate public littering | Identified |

**Table 3.11 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 |
|---|---|---|---|---|---|---|
| **Maldives** | None | Yes | None | None | None | None |

**Table 3.12 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 |
|---|---|---|---|---|---|---|---|
| Maldives | No | Yes | Yes | Yes | Yes | Yes | Yes |