Circularity Assessment Protocol
Maldives

University of Georgia

Circularity Informatics Lab

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Acknowledgments

Fieldwork for the Circularity Assessment Protocol was conducted by local implementation partner Maldives National University, with team lead Dr. Shazla Mohamed. Parley Maldives also provided local expertise to this research, with team lead Shaahina Ali. Work in the Maldives was convened and led by eXXpedition C.I.C., with funding from the UK government's International Development as part of the Defra Ocean Country Partnership Programme.

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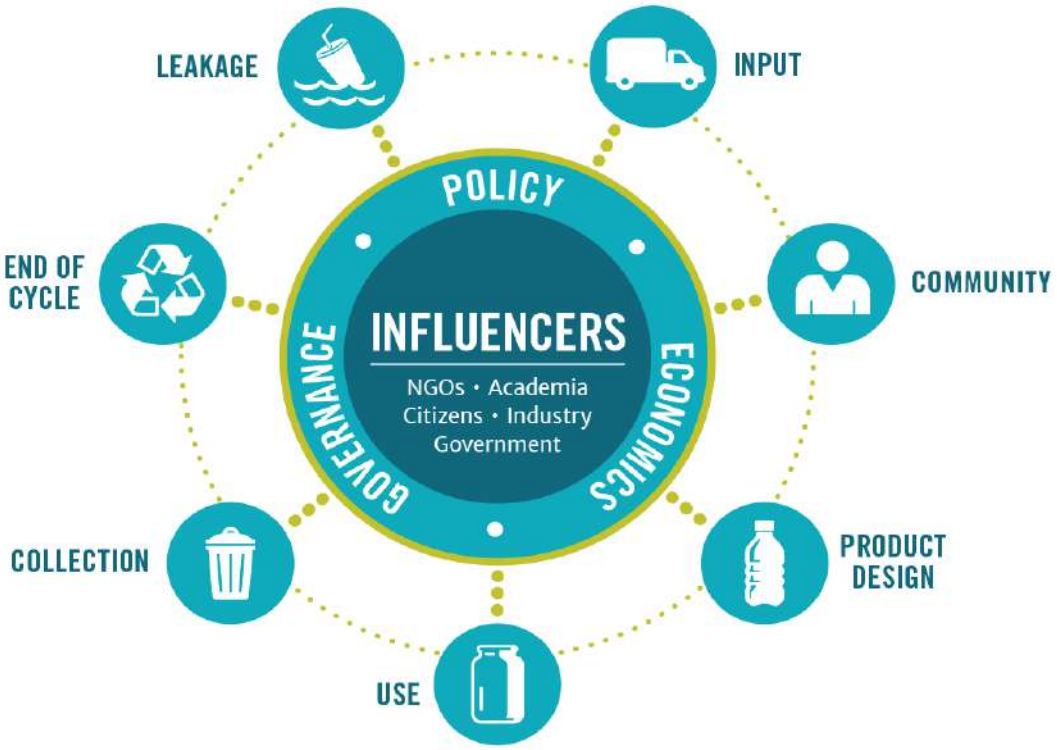
Executive Summary

The Maldives is an island nation that consists of nearly 1,200 small coral islands lying in the Indian Ocean. Malé serves as the political, economic, and administrative hub of the country. The unique geography of the Maldives, coupled with intense tourism, makes the country particularly susceptible to challenges with plastic pollution and the management of other waste materials. Small island communities like Maldives contribute a small fraction to global plastic waste generation but suffer the impacts the most. Yet small island communities and governments are leading in finding adaptable, innovative solutions. Notably, the Maldives recently enacted a single-use plastics phase-out plan to target single-use plastic (SUP) products commonly found in litter and marine environment, which are believed to have existing affordable alternatives available on the market.

Maldives SHiFT is a holistic program to help tackle plastic pollution in Maldives, led by eXXpedition CIC, in partnership with the Republic of Maldives' Ministry of Environment, Climate Change and Technology (MoECCT), the UK's Centre for Environment, Fisheries and Aquaculture Science (Cefas), Maldives National University, Parley Maldives, The Commonwealth, Fauna & Flora and with funding from the UK Government's International Development as part of the Defra Ocean Country Partnership Programme. The Maldives SHiFT program began in April 2023 and consisted of three parts: a Virtual Leadership Programme, a Circularity Assessment, and an action-focused Stakeholder Meeting.



Decision-makers at local, national, and international levels need data to take an informed holistic approach to identify successful research-driven solutions in policy, infrastructure, and industry innovation. Developed by the Circularity Informatics Lab at the University of Georgia, the Circularity Assessment

Protocol (CAP) is a standardized assessment protocol to inform decision-makers by collecting community-level data on plastic usage and alternative materials. Grounded in materials flow and systems thinking concepts, the CAP uses a hub-and-spoke model to holistically characterize how consumer plastic flows into a community, is consumed, and flows out, either through waste management systems or leakage into the environment. The model, shown above, is comprised of seven spokes: input, community, material and product design, use, collection, end of cycle, and leakage. At the center, the system is driven by policy, economics, and governance with key influencers including non-governmental organizations, industry, and government. Fieldwork for the CAP was conducted in the Maldives in the Greater Malé area, including Malé, Villingili, and Hulhumalé during July and August 2023.

The intent is for the data in this report to inform ongoing stakeholder engagement around solutions to strengthen the circular economy and waste management in the Maldives, as well as to provide a baseline for future assessment to monitor changes with the implementation of policy.

The recent SUP phase-out plan makes this a particularly interesting time to study plastic this system in the Maldives. The SUP phase-out plan prohibits SUP to-go food ware including plastic drinking straws; Styrofoam lunch boxes; single-use plastic plates, cups, cutlery, and stirrers; and plastic cups below 250ml. In 27 restaurants surveyed as part of the CAP, the impact of the SUP phase-out plan was evident. Most businesses have switched from SUP to-go food ware to other single-use products made of materials like wood, bamboo, paper, or aluminum. Some reusable options were present for in-restaurant dining, but generally, reusable alternatives were limited and reuse systems could be added as part of the expansion of the SUP phase-out plan. Unlike single-use, reuse systems would reduce not just plastic usage but overall waste generation, especially important if future iterations of the SUP phase-out plan include new products. Stakeholder interviews indicate that there is a need for better access and more support for businesses to source suitable alternatives to banned items in the SUP phase-out plan, as well as for additional education and outreach to increase community awareness of the purpose of the policy.

In store surveys of 120 brands of fast-moving consumer goods, 95% of the products entering the Maldives are imported. This is both a challenge and an opportunity, in terms of control of plastics and packaging. International companies are profiting from selling products in the Maldives without contributing to the management of the associated waste. Extended producer responsibility (EPR) is an opportunity to share the costs of waste management with producers and is especially salient in the context of current international negotiations around plastic pollution, namely the United Nations Environment Programme (UNEP) Intergovernmental Negotiating Committee (INC) on an international legally binding instrument on plastic pollution. Negotiations present an opportunity to advocate for EPR in small island nations with limited leverage.

One of the few products produced locally is bottled water – PET bottles are imported and filled in the Maldives. Stakeholders in the interviewees mentioned concerns about the perceived safety and taste of tap water. In-home water filtration as well as reusable glass bottles leveraging existing filling infrastructure could deliver drinking water to residents with less plastic waste generation.

Recycling systems are limited in the Maldives, due to the logistical and economic challenges presented by the geography of the scattered islands and the limited quantity of recyclables generated. In 27

randomized litter transects conducted in the greater Malé area, plastic bottles and aluminum cans, both of which are highly recyclable, were in the top 10 most prevalent litter items by count identified in the surveys. While expanding recycling efficiency may decrease the presence of these items in the litter, the operational obstacles of collection and the cost of international shipping for processing are significant obstacles to recycling in the Maldives. Achieving an economy of scale to lower costs is difficult with limited waste generation coupled with limited storage space available in the Maldives.

Initial results identified by the CAP were presented in an action-focused stakeholder meeting in October 2023. Seventy-five participants from NGOs, government, industry, academia, and international experts were invited to discuss and express their opinions on the findings, additional data, and opportunities to tackle plastic pollution. Participants in the workshop identified the following solutions as most important and most likely in the Maldives: expand access to in-home water filters and water refill stations; develop more support for businesses to identify SUP-free alternatives available for import; expand the Single-Use Plastic Phase Out Plan to include more items to be banned for import; establish reuse systems with vendors (such as glass bottles being returned to producers); and increase education and awareness campaigns. Despite the significant challenges in the Maldivian context, stakeholders are engaged in and enthusiastic about finding new ways to reduce plastic pollution and protect their local environment.

Table of Contents

Introduction

The Maldives is an island nation that consists of nearly 1,200 small coral islands. The islands stretch over 800 km from north to south, covering an area of over 90,000 km. The capital Male', the focus of this study, is located about 650 km southwest of Sri Lanka and is the most populous area, home to 41% of the country's population of approximately 500,000 people.[1] Male' serves as the political, economic, and administrative hub of the country.

Lying in the Indian Ocean, the Maldives is surrounded by a wealth of marine resources that play a significant role in the economy. The economy of the Maldives has grown at a rapid pace for the last 50 years, largely driven by an increase in tourism. Currently, the Maldives sees about 1.5 million tourists visiting the islands each year, nearly three times the resident population. Fishing and boat building are other important economic sectors.[2] Due to the low elevation and geographic makeup of the islands, the Maldives is particularly vulnerable to the effects of climate change, such as rising sea levels and increased susceptibility to storm surges.

The unique geography of the Maldives, coupled with intense tourism, makes the country particularly susceptible to challenges with plastic pollution and the management of other waste materials. The Maldives have recently adopted a policy to target these issues.

As part of the Strategic Action Plan 2019-2023[3], the Maldives government established four policy goals within the "Waste as a Resource" section. Each policy has associated targets, strategies, and actions, mandated to be implemented by the Ministry of Environment, Climate Change and Technology (MoECCT). Policies and targets under "Waste as a Resource" are summarized here:

- Policy 1: Promote waste as a valuable resource for income generation.
    - Target 1.1: By 2023, at least 30% of Island Waste Management Centers (IWMCs) utilize solar energy for operation.
    - Target 1.2: By 2023, open burning of waste is minimized by 50% in all inhabited islands.
    - Target 1.3: By 2023, three Regional Waste Management and Treatment Facilities (RWMFs) is developed across the Maldives in line with the National Spatial Plan.
    - Target 1.4: By 2023, a National Recycling Strategy is developed and implemented for plastics, metals, glass and other recyclables.
- Policy 2: Improve chemical and hazardous waste management practices to ensure protection of people and the environment.
    - Target 2.1: By 2021, guidelines on the handling, storage, and transport of non-medical waste and chemicals is enforced in inhabited islands.
    - Target 2.2: By 2023, a legislative framework on the sound management and safe disposal of chemicals is enforced.

[1] Maldives Bureau of Statistics. "2022 Maldives Population and Housing Census." *Ministry of National Planning, Housing & Infrastructure*. https://census.gov.mv/2022/wp-content/uploads/2023/04/Provisional-Result-Publication-amnded-2423.pdf
[2] Britannica, The Editors of Encyclopedia. "Maldives". *Encyclopedia Britannica*, 10 Dec. 2023, https://www.britannica.com/place/Maldives. Accessed 10 December 2023.
[3] Government of the Maldives. "Strategic Action Plan 2019 – 2023." https://presidency.gov.mv/SAP/

- Policy 3: Reduce plastics pollution by phasing out single use plastics.
    - Target 3.1: By 2023, phase out of importation, production and use of single use plastics in the country is enforced.
- Policy 4: Instill environmental values in the society and promote environmentally friendly lifestyle.
    - Target 4.1: By 2023, at least 65% of students recognize the importance of reduce, reuse and recycle waste.
    - Target 4.2: By 2022, a system exists for consumers to refurbish and donate or sell the end-of-life products.

The Maldivian government subsequently announced a single-use plastic (SUP) phase-out plan for 2020 – 2023. The single-use plastic phase-out plan includes banning selected SUPs, implementing Market-Based Instruments, strengthening data collection, introducing Extended Producer Responsibility (EPR), provisioning sustainable alternatives, and conducting education and awareness activities.

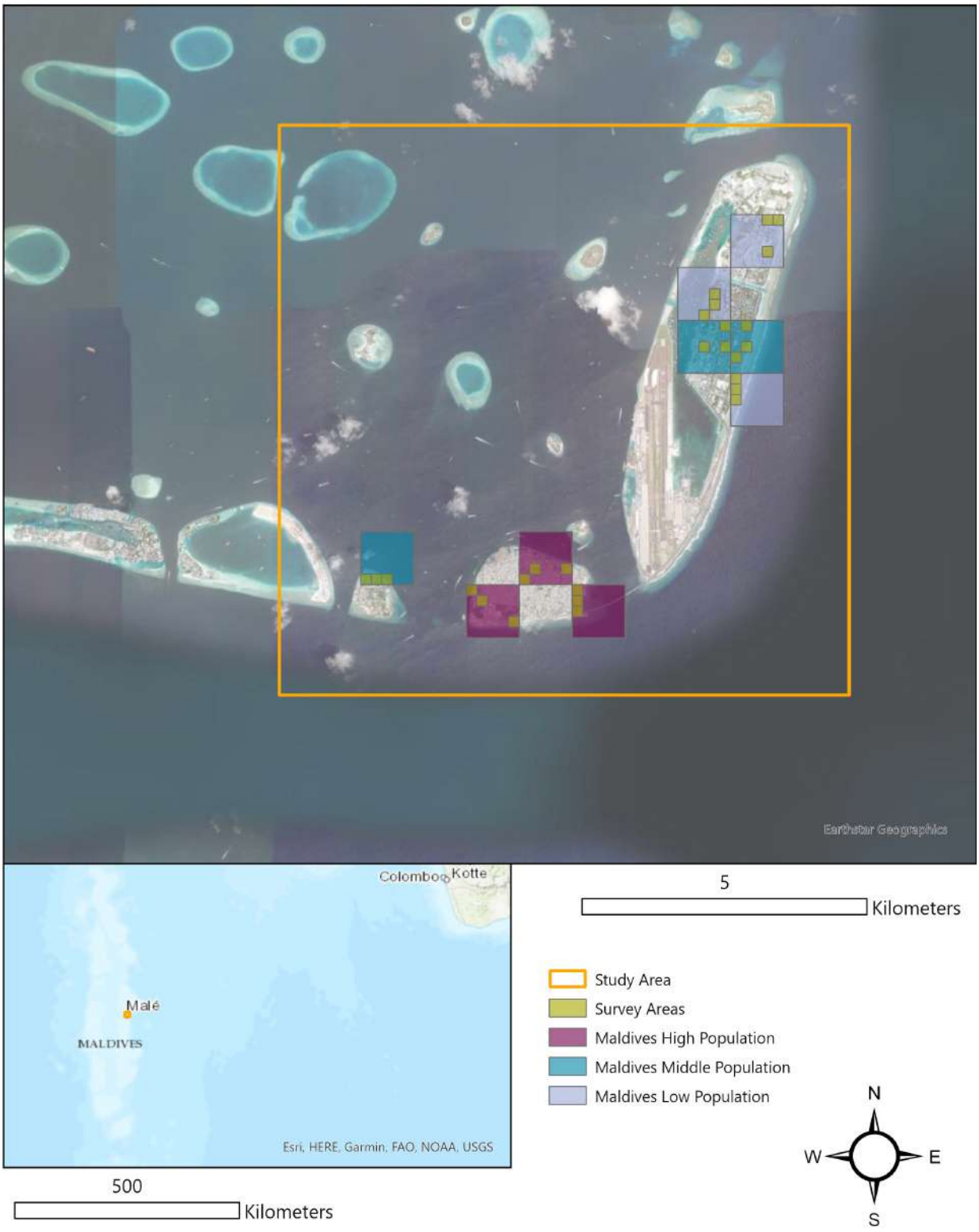
The first part of this policy specifically prohibits the import, production, and sale of 12 SUP products commonly found in litter and marine environment, and which are believed to have existing affordable alternatives available on the market. These products are:

- Bottles:
    - Polyethylene terephthalate (PET) bottles 1L and below (includes PET bottles below 500ml)
    - Shampoo and soap bottles in plastic packaging below 200ml
- To-go items:
    - Plastic drinking straws
    - Styrofoam lunch box
    - Single-use plastic plates, cups, cutlery and stirrers
    - Single-use plastic cups below 250ml
- Shopping bags:
    - Plastic shopping bags below 30cm x 30cm
    - Plastic shopping bags below 50-micron thickness
- Other items:
    - Cotton buds with plastic stems
    - Imported sweet areca nuts in plastic wrapping.[4]

The rollout of the SUP phase-out plan, completed in 2023, makes this an especially interesting time to study plastic packaging and pollution in the Maldives. Some of the proposed alternatives to SUP may reduce plastic waste but may not reduce overall waste generation if another single-use product is used. This 10 x 10 km study will focus on the Greater Malé area, including Malé, Villingili, and Hulhumalé (Figure 1). (See Samling Strategy for details.)

[4] Nashfa, Hawaa. Single-use Plastic Phase-Out Plan 2020 – 2023. *Ministry of Environment*. https://www.environment.gov.mv/v2/wp-content/files/publications/20210425-pub-single-use-plastic-phase-out-plan.pdf

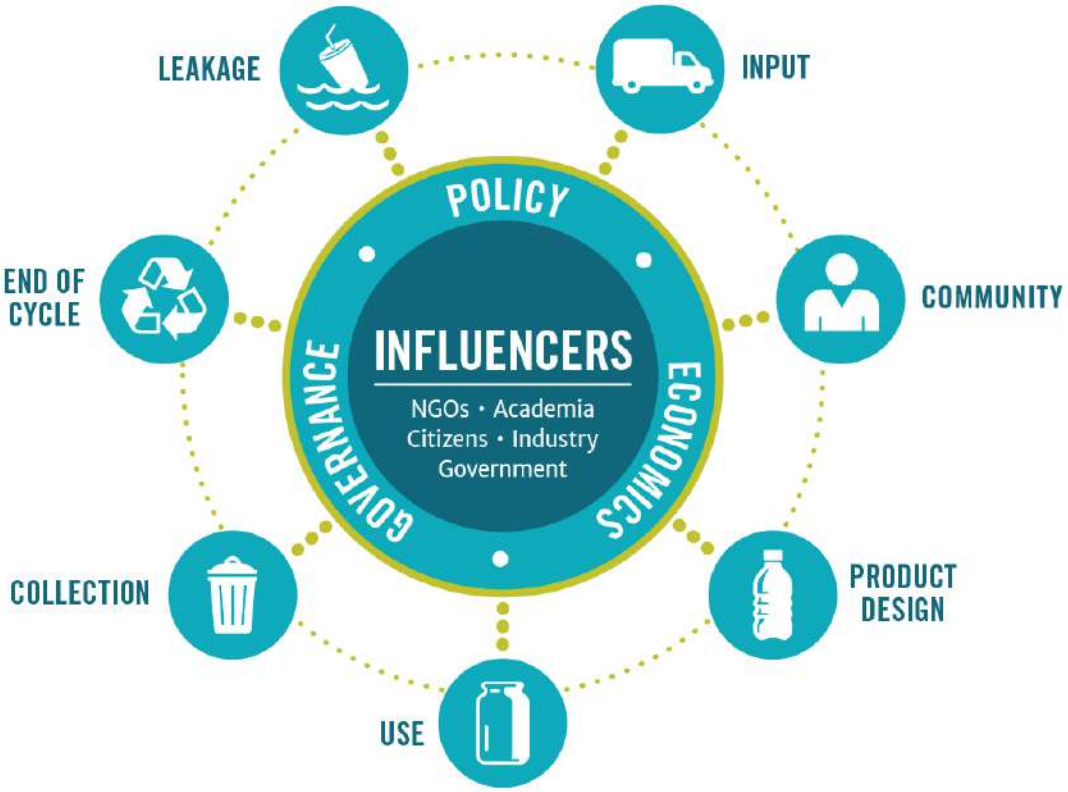
Figure 1: Overview map of the study area in the Maldives.



The Circularity Informatics Lab (CIL) at the University of Georgia (UGA) developed the Circularity Assessment Protocol (CAP) in 2018, which is a standardized assessment protocol used to collect community-level data to inform decision-makers on plastic usage and alternative materials (Figure 2). The CAP characterizes seven community components:

1. **Inputs** – What products are sold in the community and where do they originate?
2. **Community** - What conversations are happening and what are the stakeholders' attitudes and perceptions?
3. **Product design** - What materials, formats, and innovations are found in products, particularly packaging?
4. **Use** – What are the community trends around the use and reuse of product types?
5. **Collection** – How much and what types of waste are generated? How much is collected and what infrastructure exists?
6. **End-of-cycle** – How is waste disposed? What is the fate of waste once it is properly discarded? How is it treated?
7. **Leakage** - What waste ends up in the environment? How and why is it getting there?

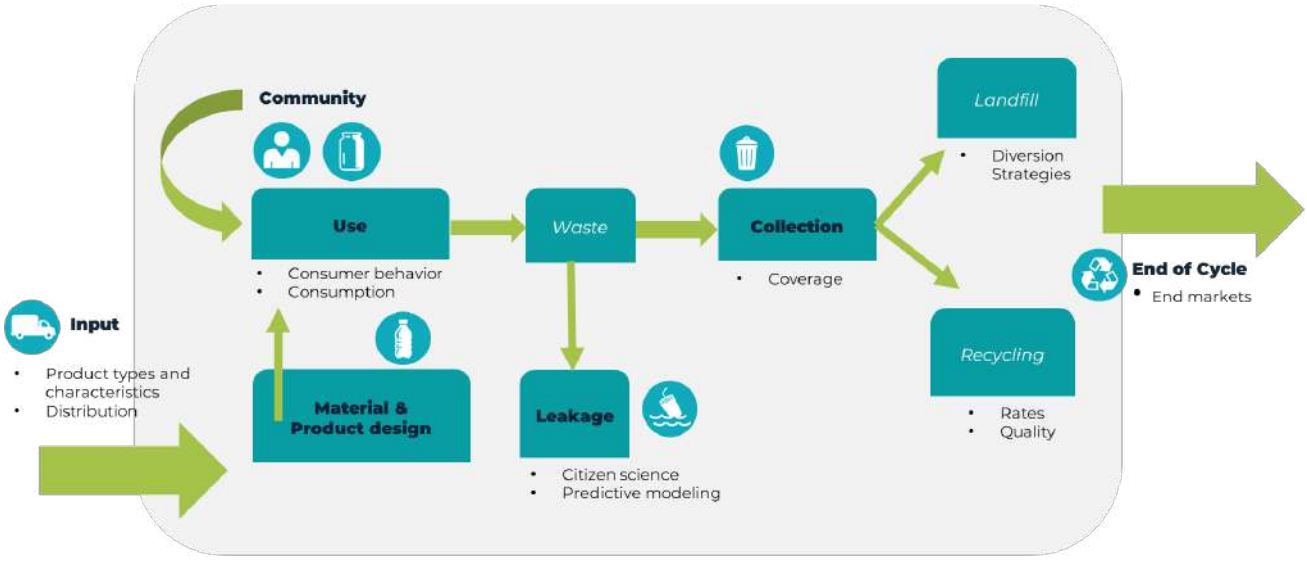
Figure 2: Circularity Assessment Protocol (CAP) hub-and-spoke model.



The CAP is grounded in materials flow and systems thinking concepts and can also be conceptualized as a material flow model (Figure 3). Data collected as part of the CAP demonstrates how consumer plastic flows

into a community, is consumed, and flows out, either through waste management systems or leakage into the environment. Other waste types are included to contextualize plastic in the system. Ter

Figure 3: Material flow depiction of CAP spokes.



Field work was conducted on the islands of Malé, Villingili, and Hulhumalé during July and August 2023. Fieldwork was conducted by local implementation partner Maldives National University, with team lead Dr. Shazla Mohamed. Parley Maldives also provided local expertise to this research, with team lead Shaahina Ali. Work in the Maldives was convened and led by eXXpedition C.I.C with funding from the UK government's International Development as part of the Defra Ocean Country Partnership Programme. The CAP report is split into the following sections, which include results and discussion of each: Input, Community, Product Design, Use, Collection, End of Cycle, and Leakage, followed by Opportunities. The intent is for the data in this report to inform ongoing stakeholder engagement around solutions to strengthen the circular economy and waste management in the Maldives, as well as to provide a baseline for future assessment to monitor changes with the implementation of policy.

Maldives SHiFT Stakeholder Meeting

An action-focused Maldives SHiFT Stakeholder Meeting took place on 23rd October 2023 in Malé, with 75 participants from NGOs, government, industry, academia and international experts. Special guests Caron Röhsler, British High Commissioner to Maldives, H.E. Aminath Shauna, Minister of Environment, Climate Change and Technology, Republic of Maldives and Dr Farah Faizal, High Commissioner of Maldives to the UK, gave speeches.

The results of the Circularity Assessment Protocol were presented by the Maldives National University and the University of Georgia. Meeting participants were invited to discuss and express their opinions on the circularity assessment findings, any key points it missed and where they think the greatest opportunities to tackle plastic pollution lie.

This was followed by a discussion led by Maldivian stakeholders and international experts presenting the opportunities and challenges of seven plastic pollution solutions, that were highlighted by the CAP data, to tackle the plastic problem at all points of the chain:

- End of Cycle: Investing in Waste-to-Energy
- Collection: Recycling - a Maldives perspective
- Material and Product Design: Alternatives to Single Use Plastic
- Material and Product Design: Bioplastics, biodegradable materials and commercial composting
- Community and Use: Engagement on Plastic Pollution
- Input: Global Plastics Treaty for People and Planet
- Leakage: Long term marine litter monitoring and assessment

This was followed by the collaborative creation of action plans to focus on the key opportunities identified by the stakeholders present. Seven groups of participants worked together on action planning canvases to focus on one solution each to address challenges and form next steps to implement the solution (Table 1).

Discussion points and feedback from local stakeholders at the Stakeholder Meeting have been incorporated into the CAP process to ensure the findings and proposed opportunities are specific to unique local challenges in Maldives. Hurdles were highlighted, additional solutions identified and priorities in next steps were heard and recorded. Overall the Stakeholder Meeting provided an excellent and unique chance for stakeholders from different sectors to share knowledge and connect with one another.

Table 1: Solutions identified in different focus areas.

Number	Solution Identified	Focus Area
1	Waste segregation at source, through colour coded bins/bags, to increase the collection of recyclables and avoid contamination	Collection / End of Cycle
2	Recycling infrastructure - segregation, transport logistics, waste storage space and equipment	Collection
3	Water filtration systems on fishing vessels and an awareness campaign in the marine community	Use
4	National awareness campaign to ignite pride, share strategy and promote successful waste management models	Community
5	A programme in schools to reconnect children with nature	Community
6	Enforcing the Global Plastic Treaty through businesses to reduce plastic imports	Input
7	National Monitoring Programme for plastic pollution through citizen science	Leakage

Despite the significant challenges in the Maldivian context, stakeholders are engaged in and enthusiastic about finding new ways to reduce plastic pollution and protect their local environment.

Maldives SHiFT Stakeholder Follow-Up Findings

Following the Stakeholder Meeting, participants were asked to choose the three most important and most likely solutions to lead to success in tackling plastic pollution in Maldives from a list of fourteen options. The top five responses were:

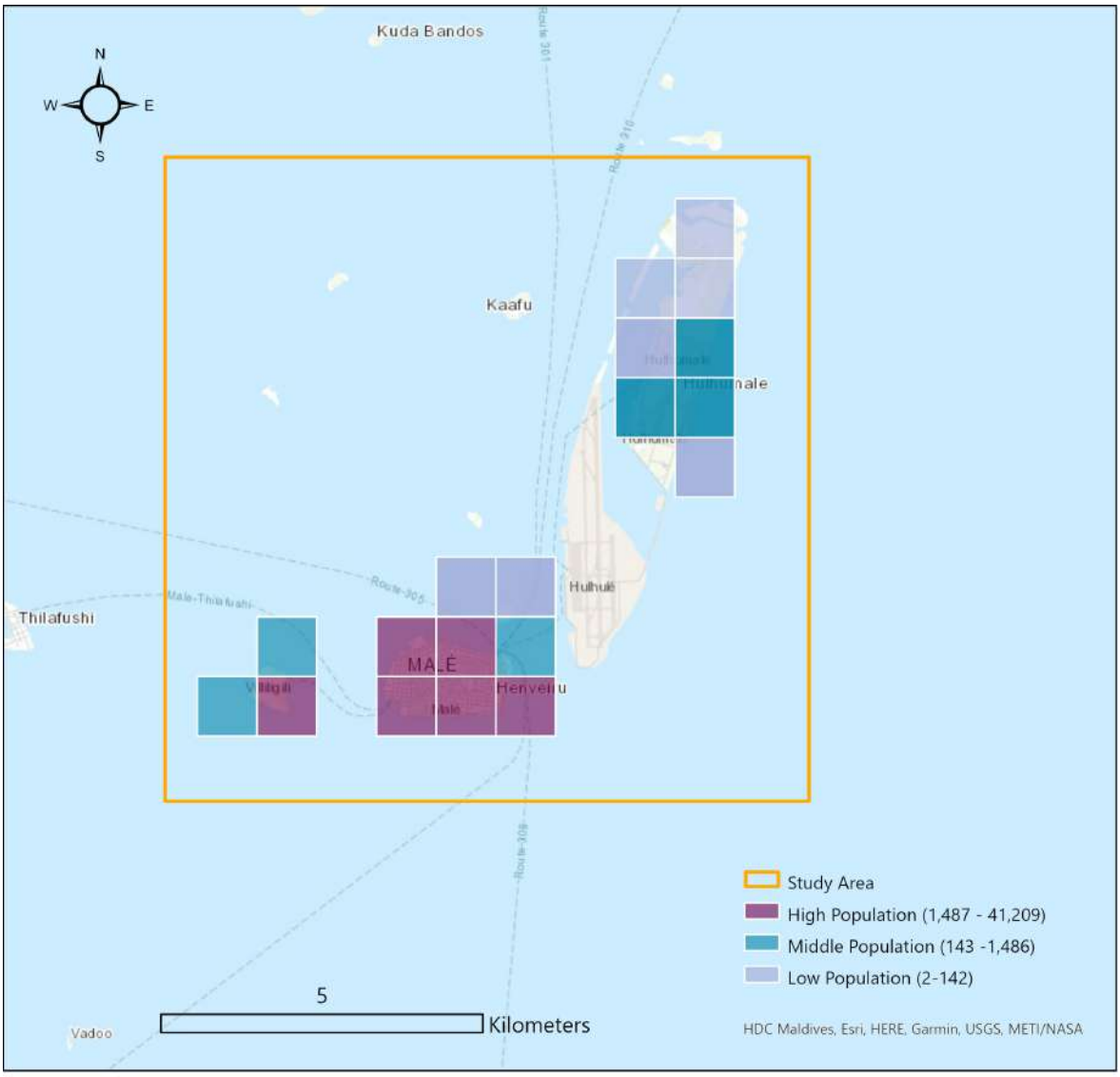
1. Expand access to in-home water filters and water refill stations
2. Increase education and awareness campaigns
3. More support for businesses to identify SUP-free alternatives available for import
4. Expand the Single-Use Plastic Phase-Out Plan to include more items to be banned for import
5. Establishing reuse systems with vendors (such as glass bottles being returned to producers)

Participants rated the Stakeholder Meeting overall 4.3 / 5 with many wanting to collaborate further in the future. A full summary of the stakeholder meeting is available in the appendix.

Sampling Strategy

To randomly sample various locations in a city, the CAP typically identifies a 10 x 10km area over a community (with the center of the city in the center of the area). Within this area, the ambient population based on a dataset called LandScan[5] is sectioned into tertiles (three groups) (Figure 4). Ambient population count can be described as "where people go" and "societal activity" — it is not the population density of where people live. These three areas typically form samples of different land uses, etc. In this case, the 10x10 km area was generated to intersect with Malé, Villingili, and Hulhumalé. Some areas (such as those over the airport) were eliminated based on input from local partners due to inaccessibility before stratified site selection. LandScan data is assigned to grid squares approximately 1 x 1 km in area.

Figure 4: Population tertiles and survey sites in the Maldives.



[5] https://landscan.ornl.gov/

Three 1 x 1 km areas for surveying were randomly selected within each population tertile using NOAA's Sampling Design Tool, resulting in a total of nine 1km2 areas for surveying. In total, 9 sites were surveyed, three each in the low, mid, and high population count tertile.

After selection, a fishnet grid with 5 rows and 5 columns was created over each selected site. The NOAA Sampling Design Tool was again utilized to randomly select three survey areas from each site for litter transects. Each transect survey area is approximately 200 m x 200 m in size.

Results

Input

To get a snapshot of the characterization, scope, and source of common plastic packaged items that are entering the Maldives, samples of fast-moving consumer goods (FMCG) in six popular categories were taken within the nine 1 km^2 transects within Malé, Villingili, and Hulhumalé. Categories surveyed included: beverages, biscuits, candy, chips, tobacco products, and water. (Note that beverages, chips, and candy are surveyed in all CAP sites; the inclusion of biscuits and the segregation of water brands were added based on recommendations from local partners to capture products of importance in the Maldives.) The team selected three convenience or grocery shops to sample within each 1km^2 transect area, where shops were present and open at the time of surveying. In total, 27 stores were surveyed and 120 unique brands of convenience products were recorded, including 25 beverages, 31 biscuits, 32 candies, 20 chips, 8 tobacco products, and 4 waters (Figure 5). Samples of identical brands were not recorded multiple times, even when present in multiple stores.

Top brands of each category, based on a visual assessment of shelf space in a store, conversations with shopkeepers, and repeated occurrence across stores, included the following:

- **Beverages**: Coca-Cola, 100 Plus, Lacnor, Fanta, Dutch Lady
- **Biscuits**: CBL Munchee, Oreo, Chipsmore, Julies, Nutro
- **Candy**: Snickers, Mentos, Kit Kat, Mars, Twix
- **Chips**: Mister Potato, Chuba, Maitos, Jacker, Oriental, Pringles
- **Tobacco Products**: Camel, Marlboro, Good Company, LD, Amber Lead + OCB
- **Water**: Taza, Life, Bonaqua

Figure 5: Examples of typical convenience store packaging for popular brands in the Maldives.

For each of the top products documented, the team noted the type of packaging (including polymer, if possible), the brand, and the parent company. From there, the team was able to determine the

manufacturing location based on manufacturing locations listed on product packaging or desktop research, as well as the headquarters location for the parent company of the brand, largely determined by desktop research. In some cases, for products manufactured for a specific local distributor, the distributor's information from the packaging was listed in place of the parent company. Manufacturer and parent company distances (Table 2) are intended to estimate the distance in kilometers between the city and the origin of each product.

Table 2: Distances between the Maldives and manufacturer and parent company locations for top FMCG convenience items

	Length Store to Parent Company (km)			Length Store to Manufacturer (km)		
	Minimum	*Maximum*	*Average*	*Minimum*	*Maximum*	*Average*
Beverages	0	19,000	7,653	33	13,883	4,221
Biscuits	0	19,086	4,254	819	9,943	3,386
Candy	3,114	19,086	10,056	2,135	13,671	6,344
Chips	829	19,086	7,691	829	9,169	3,621
Tobacco Products	2,801	17,013	12,141	2,801	17,013	9,136
Water	1	19,000	7,845	0	33	13

**Note: Distances were projected using an Azimuthal Equidistant projection, which can distort lengths at further distances. Manufacturer and parent company locations were approximated based on central coordinates for their city of residence. Values have been rounded to the nearest kilometer.*

As is to be expected in an island context, most convenience products coming into the Maldives are imported, with most convenience products traveling between 3,000 and 9,000 kilometers to reach the Maldives, except bottled water which is often locally produced. Beverages, biscuits, candy, and chips tend to have slightly lower distances from the Maldives to manufacturers compared to tobacco products, driven by the regional manufacture of these products in South and Southeast Asia.

95% of products were manufactured internationally, with only 6 out of the 120 brands identified as having local manufacturing. These products were all beverages that were bottled locally with imported bottles, although 5 out of the 6 have international parent companies. The most common countries of manufacturers for FMCG found in the Maldives include Malaysia (27 brands), India (15 brands), Indonesia (13 brands), Sri Lanka (9 brands), and Turkey (8 brands) (Figure 6).

Many of these brands, while manufactured regionally, were owned by large multinational parent companies (Figure 7). The U.S. was the most represented parent country in the sample at 24 brands, meaning 20% of the brands identified have parent companies headquartered in the U.S. This was followed

by Malaysia (12 brands), Indonesia (11 brands), India (8 brands), and Singapore, Sri Lanka, Switzerland, and Turkey with 6 brands each. International companies are profiting from the production and sale of FMCGs in the Maldives but are not involved in managing the waste generated.

Figure 6: World Map displaying manufacturing locations for top convenience items in the Maldives.

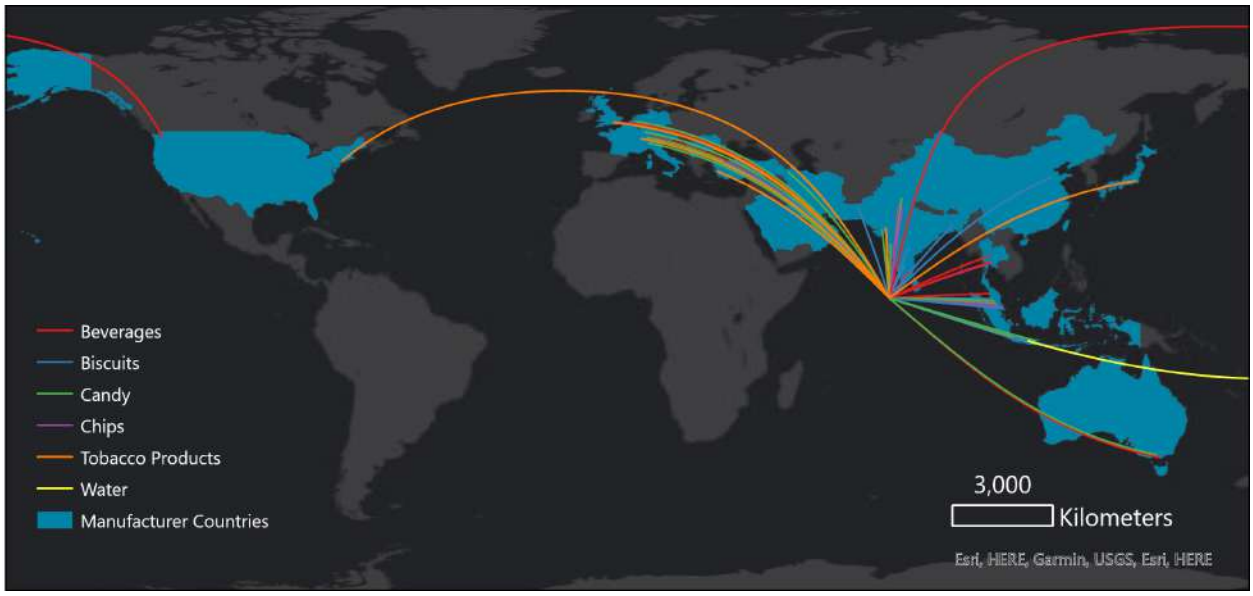
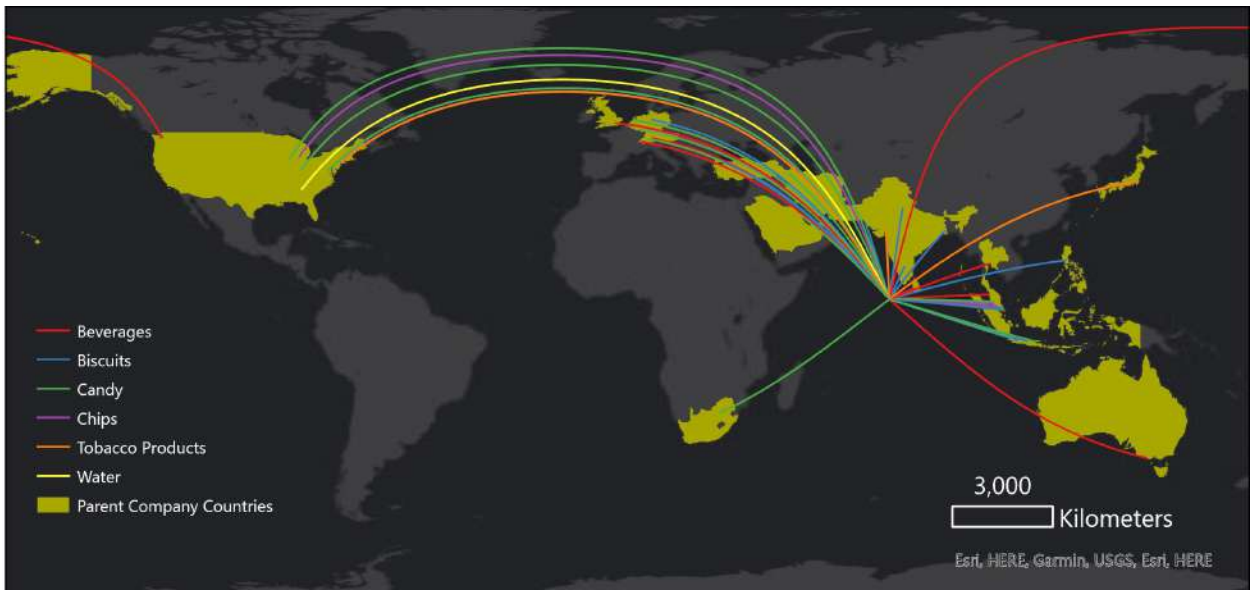


Figure 7: World Map displaying parent company locations for top convenience items in the Maldives.



Extended producer responsibility (EPR) is an opportunity to share the costs of waste management with producers and is especially salient in the context of current international negotiations around plastic pollution, namely the United Nations Environment Programme (UNEP) Intergovernmental Negotiating Committee (INC) on an international legally binding instrument on plastic pollution which presents an opportunity to advocate for EPR in small island nations with limited leverage.

Participants in the stakeholder workshop suggested that given the significant challenges associated with recycling in the Maldives, more emphasis should be placed on reducing plastic packaging importation. Aligning with other small island developing states (SIDS) was also suggested as an opportunity to have a stronger voice to put pressure on companies to change their packaging practices. For example, glass bottle refilling did previously exist and could be pursued in the future. High transport costs associated with recycling could also be overcome through additional funding, such as EPR schemes. Some small-scale examples of companies working with resorts already exist and could be expanded as an initial step. Life cycle assessments (LCAs) for certain products such as phones and electronics were suggested to validate costs associated with managing waste from these products.

Community

To understand current attitudes and perceptions of plastic waste, semi-structured interviews were conducted with 19 key stakeholders. Among those interviewed, 4 were government officials, 3 were from academia, and 8 were from non-profit organizations (Table 3). Example questions from the interview guide are included in the Appendix.

Table 3: Summary of Stakeholder Interview List

Stakeholder Group	Number of Interviews
Stores	1
Hotel Staff	2
Waste Management	1
Nonprofit Organizations	8
Academia	3
Government Officials	4

According to interviewees, reliance on plastic is especially high in the context of the Maldives. Still, there is also a recognition that plastic is impacting the environment and presenting challenges to waste management.

> **"People are very dependent on plastic, reliance on plastic is high and hence very difficult to think of reducing."**
>
> – Nonprofit organization

> **"I think plastic is just too easy and too cheap and we are too used to having to being provided everything and we don't really think it is important enough to address it."**
>
> – Nonprofit organization

> **"Plastic has always been a problem but the problem is that we can never avoid it. Plastic is widely used and accepted because of its nature and it would be a lie to say it is useless but it definitely is a big problem. Plastic is one of the most used materials which makes it easier to make products and make it more durable. Unfortunately, We are unable to minimize this because of this reasons. However, I believe that plastic should be reduced because it is affecting a lot of people and it is hard to manage."**
>
> – Store

One of the major constraints to the reduction of plastic usage is the waste generated from importation. Because of the island context of the Maldives, most products are imported, and the reliance on imported goods that come with plastic packaging was a recurring theme in several stakeholder interviews. The challenge of managing this influx of packaging was mentioned by several interviewees, especially given the limited recycling occurring currently.

> **"… everything we see here is coming from outside and not what we produce."**
>
> – Nonprofit organization

> **"I think we do package a lot but we also have constraints when it comes to a country which survives completely on imported goods. So packaging really is important and this packaging means we would also have a lot of waste…"**
>
> – Academic

> **"Plastic pollution has been highlighted due to high dependency of plastics by the community. There are no proper mechanisms to manage the waste and so they persist in the environment and damages the place."**
>
> – Government Official

> **"For different reasons, there is a high reliance on plastics in the Maldives including single-use plastics and recyclables as well. There is also a lack of collection and recycling."**
>
> – Nonprofit organization

Water is one of the few FMCGs manufactured in Male', although it is most often packaged in imported plastic bottles (see Input). However, several interviewees reported their perception that the community must rely on these plastic water bottles for drinking water due to concerns with the taste of tap water, though others also raised concerns about the safety of water consumption from plastic bottles. A 2019 survey of 384 greater Male' residents showed that only 30% of residents trusted tap water as a drinking water source, while 86% trusted bottled water.[6] A more recent study asked 1,095 survey respondents about their habits concerning SUPs, and 65.8% of participants reported that they drink bottled water.[7] In

[6] Latheef, Ahmed Aimon "Understanding bottled water consumption: a survey on public perception of drinking water." *The Maldives National Journal of Research*. Vol 7, No. 1, Dec 2019 pp 43 – 65.
[7] Aishath Naila, Raheema Abdul Raheem, Rifaath Hassan, Abdullah Nazeer, and Mariyam Samha. "Single use plastic usage in the Maldives: Knowledge, practice and attitude." Preprint. https://www.researchsquare.com/article/rs-2138273/v1

the US, perceptions of safety around water have been shown to drive bottled water consumption.[8] Outreach from the waste treatment authority on safety practices could raise awareness and increase trust.

This issue of tap water filtration may also be salient on islands outside of the Male' region which are newly developing water systems. Infrastructure, like filtered in-home filters that can remove residual chlorine taste after treatment and refilling stations or local reuse of alternative materials like glass by the existing local bottlers, may be an opportunity to avoid SUP and associated waste generation. While installing in-home filters may have an upfront cost, investment in infrastructure can be more affordable than bottled water in the long run. Filters may produce waste themselves and therefore efficiency should be considered in the selection process, but filters will produce less than bottled water in terms of waste generated for the volume of drinking water.

> **"We did a survey in Hulhumale', and in urban areas of Greater Male'. A lot of people use bottled water… only 3% I believe was using tap water directly and some are using filtered water but in the 12 houses we were able to eliminate all the bottled water by offering an alternative of using filtered water. But that also people find expensive so we had an option where they can pay in installments."**
>
> – Nonprofit organization

> **"In my opinion, now everyone is very aware about plastic and people know that it is not good to use plastic bottles. Especially when we drink water from plastic bottles, which are brought from various sources and exposed to sunlight (under high temperatures), which is again chilled and used. So when we consume it, it will surely contain microplastic leached into drinking water. So without knowing, we are consuming microplastic that is entering into our body…"**
>
> – Academic

> **"People are now changing and you can see a lot of young people carrying alternative bags and carrying water bottles but also another issue is that we do not have refilling stations even in public areas, even in a sports field, we don't have a refilling station or a fountain. So when the bottle is finished you need to buy a plastic water bottle to refill it. So there are issues with asking the public to change without infrastructure. I think that's the issues we have."**
>
> – Nonprofit organization

> **"When we were young we used to have beverages in glass bottles. We drank from it and returned the bottle. There was a deposit given back to us and everything changed when plastics came into the market. Plastic was introduced as a packaging material and people started using that in packaging and now we cannot get rid of it or we do not have any way to manage it."**
>
> – Nonprofit organization

[8] Hu Z, Morton LW, Mahler RL. Bottled water: United States consumers and their perceptions of water quality. Int J Environ Res Public Health. 2011 Feb;8(2):565-78. doi: 10.3390/ijerph8020565. Epub 2011 Feb 21. PMID: 21556204; PMCID: PMC3084479.

The environmental context of the Maldives means that the consequences of plastic pollution are evident, and environmental impacts came up as a theme repeatedly throughout the stakeholder interviews. This is especially clear on the less populated islands, which are subjected to plastic pollution washing up in ocean currents.

> **"We still have plastics from 30-40 years ago that are now broken to microplastics and this will go on till we take steps, mostly behavioral changes at government levels, island council levels."**
>
> – Nonprofit organization

> **"That's the reason we have been working on single-use plastic behavior change because it's a huge problem, especially in public spaces. The majority of litter you see will be plastics. And since our islands are very small and the oceans are nearby, a lot of this will eventually end up in the oceans."**
>
> – Nonprofit organization

> **"If you look around the islands and if you go around islands, where people have very less inhibition, like let's say uninhabited islands, you just see plastic hanging around the tree lines of this island, where usually the water line would go during the high tide. It's just the trees that we see that these plastics come and show and they are hanging on the trees. You can imagine the amount of plastic that is there in the near shore waters itself."**
>
> – Academic

In addition to environmental impacts, concerns about human health impacts from microplastic exposure were also mentioned by interviewees. Some interviewees highlighted higher levels of awareness for environmental pollution than for human health concerns around plastics.

> **"We know single-use plastic is also creating the microplastics in our oceans which impacts on human health through the food that we eat. Maldivians like eating fish almost everyday, and we know fishes also ingest these microplastics that transfer to humans. We are very concerned about plastic and impacts on human health and the physical environment."**
>
> – Academic

> **"People know the impact on turtles only - they don't talk about human health."**
>
> – Government Official

> **"Based on the research work we did, people have very high awareness about plastics, impacts of plastics on the environment, like how it can cause damage to the oceans. But we found they have less awareness on the health impacts to themselves from this..."**
>
> – Nonprofit organization

Interviewees had both positive and negative reactions to Maldives' progressive policy to phase out SUPs. The cultural shift to reusable bags seems to be a success highlighted by multiple interviewees.

> **"Some customers especially now don't ask for plastic bags due to the single-use plastic ban."**
>
> – Store

> "**I think the most recent event of these kinds of changes is the ban on single-use plastics and especially the shopping bags… Nowadays people do not really ask for these bags. We do see people actually go to shops with their own bags. The shops do not consider putting everything in a bag as part of their service. They do not think or they do not even ask whether you want a bag, they just hand over the things and it's up to you to carry it whichever way you want. Whether you pay for a plastic bag or whether you carry your own bag. One thing that I have noticed is that most of these shops have actually started their own business of selling reusable bags themselves. So which is I think very positive…"**
>
> – Academic

However, other products included in the ban have fewer viable alternatives, and many interviewees expressed a desire for refill systems to be introduced. Compostable packaging was also mentioned as a preferred alternative, although challenges with sourcing these products were highlighted by other interviewees. Economic concerns about the price of alternatives remain a concern, as does functionality. The switch to paper straws was mentioned as an alternative that does not meet customer expectations. Overall, even with the current policies, the burden of change in terms of finding, paying for, and switching to alternatives seems to rest with the community.

> **"I think people are very positive about it and they want to adapt to using the glass bottles… they are actually selling the glass bottled water almost at the same price range as plastic bottles. So if there is any economic incentive, people are adapting it more rapidly actually if they have to put in an effort by them."**
>
> – Nonprofit organization

> **"[I would like to see] more options for reusable products such as the option to handover the empty bottles of shower gels and shampoos back to the supplier for refilling."**
>
> – Nonprofit organization

> **"Like locally there are a lot of spices and food products that are packaged in plastics. If even that can be replaced through a more compostable, environmentally friendly packaging."**
>
> – Nonprofit organization

> **"We are also trying to introduce more reusable and environmentally friendly products to our customers… We have products ranging from paper straws, paper cups/plates, wooden utensils, wooden cotton buds, reusable containers, and many more. We are trying to bring compostable products too but trying to find quality products is a bit challenging but we are getting there."**
>
> – Store

> **"Not sufficient alternatives are available to switch from plastics and it's usually more expensive. I think providing awareness will enable people to shift but there will be people who won't understand."**
>
> – Government Official

> **"The thing with the alternatives is, it is not as cheap as the plastic."**
>
> – Nonprofit organization

> **"When it comes to any entrepreneur or anybody who wants to start a business, going against plastic you cannot make a profit. You cannot beat the price point of plastics, especially in the Maldives."**
>
> – Nonprofit organization

> **"I think if the alternatives come without enough awareness, it can be frustrating for some of the population… you may have seen in the past couple of years there has been production of paper straws. Internet memes - not just in Maldives but throughout the world; my straw is already dissolving in the drink. But if it's good quality paper straw it wouldn't dissolve… On the other hand, there are some really bad examples as well. There's this milk packet brand.. and they have introduced a paper straw which is a disaster. Plastic is plastic and there are some good aspects of it and we have to understand that but we also have to make sure that the user experience is good enough – I can accept that but not everyone will. So the alternatives need to be up to the mark in terms of providing the same experience for the users. Not everybody will be able to willingly compromise as much but technology can be developed and I believe there is a way forward."**
>
> – Nonprofit organization

Despite some concerns around the availability and quality of alternatives, some interviewees praised the progressive policy around SUPs in the Maldives. Many interviewees mentioned the lack of follow-up for policy implementation such as investment in infrastructure as an obstacle to success. The lack of support for finding alternatives was also highlighted as a challenge, one which is especially salient on the outer islands. Interviewees cautioned that change will happen slowly over time and discussed the need to raise awareness as part of the process leading up to policy implementation. Participants in the stakeholder workshop emphasized that different islands, such as those in the greater Male' area or the outer islands, will need different types of tailored, community-led solutions.

"The recent effort from the Maldivian government to have this phase-out plan for single-use plastic is a good effort from the national level."

– Academic

"Being a small island nation is sometimes good because when the central government imposes something on the population and the message is spread so quickly to the people."

– Academic

"These policies are very important to the business and the community. It is very important to follow up and to check whether these policies are being followed. Some businesses do follow the policies and have made a list just to check how much they have been using the plastic bags."

– Academic

"We have the phase out policy and the regulations are very ad hoc I think. Phase out comes before infrastructure and so I think maintaining a policy is difficult when you don't have the infrastructure and capacity for us actually to do it."

– Nonprofit organization

"There are challenges because the government has enforced a very strict and ambitious plan for phasing-out single-use plastic. At the same time the government did not propose alternatives and left it for consumers to find the alternatives. In outer islands the availability of alternatives is a challenge."

– Academic

"…the majority of the people feel difficulty in accepting it as it is easy. While we go shopping, we need to carry a bag, or instead we give 2 rufiyaa and get a bag from shop… around 30 to 40% of the people are changing slowly."

– Hotel Staff

"…the whole of the policy directions have lacked some awareness components. There needs to be discussion on what is happening rather than just the day that it happens… Everything becomes expensive or disappears from the market and then people start talking about it. Alternatively, this discussion should happen earlier and there should be representatives from policy implementation, organizations, going on mass media and social media to address this situation."

– Nonprofit organization

Participants in the stakeholder workshop shared that some felt there was not much warning before the SUP phase-out plan that started on June 1st, 2022. However, attendees also felt that it was unrealistic to try to achieve perfect awareness before the plan was implemented. Some attendees expressed that the SUP phase-out plan deadline should not be pushed back, but rather that collaborations on awareness raising and providing alternatives should be expanded. The SUP phase-out plan was characterized as

"low-hanging fruit," and attendees expressed the need to focus on systems change to limit plastic imports, expand recycling, and add composting.

Emphasis on the importance of education and awareness was mentioned by many interviewees, with some highlighting the unique opportunities in the context of the Maldives to foster a sense of environmental protection through a love of the ocean. However, others mentioned that in their efforts to raise awareness, they had found human health and cost savings to be more persuasive to the general public than environmental concerns.

> **"Inspire is everything we do in terms of education, awareness, inspiring environmental stewardship. A big part of this is to getting people to spend more time in the ocean because we see a very clear link especially in the context of the Maldives. When we talk about creating empowered zero waste communities for us… inspire is basically understanding the why, in the context of the Maldives. The ocean and protecting the ocean is a big part of the why and if you don't know the ocean, if you don't spend time in the ocean, you don't love the ocean, then it's going to be very difficult for you to do anything to protect the ocean."**
>
> – Nonprofit organization

> **"…we talk about the cost savings of these alternatives or when we talk about the health benefits or the dangers to the health by single used plastics, that is far more effective than an environmental argument, unfortunately."**
>
> – Nonprofit organization

Participants in the stakeholder workshop explored in detail how to improve education and awareness. The solution suggested was to create a standardized, nationwide system in schools to engage children with the environment and integrate it into the curriculum and school syllabus, leading to a community with a passion for nature in future generations. Workshop attendees suggested overcoming the challenges of a lack of involvement from parents and a lack of resources by creating pressure through lobbying groups, involving parents in program design and implementation, conducting teacher training, providing financing through a green tax, and involving local businesses like resorts and hotels.

Product Design

To characterize material types used in common consumer products, samples of common convenience were obtained as described in the Input section. The team sampled stores in each of the nine 1 km^2 sites. 127 samples of unique forms and brands of FMCGs were purchased to obtain packaging weights; these included 26 beverages, 35 biscuits, 42 candies, 20 chips, and 4 waters. The average weight of both the packaging and the product itself was collected for all samples (Table 4).

Table 4: Average weight of products and their plastic packaging for common convenience items.

Product Type	Number of Samples	Average Weight of Plastic Packaging (g)	Average Quantity of Product (g or mL)
Beverages	26	20	364
Biscuits	35	5	119
Candy	42	3	47
Chips	20	12	85
Water	4	28	1,042

In reviewing the ratio of plastic packaging produced compared to the product delivered, chips have the highest packaging-to-product ratio, generating 0.14 g of packaging waste for each gram of product. Candy, beverages, and biscuits had similar ratios of around 0.04 – 0.06 g of packaging waste per gram of product, while water generated only 0.02 grams of packaging per gram of product, likely due to the generally larger size of water bottles available in convenience and grocery stores.

Samples taken in several cities in India showed that the average product weight for candy items was around 3.8g and the average packaging weight was around 0.15g, about 12 times smaller than the products surveyed in the Maldives, similar in size to candy brands surveyed in a CAP in Santiago, Chile. Compared to samples from a U.S. city (Miami, FL), the size of beverages available in the Maldives was about 21% smaller, while chips and candy were comparable in size. Smaller product sizes generally have higher packaging-to-product ratios and may lead to the generation of more packaging weight in summation. More frequent, less individually expensive purchases compared to larger product sizes, are also often associated with a “poverty tax” for these small packets compared to the price per quantity in larger sizes.

Cigarettes were excluded from our purchasing of samples in this case, but they are typically a standard size and CIL has previously found an average of about 10 g of plastic packaging to about 15 g of product.

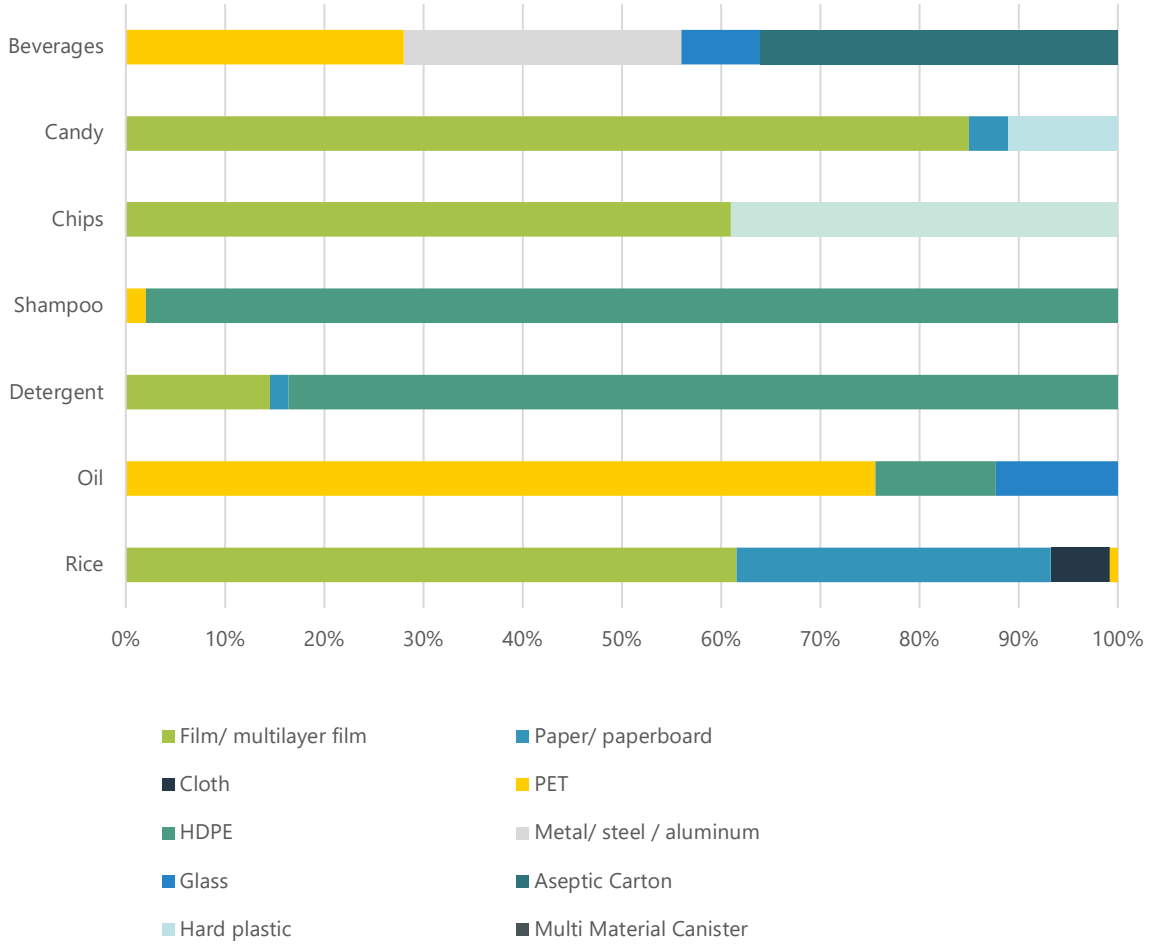
This relatively high plastic packaging-to-product ratio means cigarettes generate larger amounts of plastic waste per unit of product, which is driven by the cellulose acetate filters in cigarette butts that typically weigh about a gram each.

While in stores, in addition to surveying FMCGs packaged in plastic, the team conducted visual surveys of the overall material types available for beverages, candy, and chips (Figure 8). On average, convenience products sold in stores had the following packaging composition:

- Chips were 61% multilayer film or film and 39% multimaterial canister.
- Candy was 85% film or multilayer film, 11% hard plastic, and 4% paper.
- Beverages were 8% glass, 28% aluminum, 28% PET, 36% aseptic cartons.

Material types of a selection of staple goods and home and personal care products – oil, rice, laundry detergent, shampoo – were also assessed visually for estimated percentages of each material type present (Figure 8).

Figure 8: Material breakdown of convenience items and staple products in the Maldives.



Most packaging formats for chips and candy are not recyclable due to their multi-material composition, even if infrastructure was present in the Maldives. These light packaging formats like film and multi-layer film can also easily escape the waste stream. Multi-material canisters (e.g., Pringles) were also common for chips; these packages are a combo of paper, metal, and plastic, and are not recyclable. Aluminum, glass, and PET formats in beverage packaging are technically recyclable, although only small amounts of PET recycling currently occur in the Maldives. Aseptic cartons (e.g. Tetra Pak) are typically composed primarily of paper but also consist of plastic and aluminum, and separating these layers can present challenges with recycling, though they do contain less plastic compared to PET bottles. The SUP phase-out plan suggests "water dispensers, filtration systems, reusable bottles, and refilling stations" as alternatives to PET bottles[9], but currently, stores seem to be shifting to other types of single-use, which will not reduce the total amount of waste materials generated.

Similarly, shampoo and detergent are largely packaged in high-density polyethylene (HDPE), which is technically recyclable but infrastructure does not exist in the Maldives. Oil is often packaged in PET, while rice is predominantly packaged in film.

In addition to surveying convenience and grocery stores, the field team surveyed restaurants in each of the nine 1 km^2 survey areas. Through visual assessments and discussions with restaurant owners, the team assessed the material type for to-go food items like containers (including their lids), cups, utensils, and straws (Figure 9). In total, 100 items were characterized in 27 restaurants (Figure 10). Of the food vendors surveyed, 25 offered cold cups, 25 offered food containers, 26 offered straws, and 24 offered utensils.

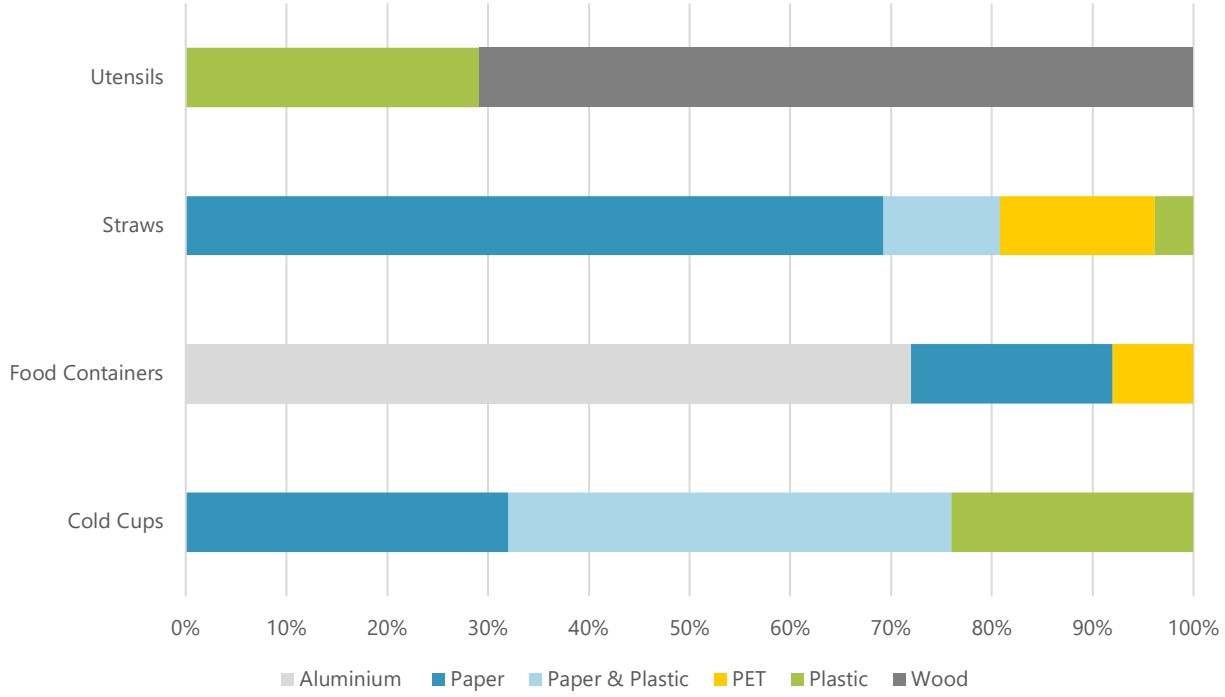
Figure 9: Example of to-go materials surveyed in the Maldives.

In restaurants, products reflected the implementation of the SUP phase-out plan. Utensils were primarily constructed of wood or bamboo (71%), and straws were mainly available as paper (70%), both of which can be biodegradable alternatives to SUPs, depending on the presence of coatings and additives. Food containers were found to be mostly aluminum and paper; only 8% of the food containers surveyed were

[9] Nashfa, Hawaa. Single-use Plastic Phase-Out Plan 2020 – 2023. Ministry of Environment. https://www.environment.gov.mv/v2/wp-content/files/publications/20210425-pub-single-use-plastic-phase-out-plan.pdf

PET. Most cold cups surveyed were paper and plastic. Paper-to-go containers and cups are often lined with plastic or chemicals like Perfluoroalkoxy alkanes (PFAs) to make them water-resistant, and these additives can be dangerous to human health. For comparison, in a recent CAP conducted in 2023 in Hilo, Hawaii, an island where SUP policy for to-go ware is not enacted, to-go ware in 32 restaurants surveyed had fewer alternative materials to SUPs. Utensils in the Hilo restaurants surveyed were 29% compostable plastic, with the remainder composed of hard plastic; straws were 38% compostable plastic or paper, with 62% composed of hard plastic; food containers were 50% paperboard, fiberboard, or compostable plastic, with 50% made of hard plastic; and cold cups were 39% compostable plastic or paper, 48% paper, and 13% hard plastic.

Figure 10: Material breakdown of to-go items surveyed in the Maldives.



Utensils, straws, food containers, and cold cups all fall under the list of banned SUP products in the Maldives. Bans for these product categories were intended to go into nationwide effect as of June 2021. Suggested alternatives included in the ban for each product category are listed below:

- Plastic drinking straws: silicone, metal, paper, bamboo.
- Single-use plastic plates, cups, cutlery, and stirrers: non-plastic single-use cutleries made from bamboo or any other biomass.
- Styrofoam lunch box: aluminum foil containers, paper, sugar pulp boxes, or reusable packaging or container.[10]

[10] Nashfa, Hawaa. Single-use Plastic Phase-Out Plan 2020 – 2023. Ministry of Environment. https://www.environment.gov.mv/v2/wp-content/files/publications/20210425-pub-single-use-plastic-phase-out-plan.pdf

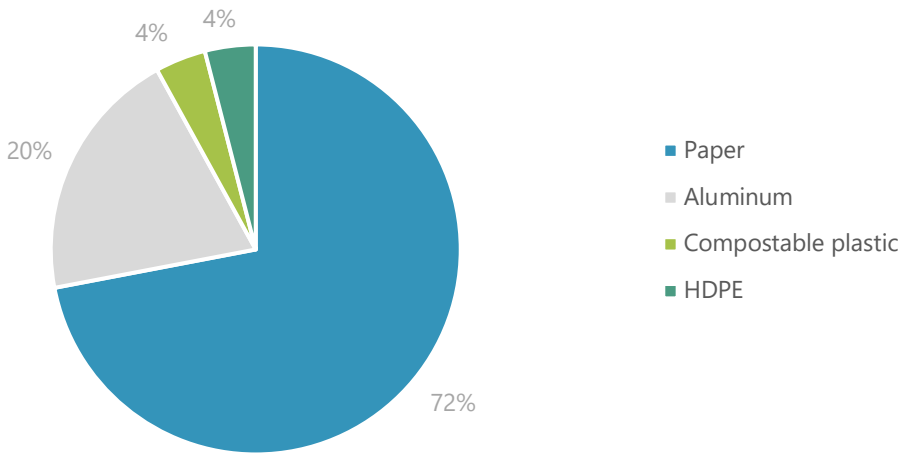
While alternatives to SUP were prevalent in the restaurants surveyed, the reusable options articulated in the ban were not present for to-go food ware – most businesses have switched from SUP to other single-use products made of materials like wood, bamboo, paper, or aluminum. While these alternatives are not plastic, they are still single-use, and therefore will not reduce the total amount of waste requiring management in the Maldives. Some reusable options were present for in-restaurant dining.

Additionally, compostable foodware items are typically designed to break down in commercial composting settings, but they often will not biodegrade if they leak into the environment – although compostable alternatives are not well regulated, so verifying their composability remains an obstacle. Commercial composting could have the added benefits of diverting food waste, thereby reducing landfill space and greenhouse gas emissions, but given the extremely limited land mass in the Maldives, composting may be a significant challenge.

Use

While conducting store surveys, the field team also observed the home and personal care products aisles and noted any observations of alternatives to SUP packaging, including both alternative materials (such as paper or compostable plastics) and reusable alternatives. 59% of the 27 stores surveyed offered some type of alternative. Most alternatives observed in stores in the Maldives were related to picnic-ware items, such as plates, snack bags, and straws. In total 28 alternative products were observed. 26 were alternative materials to SUP (which are still intended as single-use products), and 2 were reusable products (Figure 11). Most alternative material products were composed of paper or aluminum. For comparison, in a recent CAP conducted in 2023 in Hilo, Hawaii, 52% of stores offered some type of alternative to SUPs, and 46% of the 135 alternatives surveyed were compostable products.

Figure 11: Types of alternatives to single-use plastics observed in stores in the Maldives.



Product prices and quantity were also recorded and compared to similar products packaged or composed of SUP to calculate an average cost difference between alternatives and SUP (Table 5). total, alternatives to SUP cost about 48% more compared to their SUP versions. The data also showed that some alternatives, like wooden utensils and paper plates, might be available at a cost savings to consumers. Compostable plastic was the most expensive alternative observed in stores, costing 612% more compared to single-use plastic.

Participants in the stakeholder workshop expressed that residents in the Maldives often buy small quantities of products due to cost and storage restrictions, limiting the possibility of reducing waste through bulk buying. Attendees also expressed concerns about the high upfront costs to businesses associated with switching to reusable containers.

Table 5: Cost comparison of alternatives and single-use plastic.

Product	Alternative Type	Number of Observations	Average Cost Difference for Alternative
Bowls	Alternative material – aluminum	5	+12%
Bowls	Reusable	2	-4%
Cups	Alternative material – paper	9	-43%
Dessert Plates	Alternative material – paper	1	-20%
Dinner Plates	Alternative material – paper	4	-73%
Snack Bags	Alternative material – paper	1	+22%
Snack Bags	Compostable plastic	1	+612%
Straws	Alternative material – paper	4	+387%
Utensils	Alternative material – wood	3	-62%

Of the 27 stores surveyed, most offered plastic bags as the primary bag type (Figure 12). However, most stores (26 out of 27) did charge for bags. Plastic bags typically cost around 2.09 MVR per unit, while paper bags cost 3.42 MVR. Several stores also offered non-woven plastic bags, which cost an average of 3.33 MVR (Figure 13). These are thicker than a typical plastic bag and will have a higher environmental footprint if they are not reused. However, they may be less likely to enter the environment compared to thinner plastic bags that can be easily blown in the wind. Ten stores (37%) sold reusable bags, most often made of cloth. Cloth reusable bags were sold in eight stores, typically for a cost of 4 MVR. For comparison, in a recent CAP conducted in 2023 in Hilo, Hawaii, where a bag ban has been instituted, 81% of stores were offering paper bags as the primary bag type, and 86% of stores offered reusable bags. Only 10% of stores in Hilo offered non-woven plastic bags as the primary bag type.

Bags less than 30 x 30 cm, and bags below 50-micron thickness, are included in the SUP phase-out plan; suggested replacements in the ban include reusable plastic bags made from PET, PP, and nylon; reusable low-density and high-density bags from polyethylene, LDPE, HDPE, and PET; long life bags made from

lightweight synthetic fabrics; and compostable and biodegradable bags.[11] As more stores begin to offer reusable bags like non-woven plastic bags as the SUP phase-out plan is implemented, building a culture of reuse will be necessary to ensure the current thin plastic bags are not just replaced with thicker single-use bags. The fee charged to consumers for bags may help to encourage reuse, although participants in the stakeholder meeting suggested that many of the non-woven plastic bags are still only used once and that the SUP phase-out plan might expand to include them.

Figure 12: Most common material of shopping bags offered in stores in the Maldives.

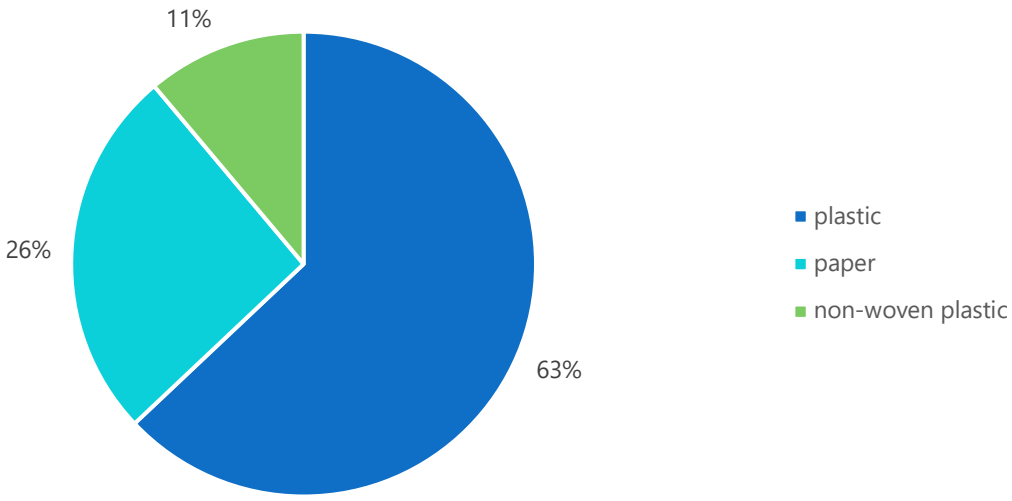


Figure 13: Example of a non-woven plastic bag.

[11] Nashfa, Hawaa. Single-use Plastic Phase-Out Plan 2020 – 2023. Ministry of Environment. https://www.environment.gov.mv/v2/wp-content/files/publications/20210425-pub-single-use-plastic-phase-out-plan.pdf

One of the solutions explored by participants in the stakeholder workshop was enabling the reuse of water bottles by installing water filtration systems on small vessels, which could reduce a waste source that is often leaked into the ocean. Participants suggested that vessels should receive recognition for good practices and subsidized rates for filtration systems, perhaps with a payment plan for installment payment. Attendees also suggested including this as a requirement in the audit report for liveaboard license renewal. Initial costs and maintenance requirements were identified as the biggest obstacles. Participants suggested creating a toolkit in Dhivehi & English, conducting in-person training, and implementing policy changes to compliance requirements to implement this solution.

During the workshop, Hudha Ahmed, the Technical Advisor for Maldives Authentic Crafts Cooperative Society (MACCS), Plastic Noon Gotheh, presented on alternative mindsets and systems transformation needed in the Maldives. Suggested systems included in the presentation were:

- Cleaning facilities for cloth nappies and take away food containers
- Composting facilities for compostable bags with biodegradable waste
- Recycling facilities: for plastic, metal, and glass
- Repair culture for electronics and furniture.

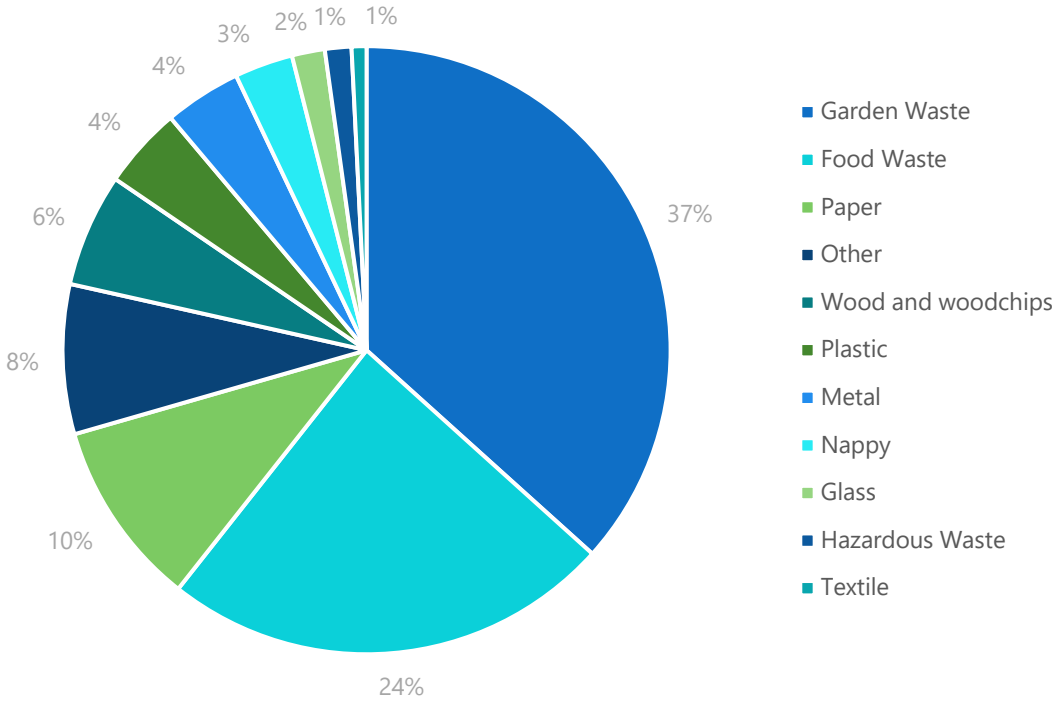
These examples represent a more systemic shift in how products are used and reused, rather than replacing SUPs with alternative single-use materials.

Collection

Each year, the Maldives generates about 365,000 tons of solid waste. Daily solid waste generation in Male' occurs at a rate of approximately 1.8 kg per person; tourism is also a significant source of waste, with an estimated 3.5 kg per person per day generation rate on resort islands.[12]

Over 60% of the waste generated in the Maldives is organic waste, like garden and food waste (Figure 14). According to a 2022 waste audit, plastics comprise about 4% of the waste stream. Other estimates place plastics at 12% of the total waste stream, with PET alone accounting for 1% of waste.[13]

Figure 14: Waste composition by weight in the Maldives, from all economic sectors.[14]



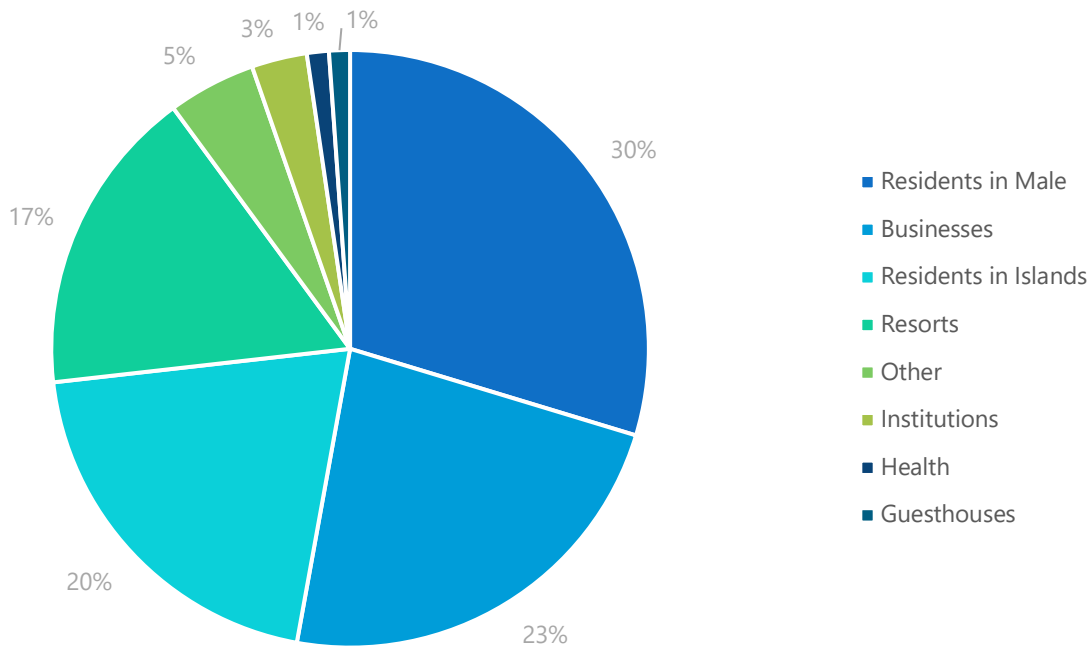
Households in Male,' followed by businesses and the n households in the other islands, are the largest contributors to waste in the Maldives (Figure 15). Male' residents contribute about 30% of the overall national waste generation.

[12] "Maldives to Improve Solid Waste Management with World Bank Support." *World Bank*. June 23, 2017. https://www.worldbank.org/en/news/press-release/2017/06/23/maldives-improve-solid-waste-management

[13] Maldives Ocean Plastics Alliance and NIG Capital. "Socioeconomic Impact Assessment of the Use PET in the Maldives." https://mopa.mv/wp-content/uploads/2021/02/PET_use_SocioEconomic_impact_Maldives.pdf

[14] Shumais, Mohamed, Mahmood Riyaz, and Aishath Leeza. "Waste Audit for Residential Islands in Maldives." GeoTech Maldives. August 2022. https://climateactiontransparency.org/wp-content/uploads/2022/12/D9-Waste-Audit-Report.pdf

Figure 15: Waste generation estimates by sector.[15]



Under the National Solid Waste Management Plan, local authorities like island or city councils are responsible for waste management within their jurisdiction. In the Greater Male' Region of the Maldives, waste from both households and commercial businesses is collected by the Waste Management Corporation (WAMCO). Waste is usually not segregated before collection. Illegal dumping of bulky waste, such as furniture and appliances, is common along roadsides and in vacant lots.[16]

Recycling in the Maldives is extremely limited and generally occurs through partnerships with NGOs and businesses. Parley Maldives, for example, has worked to set up collection points for plastics in schools, urban centers, and outer islands, and, at the time of writing, the organization has collected more than 2,400 metric tons of plastic (Figure 16).[17]

In the stakeholder workshop, Shaahina Ali, the Executive Director for Parley presented some of the challenges associated with recycling in the Maldives. Space for sorting is an obstacle, as is inadequate throughput to scale recycling to be cost-effective. The sorting and storage facilities required for recycling are not compatible with the infrastructure already present in the Maldives. The limited volume of recyclables makes it challenging to justify investment in new infrastructure. Currently, Parley Maldives partners with Sri Lanka, where resources and water are more affordable, highlighting the need to look at recycling from a regional perspective. The transportation costs of moving recycling between islands are

[15] Shumais, Mohamed, Mahmood Riyaz, and Aishath Leeza. "Waste Audit for Residential Islands in Maldives." GeoTech Maldives. August 2022. https://climateactiontransparency.org/wp-content/uploads/2022/12/D9-Waste-Audit-Report.pdf
[16] "Maldives National Waste Accounts 2018 & 2019." https://www.unescap.org/sites/default/d8files/2021-04/Maldives_National_Waste_Account_Report_2018-19.pdf
[17] Parley Maldives. https://www.maldives.parley.tv/

also significant. To make recycling work in the Maldives, equipment for sorting and bailing and storage space are needed on each inhabited island to prepare recycling for transport.

Figure 16: PET bottles bagged and baled for export at a recycler.

Participants in the stakeholder workshop explored in detail what would be needed to improve recycling infrastructure in the Maldives. Participants identified that waste segregation at the source, improved transportation logistics, more waste storage space, and more waste management equipment would be required. Obstacles discussed included a lack of specific policies for recycling and limited funding. Stakeholders felt national level. conversations & consideration, policy decisions including strategic plans, waste-to-energy schemes, and community engagements & awareness could overcome these challenges. Policy formation, including action plans and key performance indicators (KPIs), and training to increase institutional capacity are needed. Stakeholders estimated the funding required for recycling to be $16m for logistics, $2.4m for sorting, and $5m for infrastructure. A successful recycling system in the Maldives would need the government to fund and regulate service providers, and businesses to provide alternatives to plastic and collect waste they generate through EPR, and communities – including NGOs, education providers, households, and individuals – to increase participation.

Waste segregation at the household level could further enable recycling, but key stakeholders interviewed expressed concerns about transportation once segregation occurs.

> **"People are willing to segregate and communities are keen to do it but after segregating and keeping the waste in separated piles then what do they do? If there is no proper solution or mechanism to transport, then they will go back to what they have been doing."**
>
> – Nonprofit organization

Participants in the stakeholder workshop also discussed waste segregation as a solution. Stakeholders felt there should be separate collection systems for different streams, and that it would be necessary to raise public awareness about waste segregation. Separate waste streams are a key to extracting recyclables and creating value. The participants discussed obstacles including funding, infrastructure creation, and a community mindset of distrust. Improved regulations and guidelines, providing enforcement, and

localized solutions based on successful models could address these challenges. Stakeholders also noted that color-coded bin liners and a national strategy are needed to implement this solution.

Interviewees also expressed concern about the loss of waste to the environment during the collection process, especially when transporting waste by boat where the likelihood of leakage to the marine environment is significant.

> **"I don't believe that all the policies are being enforced efficiently. For example, as per EPA [Environmental Protection Agency] guidelines waste has to be taken in covered vehicles while transporting and we still see waste not being covered and it's open. The vessels coming from the resorts are also required to follow this rule. However, this is not being enforced at the right level."**
>
> – Nonprofit organization

End of Cycle

Waste collected by WAMCO in the greater Male' area is transported to transfer stations, located in in Male' City and Hulhumale'. From there, waste is moved to Thilafushi, an artificial island near Male used for waste management (Figure 17).[18] On the administrative islands, there is a decentralized system where producers transport waste to Island Waste and Resource Management Centres (IWRMCs).

Figure 17: Thilafushi landfill in the Maldives.

Thilafushi was created in the 1990s, and as the site fills up, operators are beginning to stockpile waste in anticipation of an incinerator coming online. The government of the Maldives received a 73 million dollar loan from the Asian Development Bank to invest in waste-to-energy (WTE) technology in 2020.[19] While Thilafushi has stopped open burning, it is still a common practice on smaller islands.

> **"Waste in Thilafushi, they have stopped burning, and there are huge piles… Small islands do not have the capacity or infrastructure to manage waste, that's why there is illegal dumping, burying, or stockpiling of waste. No responsible waste management is seen."**
>
> – Government Official

[18] Nazeer, Abdul and Hamdhoon Hameed. "POLICY BRIEF (Input Paper): Prevention of Marine Litter in the Maldives." Promise: Prevention of Marine Litter in the Lakshadweep Sea. Sep 2021. https://projectpromise.eu/sites/projectpromise.eu/files/documents/promise_policy_brief_input_paper_maldives_fin.pdf

[19] "ADB Approves $73 Million Package to Develop Waste-to-Energy Facility in Maldives." Asian Development Bank. Aug 12, 2020. https://www.adb.org/news/adb-approves-73-million-package-develop-waste-energy-facility-maldives

> **"There is difficulty due to the space limitation and now the dump area is more than 40 meters high (mounds). If the site is full, I think the decision will be taken at policy level. The plan is to start and bring the incinerator facility operational at the earliest so that the waste will be incinerated."**
>
> – Nonprofit organization

> **"At present, waste is being disposed of at a landfill. During disposal, we segregate the wastes like metals, which are supplied to local buyers. The dry wastes are shredded and bailed for future. This is being kept for the second phase, where an incinerator facility is planned to be built. Once the facility is set up, the compostable waste which is bailed will be burnt in the incinerators. However, as the facility is not ready at present, the shredded and bailed wastes are stored. The wet wastes are currently disposed of in the waste mound. Now it's been a long time that we have stopped the open burning and now we are managing the layered compaction. Dry wastes are shredded except the metals and construction wastes. The wastes include plastic as well and the plastics segregated at the transfer stations are taken by PARLEY."**
>
> – Nonprofit organization

During the stakeholder workshop, Ahmed Azim, an Education & Communication (IEC) Specialist from the Ministry of Environment, Climate Change, and Technology, presented the new waste-to-energy facility being developed at Thilafushi. Energy recovery from waste was presented as critical in the Maldives due to the dependence on diesel-generated electricity. Three WTE plants are being established across the Maldives, including one in the Greater Male area. The expansion of waste-to-energy plants nationwide aims to address the unique environmental challenges of the Maldives, including waste transportation over the open sea and varying population demographics.

Typically, 800 to 1,000 tons of waste are brought to Thilafushi daily, encompassing both wet and dry waste, along with significant volumes of construction & demolition (C&D) waste. The WTE plant will incorporate a 6-layer filtration system meeting EU standards, capable of filtering approximately 98.87%–99.91% of emissions. Continuous monitoring, reported in real-time to the Maldives EPA, will ensure transparency and compliance. The project's approach involves treating non-recyclable waste via the WTE plant while diverting recyclable fractions through secondary sorting and empowering waste reduction at the source.

According to Azim, the project provided support to stop the open burning of waste on Thilafushi Island, which has facilitated urban development in previously uninhabitable areas like Gulhifalhu and Giraavarufalhu. These measures have also bolstered the local tourism and fisheries industries within the region. Additionally, containerized waste transportation initiative as part of the project will reduce ocean spillage. The project's first phase, named the Greater Malé Environmental Improvement and Waste Management Project (GMEIWMP), began in 2018 with a targeted completion by December 2024,

spanning five years. The subsequent phase, involving the waste-to-energy plant contracted in 2021, is scheduled to run until 2026. Both phases form integral parts of the broader waste management strategy for this region and will proceed concurrently. Presently, the construction of the C&D waste processing plant is underway and is anticipated to conclude by late 2024. Additionally, the end-of-life vehicle (ELV) dismantling plant is nearing completion and will allow the facility to handle distinct types of waste categories. The Thilafushi Regional Waste Management Facility (RWMF) plant will employ a modular approach. Initially structured with two distinct lines, each capable of processing 250 tons/day, totaling a capacity of 500T of waste, the facility plans to activate a third line, adding 250T capacity, thereby reaching a total processing capability of 750T. This expansion aligns with the ongoing development of new urban centers around the Greater Malé Area. The design focuses on sorting waste to divert plastic away from the incinerator, prioritizing efficient waste management strategies. Public support and behavior change are vital for the facility's sustainability, especially in reducing waste at its source, crucial as the facility presently operates well beyond its designed capacity.

Recycling does not occur locally in the Maldives, and recyclables must be exported to other markets like India, Sri Lanka, or Taiwan. This required transportation adds both cost and logistical challenges.

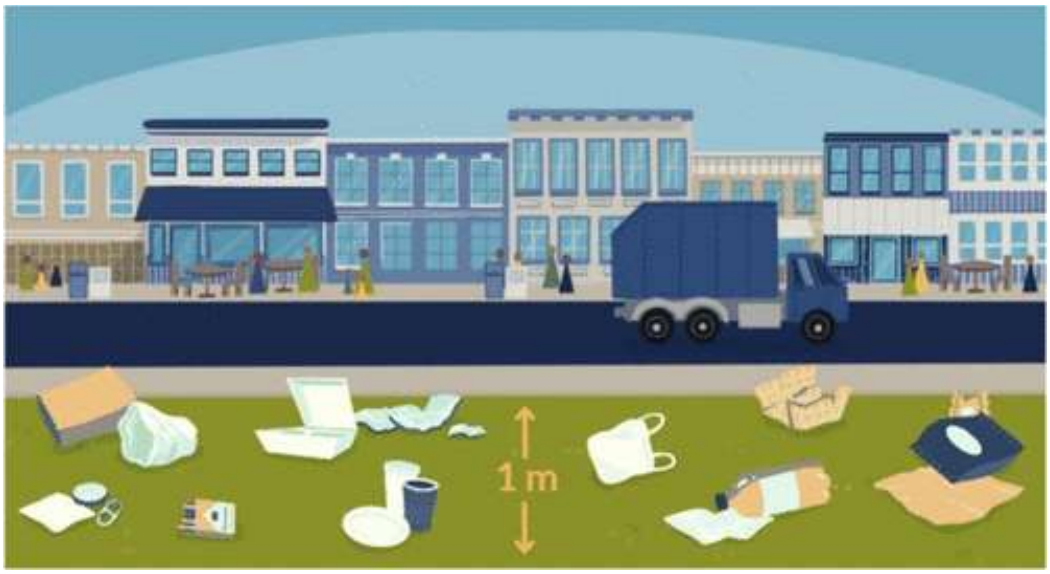
Many of the current alternatives seen in stores and restaurants in the Maldives are not made of SUPs, but are still single-use, and therefore will not reduce the total amount of waste going into Thilafushi.

Leakage

In total, 7,876 items were logged in 27 transects (each 100m^2) characterizing nine different square kilometer areas. Transect locations were selected using a stratified random sampling method, in which transect survey areas were randomly selected in nine square kilometers distributed across three groups of population count (upper, middle, lower) based on LandScan[20] ambient population data (See Sampling Strategy). Each site was gridded with a fishnet, and three survey areas were randomly selected for litter transects. Transect paths were selected upon arrival at the survey area in a litter aggregation pathway (along a walkway or an open gutter along the side of the road) based on safety considerations and accessibility (Figure 18).

Litter items were recorded using the open-source Marine Debris Tracker app. A full list of items available in the app and their associated material categories as well as a map of sample sites and their surveyed litter densities can be found in the Appendix.

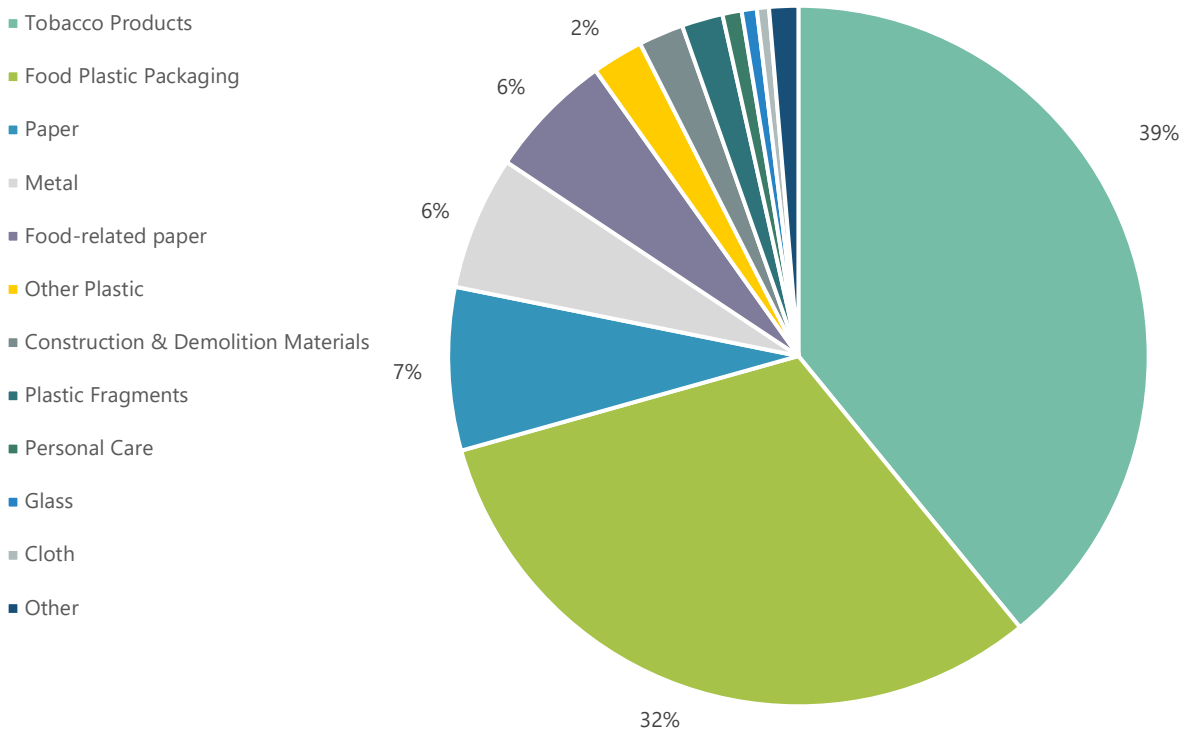
Figure 18: Transect data collection along a 1 x 100 m pathway.[21]



[20] https://landscan.ornl.gov/

[21] "Rapid Characterization of Macroplastic Input and Leakage in the Ganges River Basin." Kathryn Youngblood, Amy Brooks, Navin Das, Avinash Singh, Meherun Sultana, Gaurav Verma, Tania Zakir, Gawsia W. Chowdhury, Emily Duncan, Hina Khatoon, Taylor Maddalene, Imogen Napper, Sarah Nelms, Surshti Patel, Victoria Sturges, and Jenna R. Jambeck. *Environmental Science & Technology* 2022 *56* (7), 4029-4038. DOI: 10.1021/acs.est.1c04781

Figure 19: Litter characterization by count.



As is a common trend across many CAP sites, tobacco products were the largest category of litter items surveyed (39%), followed by food-related plastic packaging (32%) and paper (7%) (Figure 19). Plastic fragments were not as commonly observed in the surveys, suggesting that macroplastics may be moving to environmental reservoirs like the ocean because they have an opportunity to break down. Food-related paper comprised 6% of the litter, and this fraction is likely to increase as more businesses in the Maldives switch to paper products rather than plastic. In total, about 76% of the items observed were plastic or multi-material including plastic, from the categories of tobacco products, food-related plastic packaging, other plastic, plastic fragments, and personal care.

Notably paper cups (n = 125) were more prevalent in the litter compared to foam (n = 1) or plastic cups (n = 2), further highlighting that replacing SUPs with other single-use materials may not prevent these materials from being littered. Aseptic cartons (n = 203) were about half as prevalent in the dataset as plastic bottles (n = 466), even though they were more frequently observed than PET bottles in the store surveys. There may be a lag in changes in the litter composition compared to product availability in stores.

Figure 20: Example photos of items found during litter surveys.

Of the common litter items observed during surveys (Figure 20), cigarettes, plastic food wrappers, paper fragments, plastic bottles, and plastic bottle caps were the most observed across all sites (Figure 21).

Figure 21: Top 10 litter items observed across all sites by count.

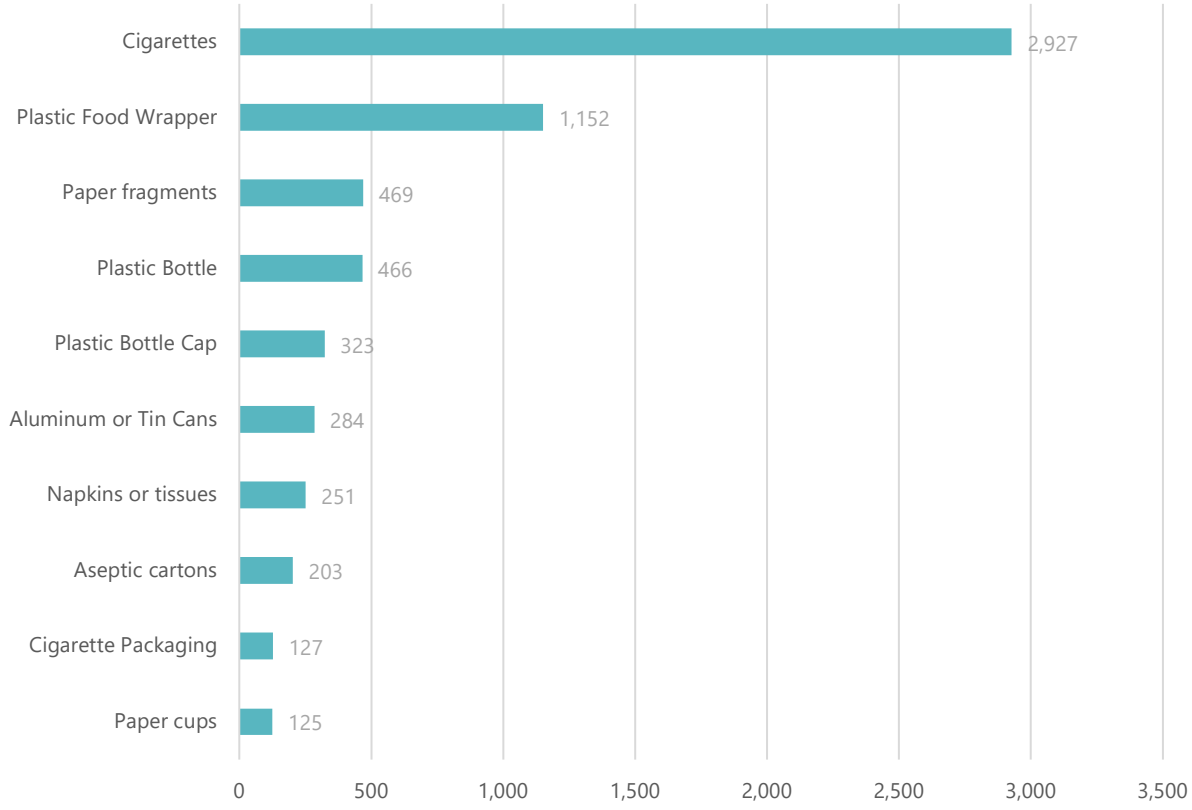
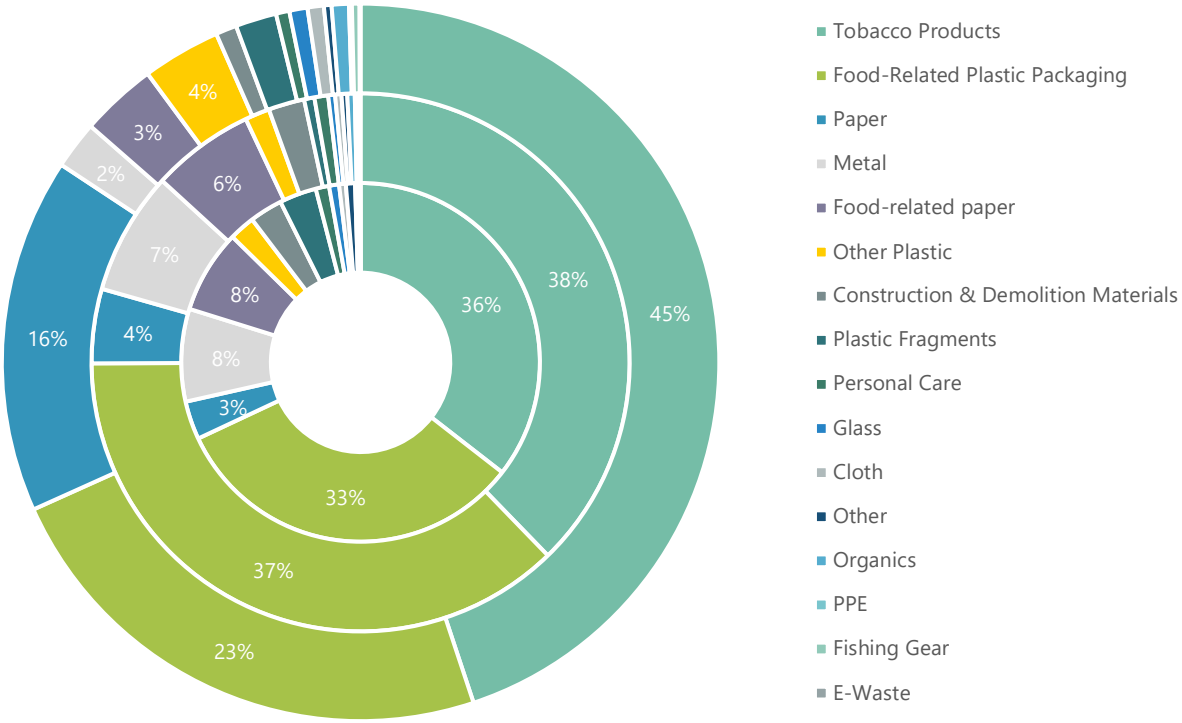


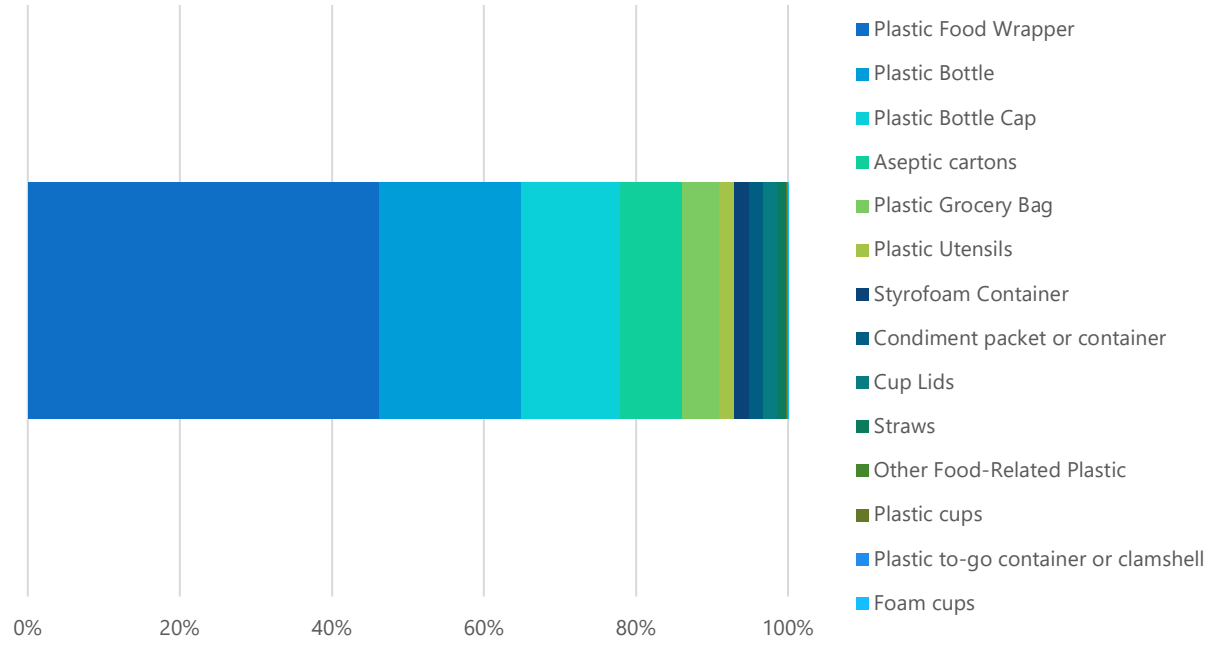
Figure 22: Proportion of most common plastic items in low (inner), mid (middle), and high (outer) population count areas in the Maldives.



Higher population areas tended to have a higher proportion of tobacco products in the litter, as compared to the middle and lower population activity areas (Figure 22). Cigarette butts are often consumed and disposed of on the go, and there is little awareness that filters in cigarettes are generally made of a type of plastic and thus will persist in the environment. Middle and lower-population areas had higher proportions of food-related plastic packaging, which could be a key target for interventions.

Notably, the most observed items within the food-related plastic packaging category include plastic food wrappers, plastic bottles, plastic bottle caps, and aseptic cartons, which are often imported into the country already in SUP packaging (See Input) (Figure 23). Some of this SUP packaging observed in the litter could be targeted through local reuse systems. Additionally, some litter observed in the litter, like grocery bags, utensils, and foam containers, represent items that could be reduced through reuse at the individual level (e.g. bring your own bag or container programs) or through alternatives like cloth bags and wooden utensils already observed in some stores and restaurants.

Figure 23: Proportion of various litter items within the food-related plastic packaging category.



For comparison, some of the key items included in the SUP phase-out plan that were also observed in the litter are contrasted below to their density in CAP litter datasets in other island locations, Hilo, Hawaii, and Dominica. Surveys in both sites were conducted in 2023. Hawaii has established bans on SUP bags and foam to-go ware products. Dominica has enacted a ban on SUP foodware items including cups, straws, utensils, and to-go containers, but does not have any legislation around bags. The overall average litter density per 100 m^2 transect, which is about the length of a city block, was 292 items in the Maldives, 27 items in Hilo, and 92 items in Dominica.

Table 6: Average density of items per transect in litter surveys in island locations.

Item	Average items per transect in Maldives (items/100 m^2)	Average items per transect in Hilo, Hawaii (items/100 m^2)	Average items per transect in Dominica (items/100 m^2)
Plastic grocery bags	4.48	0.03	1.42
Plastic and foam cups or lids	1.78	0.42	4.52
Plastic Utensils	1.81	0.22	1.03
Straws	1.07	0.19	0.39
Plastic and foam containers	1.85	0.33	0.16

Grocery bags, cups and lids, utensils, straws, and to-go containers have higher frequencies in the litter transects conducted in the Maldives compared to the same items surveyed in transects in Hilo, Hawaii (Table 6). This trend is also true in Dominica, except for plastic and foam cups or lids, which were more frequently observed in Dominica compared to the Maldives. This is likely due to the comprehensive switch to paper cups, as observed in food vendor surveys. The density of paper cups in the litter in Maldives was 4.63 items per 100 m^2 transect. This data shows that the items selected as part of the SUP phase-out plan are frequently littered in the Maldives compared to other islands, and therefore are effective targets for reduction. The low occurrence of plastic bags in the litter dataset in Hilo, Hawaii, where a SUP bag ban has been in effect for more than 10 years, holds promise for further litter reduction in the Maldives if current policies are enforced and expanded.

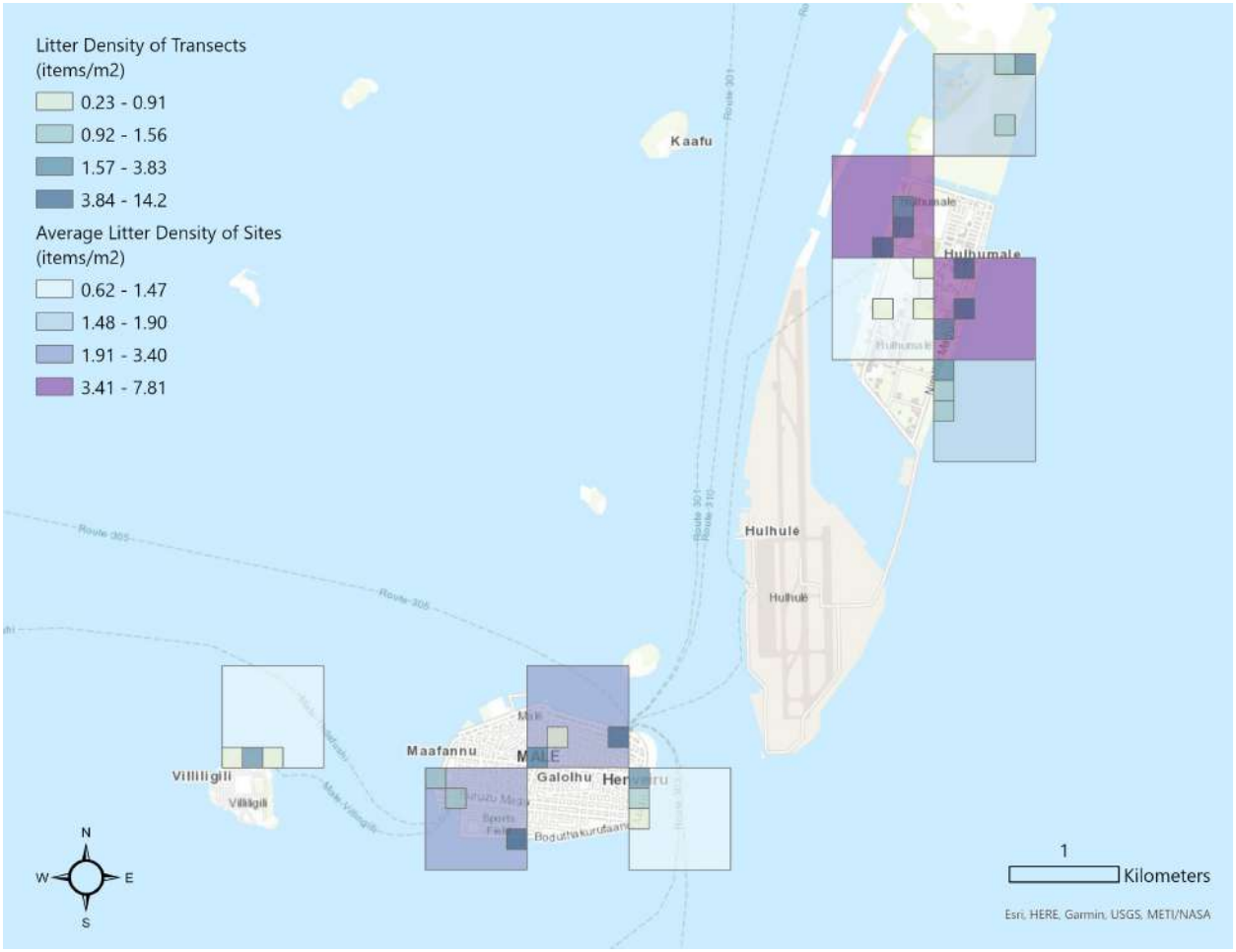
Table 7: Litter Density and Top Litter Items for Each Area of Population Count

Population Tertile	Top 5 Litter Items	Litter Density (count/m2)
Upper (2-142 persons)	1) Cigarettes, 2) Plastic Food Wrappers, 3) Paper Fragments, 4) Plastic Bottle Caps, 5) Plastic Bottles	2.92
Middle (142 – 1,486 persons)	1) Cigarettes, 2) Plastic Food Wrappers, 3) Plastic Bottle Caps, 4) Plastic Bottles, 5) Aluminum or Tin Cans	3.23
Lower (1,487 – 41,209 persons)	1) Cigarettes, 2) Plastic Food Wrappers, 3) Plastic Bottles, 4) Aluminum or Tin Cans, 5) Napkins or tissues	2.96

The overall average litter density across all sites surveyed in the Maldives was 2.92 items/m2. This is equivalent to observing 292 litter items next to the sidewalk while walking along a 100 m city block. No significant differences were observed between various population activity areas across the sites (Table 7). The highest litter density sites were in Hulhumalé (Figure 24).

This average litter density in the Maldives is lower compared to other South Asia cities, which typically range from 0.5 items/m^2 to 15 items/m_2, with an average of around 4-5 items/m^2. For comparison, litter densities in Santiago, Chile, averaged 3.34 items/m^2 and 2.89 items/m^2 in San Antonio. Chile. In a CAP conducted in Miami in the U.S., the litter densities were found to be 2.46 items/m^2 in high population count areas, 1.48 items/m^2 in middle population count areas, and 3.79 items/m^2 in lower population count areas as of 2021. The densities are also comparable to those found in Hanoi, Vietnam which ranged from 1.5 — 4.4 items/m^2 across the three population tertiles there. A web map to explore the densities of each site in the Maldives is available here.

Figure 24: Litter densities in transects and sites surveyed in the Maldives.



Opportunities

CIL found the following opportunities to expand and enhance circularity in the Maldives based on the findings of this report. These opportunities are categorized based on the seven spokes of the CAP model. Stakeholder engagement with the partners of this project should take place to further expand, refine, and prioritize these opportunities based on local context, impact, feasibility, and cost. It is important to note that the opportunities listed below are individualized based on the findings, but solutions cannot happen in a vacuum and are most impactful when strategically combined within a holistic system framework.

INPUT

Methods: Twenty-seven stores were surveyed and 120 unique brands of fast-moving consumer goods were recorded, including 25, beverages, 31 biscuits, 32 candies, 20 chips, 8 tobacco products, and 4 waters.

Findings: Most convenience products travel between 3,000 and 9,000 kilometers to reach the Maldives, except for bottled water which is locally produced. 95% of products were manufactured internationally, with only 6 out of the 120 brands identified as having local manufacturing. These local products were all beverages that were bottled locally with imported bottles. International companies are profiting from selling products in the Maldives without contributing to the management of the associated waste.

Opportunities:

- Everything is imported, which is both a challenge and an opportunity, in terms of control of plastics & packaging.
- There are local bottlers currently importing PET bottles for their beverages, which could be migrated to a local reuse system leveraging existing bottling infrastructure.
- Extended producer responsibility (EPR) could spark new industry and investment around waste collection from importers.
- Aligning with other small island developing states (SIDS) was also suggested as an opportunity to have a stronger voice to put pressure on companies to change their packaging practices.

COMMUNITY

Methods: To understand current attitudes and perceptions of plastic waste, semi-structured interviews were conducted with 19 key stakeholders.

Findings: The taste and safety of tap water are a concern for many residents, leading to a lot of bottled water use. Overall, interviewees felt that there is limited awareness about plastic pollution's impacts on human health. Alternatives are more available with the single-use plastic phase-out plan currently being implemented in the Maldives, but there is still a desire for refill and composting systems. Even with current policies, the burden of change still rests on the community.

Opportunities:

- Because many community members have not historically had access to formal waste management, as segregation, collection, and recycling expands, there is a need to improve awareness of proper waste practices.
- Expanding home water filtering infrastructure and public filtered refill stations could expand trust and ability to refill reusable water bottles.
- Further communication and information on the benefits of the plastics ban to community members could help gain more support and participation.

Methods: 127 samples of unique forms and brands of fast-moving consumer goods were purchased in stores to obtain packaging weights; these included 26 beverages, 35 biscuits, 42 candies, 20 chips, and 4 waters. Visual surveys were conducted in stores to estimate material composition for chips, candy, beverages, shampoo, laundry detergent, oil, and rice. To-go ware was also surveyed in 27 restaurants, with 100 items categorized including straws, utensils, cold cups, and food containers.

Findings: In stores, most chips and candy were packaged in a multi-layer or film plastic, which is not recyclable and can easily escape the waste stream. Multi-material canisters (e.g., Pringles) for chips are a combination of paper, metal, and plastic and are not recyclable (39%). Convenience beverage products were packaged in PET, aluminum, and glass, which are recyclable, but the highest quantity was in aseptic cartons (e.g. Tetra Pak). Aseptic cartons contain less plastic but are not easily recyclable**.** In restaurants, to-go ware reflected the implementation of the single-use plastics phase-out plan – surveys showed a relatively high percentage of wood utensils (41%), paper straws (70%), and aluminum or paper food containers (82%). Cold cups were primarily paper, often lined with plastic. The higher percentage of alternatives to plastic is likely due to the single-use plastic phase-out plan, but many of the available alternatives are still single-use.

PRODUCT DESIGN

Opportunities:

- Reduction is key to limiting the amount of waste that needs to be managed. Swapping single-use plastics for other materials that are also single-use will not reduce overall waste generation.
- Compostable materials, including compostable plastics, are not widely available; these should not be emphasized as an alternative unless composting infrastructure becomes available.
- Chips in multi-material canisters could be converted to paper-only canisters such as those available in Europe.
- The impact of the single-use plastics phase-out plan will expand as stores and vendors use up their current inventory of plastic.
- Recyclable polymers are already in use for some products, like beverages and laundry detergent, though infrastructure for recycling is limited.
- The single-use plastic phase-out plan also offers an opportunity to explore reuse systems. Reusable alternatives to single-use plastic, such as cup return systems, could be promoted.

USE

Methods: The field team surveyed the home and personal care products aisles and noted any observations of alternatives to single-use plastic packaging, including alternative materials or reusable alternatives. The type of bag offered was also surveyed in the 27 stores included in the assessment.

Findings: 59% of the stores surveyed offered some kind of alternative to single-use plastic. Alternatives to single-use plastic cost about 48% more compared to their single-use plastic versions. Out of 28 alternatives to single-use plastics that were identified in stores, only 2 were reusable products. 26% of stores offered bags made from non-woven plastic and typically cost 3.3 MVR. 37% of stores offered reusable bags for sale, typically made of cloth.

Opportunities:

- Access to filtered drinking water and refill stations with controls for taste quality could be expanded, allowing for more reuse of water bottles.
- More focus on reuse and refill could offer more affordable local solutions.
- The availability of reusable bags of more durable materials like cloth could be expanded.
- There is an opportunity to increase the availability of reusable products available to community members in stores.
- Alternatives are more expensive than single-use plastics. An economy of scale for vendors could reduce costs.

COLLECTION

Methods: Existing sources were reviewed to summarize current processes, supplemented with information from stakeholder interviews.

Findings: The Waste Management Corporation (WAMCO) oversees waste collection in the greater Male' region. Tourists generate waste at a higher rate than Maldivian residents. Segregation for recycling is limited, and waste leakage may occur during transport between islands.

Opportunities:

- Challenges remain with collection and transport between islands. There is an opportunity for innovation in logistics, baling, and transport of recyclables and waste. For example, if materials were homogenized and sorted, multiple collection and aggregation points may become more economical and logistically possible.
- A supplemental tourist tax could offset the cost of waste management.

END OF CYCLE

Methods: Existing sources were reviewed to summarize current processes, supplemented with information from stakeholder interviews.

Findings: Logistics and economics make recycling a significant challenge in the Maldives. Thilafushi. the main island for waste disposal in the Male' region, has stopped open burning, but this practice is common on the outer islands.

Opportunities:

- While lack of land availability and weather conditions are a challenge, commercial composting on the islands would provide an opportunity to reduce waste going to the ocean or being burned.
- There is a risk that the proposed new incineration system could discourage reduction and recycling.
- Increased awareness of human health issues of open burning & plastics may promote new management options.

LEAKAGE

Methods: Transects of litter along roadsides were conducted in 27 locations, stratified by population activity.

Findings: Maldives litter density ranged from 0.23 items/m^2 to 14.2 items/m^2, with an average of 2.92 items/m^2. This a lower than other South Asia cities, which typically range from 0.5 items/m2 to 15 items/m^2, with an average of around 4.5 items/m^2. Cigarettes were the top litter item across all three population count areas. Plastic food wrappers were second in terms of abundance.

Opportunities:

- Recyclable items, like plastic bottles and aluminum cans are relatively high in the litter counts. Giving recyclables more value (through a deposit-return scheme or other policies) could facilitate more collection and reduce leakage.
- There is an opportunity to increase awareness of microplastics in the environment, fish, and potential human health impacts to motivate changes to plastics use and management.
- Increased awareness of cigarette butts' plastic composition and associated toxicity, as well as the availability of infrastructure like butt receptacles, could address cigarette butt leakage.

Glossary

C&D: construction & demolition

CAP: Circularity Assessment Protocol

CIL: Circularity Informatics Lab

ELV: end-of-life vehicle

EPA: Environmental Protection Agency

EPR: Extended producer responsibility

E-Waste: electronic waste

FMCG: Fast-moving consumer goods

GMEIWMP: Greater Malé Environmental Improvement and Waste Management Project

HDPE: high-density polyethylene

IEC: Education & Communication

INC: Intergovernmental Negotiating Committee

IWRMC: Island Waste and Resource Management Center

KPI: key performance indicator

MACCS: Maldives Authentic Crafts Cooperative Society

MoECCT: Ministry of Environment, Climate Change and Technology

NGO: non-governmental organization

PET: polyethylene terephthalate

PFA: Perfluoroalkoxy alkane

PPE: personal protective equipment

RWMF: Regional Waste Management Facility

SIDS: small island developing states

SUP: single-use plastic

UGA: University of Georgia

UNEP: United Nations Environment Programme

WAMCO: Waste Management Corporation

WTE: waste to energy

Appendix

Maldives SHiFT Stakeholder Meeting Summary

An action-focused Maldives SHiFT Stakeholder Meeting took place on 23rd October 2023 in Malé, with 75 participants from NGOs, government, industry, academia, and international experts. Special guests Caron Röhsler, British High Commissioner to Maldives, H.E. Aminath Shauna, Minister of Environment, Climate Change and Technology, Republic of Maldives, and Dr Farah Faizal, High Commissioner of Maldives to the UK, gave talks.

The results of the Circularity Assessment were presented, followed by a series of presentations spotlighting the opportunities highlighted by the data. Then working in groups, the participants collaborated to create action plans that focused on key areas to tackle the challenges raised and work up a plan to devise the next steps.

This summary details the content of the meeting, the points raised by stakeholders during the discussion of the data and opportunities, the action plans that resulted from the workshop, and the results from a follow-up survey.

Presentation of the findings from the Circularity Assessment

The results of the Circularity Assessment were presented by the Maldives National University and the University of Georgia. Meeting participants were invited to discuss and express their opinions on the findings, any additional key information, and where they think the greatest opportunities to tackle plastic pollution lie.

These were some of the discussion points that were raised:

- We need to avoid replacing Single-Use Plastic with another single-use item that has no system for recycling or safe disposal.
    - Plastic shopping bags below 30×30 cm were banned in 2022. Non-woven plastic bags, slightly thicker than those banned, are still used only once, suggesting more items need to be banned.
    - The first phase of the production and sales ban of single-use plastic items, which came into effect in 2022 is a good start, but phasing out plastic bottles is a major challenge. In Maldives, there is a lack of alternatives. It would need a nationwide campaign encouraging people to take reusable water bottles with them. It will take a lot of effort and time. There is an option to sell water in cans instead of plastic. Alternatives to 500ml water bottles are needed for the ban to work.
    - Focus is needed to establish circular economy logistics of reusable takeaway containers, which currently does not have a waste-free solution.
- Awareness and engagement of residents is vitally needed.

    - We don't understand the health impacts of plastics, e.g. health impacts from bottled water left in high temperatures and in the sun.
    - We need to provide the right motivation for people to change their behavior. We have to find the right arguments and economic arguments, and show people the link between plastic and other issues that affect them.
- Challenges exist with buying in bulk in reusable containers.
    - In Maldives people buy in small quantities for cost and storage needs.
    - There are concerns for businesses having high upfront costs to provide reusable containers.
- There is a need for fast and collaborative action from all sectors.
    - Everyone has a role to play in teaching, design, and product innovation.
    - Malé vs outer islands need different types of solutions - these must be tailored and community-led. There's no "one size fits all" solution.
    - There was not much warning before the Single-Use Plastic Phase Out Plan started. However, if we wait until we have perfect awareness and alternatives the phase-out plan would not have already happened. The phase-out plan deadline must not be pushed back. Collaboration on awareness raising and providing alternatives is needed.
- Tap water is available but not accepted by residents.
    - People have the perception that tap water tastes bad and don't trust tap water.
    - One island has eliminated half the plastic bottle use by installing water filters in homes.

<u>Presentations to spotlight opportunities arising from the CAP data</u>

Maldivian stakeholders and international experts presented the challenges and opportunities of seven solutions that were highlighted by the CAP data. Their presentations were ordered to reflect the material flow chain, starting with end of cycle plastic, then to recapturing waste materials back into the system through recycling, using alternative materials and design circular products/systems, behavior change and avoiding more waste being put into the system via policies, treaties and EPR.

Emphasis was put on the fact there is no silver bullet solution and that there is a need for solutions at every point on the material flow chain, particularly as the higher-up solutions may need time to be developed and implemented. Each was followed by a discussion which included a high level of engagement and input from a variety of stakeholders in the room.

End of Cycle: Investing in Waste-to-Energy

Ahmed Azim, Information Education and Communications Specialist on the MoECCT's Greater Malé Waste-to-Energy Project, shared the plans for the Thilafushi incinerator, tackling the challenging issue of 'End of Cycle' waste disposal in Malé:

In Maldives, incineration can dispose of 95% of waste and create energy, whilst monitoring air quality and pollution, decreasing the need for landfill space, and allowing for the expansion of the Malé area.

- Modern waste-to-energy plants are efficient and small, with multiple layers of control to prevent harm to the environment.

- The municipal waste incinerator is due to be completed in 2026. It is nearing completion of the first phase in 2026, with the potential to expand to include construction waste and vehicle disposal.
- Discussion points: Participants raised concerns that the incineration of plastic will release microplastics and that additional vessels will be needed to collect and transport waste to the incinerator.

Collection: Recycling - a Maldives Perspective

The CAP data showed relatively high counts of plastic bottles and aluminum cans compared to other nations. Shaahina Ali from Parley Maldives shared the realities of working on plastic recycling in Maldives, and what can be done to get recyclable items back into the system:

- Maldivian islands don't have the space, facilities, or throughput to justify investment in recycling.
- By looking at the regional perspective, Maldives could send its recycling to Sri Lanka which has cheaper resources and water for recycling.
- 1 kg of recycled plastic currently costs $2.3 per kg, with recycling needing sorting, washing, storing, bailing, and transportation between islands. Equipment and storage would be needed on each of the 187 inhabited islands to prepare recycling for transport.
- Discussion points: All plastic in the Maldives could be collected for recycling, and importers and businesses producing plastic could phase out plastic completely.

Material and Product Design: Alternatives to Single-Use Plastic

The CAP data showed 59% of stores had alternatives to SUP available - a relatively high percentage which indicates that the phase-out policy is working. Hudha Ahmed from MACCS presented on the challenges that have emerged around the alternatives to SUPs:

- Alternative mindsets and system transformation are needed.
- Facilities are required for the cleaning of cloth nappies and takeaway containers to be in circulation, the composting of compostable bags with biodegradable waste, and the recycling of plastic, metal, and glass.
- Repair culture could be established for products like electronics and furniture.
- Discussion points: Need to address stigma around using reusable items e.g. tote bags and reusable nappies. The use of alternatives to single use plastics could be made more convenient and widespread through system change e.g. composting and recycling, and businesses making changes could be recognized through certification and financial incentives.

Material and Product Design: Bioplastics, Biodegradable Materials and Commercial Composting

Bioplastics offers a solution clouded in vague terminology and get held up as a silver bullet solution that requires no behavior change. Professor Jenna Jambeck of the University of Georgia's Circularity Informatics Lab shared her knowledge on bioplastics, biodegradables, and commercial composting via a video presentation, busting myths and giving her expert opinion:

- Truly biodegradable plastics make up only 1% of the market currently. Items marked "degradable" and "oxo-degradable" are not biodegradable, and neither is "biodegradable polyethylene". Very few home-compostable plastic items exist.

- Bio-based plastics are typically sourced from bio-based materials. Some bio-based plastics are chemically identical to fossil fuel-based plastics. Biodegradable plastics can be bio-based or fossil fuel-based and can typically be decomposed by living organisms such as bacteria, but won't all degrade in all situations. Not all biodegradable plastics are bio-benign.
- Temperature and humidity are challenges for organic recycling in Maldives. There can be collection sites throughout the community. A system of forced aeration can keep organic composting aerobic and odor-free. A rotating drum system is another option.

Community and Use: Engagement on Plastic Pollution

The CAP data confirmed that behavior change is needed. Zameela Ahmed from Live and Learn Environmental Education presented how behavior change can be motivated.

- Behavior change can be motivated through campaigns on a community and national level, tailored messages, and a link to personal values and research, such as on the health impacts of microplastics in the food chain and inhaling smoke from burning plastic.
- Behavior change can be socialized through increased behavior observability and accountability, the right messenger, promoting the norm, and encouraging institutional and public commitment.
- We can ease the change by decreasing friction, offering alternatives, using simple messages, and providing support plans and activities.
- Discussion points: Community leaders and island councils should be involved in creating waste management and reduction plans specific to their island.

Input: Global Plastics Treaty for People and Planet

Sophie Benbow, Marine Director at Fauna & Flora, discussed how the resounding support for the development of the UN Global Plastics treaty is being translated into action:

- A draft Treaty was published in September 2023, which will form the basis of upcoming negotiations. It includes control measures to address the full life cycle of plastic, means of implementation including financing, technology transfer, and capacity development, and implementation measures including national action plans, transparency, awareness raising, and commitments from the private sector.
- The Treaty aims to be inclusive, address the triple planetary crisis (climate change, pollution, and biodiversity loss), support waste hierarchy principles, facilitate a transition to a circular economy, stimulate innovative product packaging and delivery mechanisms, be science-led, precautionary and steer away from false solutions.
- Fauna & Flora are keen to support countries like Maldives to engage meaningfully in the Treaty negotiations so that the final outcome is implementable and relevant to the local contexts.
- Discussion points: The treaty will create a level playing field, by creating a framework that businesses and countries need to align with. Treaty creation and signing is a long process over the years, but the benefits will reach communities, so community views are being used to shape the treaty.

Leakage: Long-Term Marine Litter Monitoring and Assessment

Long-term monitoring allows for continued review of plastic pollution solutions, to see what is working and what needs further attention. Josie Russell, Senior Marine Litter Scientific Advisor at Cefas, discussed the importance of long-term monitoring of marine litter:

- We can use science to inform policy through monitoring of indicators, including beach litter, seafloor litter, fulmars, sea turtles, and microplastics.
- In the future, we should focus on the integration of technologies (in situ and models) and moving towards automated monitoring systems.
- Automated marine litter monitoring can include: remote surveys; training for automated classification algorithm; automating collection, analysis and reporting; automated reporting; informing action and policy
- Discussion points: A simple, repeatable citizen science methodology is needed, such as the Debris Tracker app, which can be customized to sample a specific list of items to show changes over time.

Funding Opportunities via Commonwealth Blue Charter

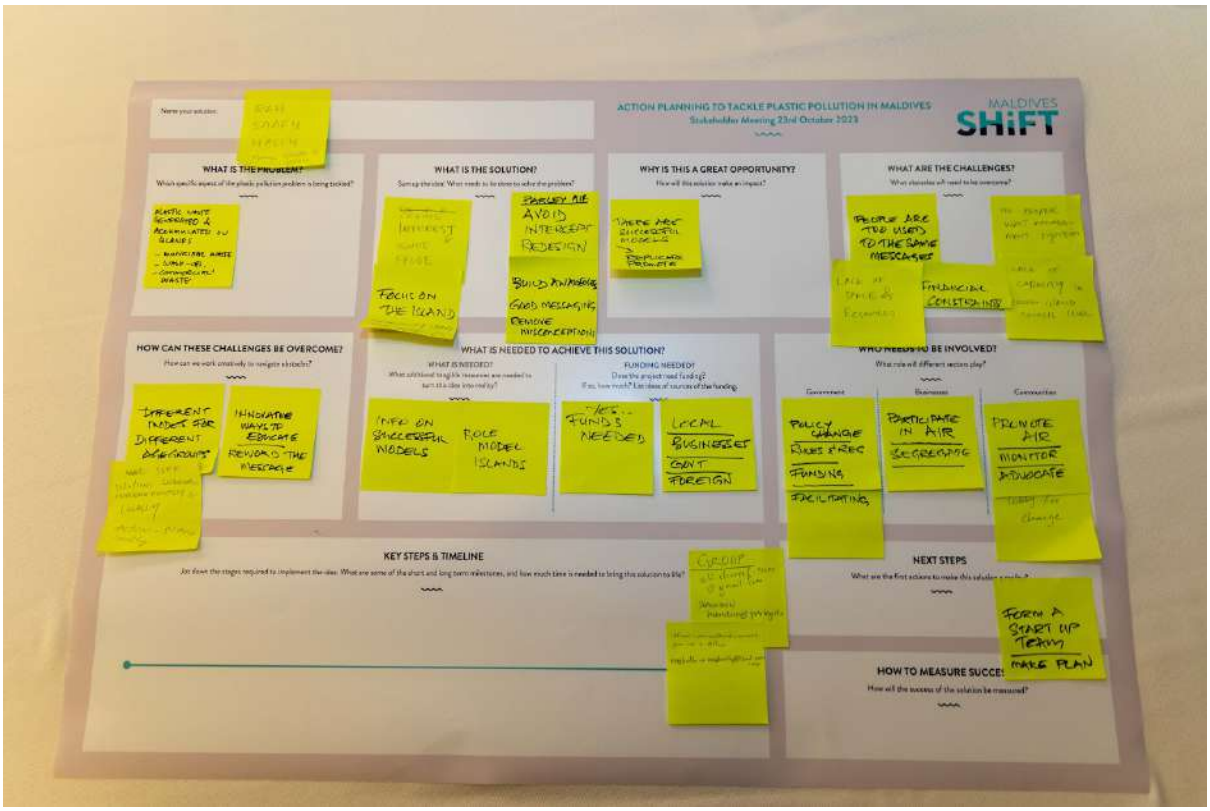
Heidi Prislan, Commonwealth Blue Charter Adviser at The Commonwealth, presented the funding opportunities from the Commonwealth Blue Charter Incubator:

- The Commonwealth Blue Charter Incubator goal is to assist governmental transition to ocean sustainability, through the development and support of equitable, climate-resilient projects.
- The Project Incubator is government focused, open to all Commonwealth countries that are members of the relevant Blue Charter Action Groups.
- The funding supports the full lifecycle of projects, including developing ideas, knowledge exchange, testing and implementing pilot projects, upscaling and proposals to larger international development funds.

Action Planning Workshop

The final session of the meeting involved the collaborative creation of action plans to focus on the key opportunities identified by the stakeholders present. Seven groups of participants worked together on action planning canvases to focus on one solution each to address challenges and form the next steps to implement the solution.

Figure A1. Collaborative creation of action plans to focus on the key opportunities identified by the stakeholders present.



Solution 1: Waste segregation at source, through color-coded bins/bags, to increase the collection of recyclables and avoid contamination

This action plan focuses on the problem of cross-contamination of recyclable plastic with wet waste and chemicals as a result of no proper waste management system or infrastructure, as well as the logistics and high cost of transportation. The proposed solution is to have separate collection systems for different waste streams in color-coded bin liners and raise public awareness of the issue. This would make an impact by recovering recyclable materials and reducing the amount of waste going to incineration/landfill.

Solution 2: Recycling infrastructure - segregation, transport logistics, waste storage space and equipment

With a lack of waste management recycling infrastructure, storage, and technology, as well as system barriers and coordination between stakeholders, this solution focuses on the segregation of waste at its source, improved transportation logistics, more waste storage space, and more waste management equipment. Policy formation, including action plans and KPIs, and training to increase institutional capacity are needed to implement this solution. This would make an impact by decreasing the plastic footprint and enabling waste to be turned into resources.

Solution 3: Water filtration systems on fishing vessels and an awareness campaign in the marine community

This action plan focuses on the problem of plastic pollution in the sea due to waste dumping by marine vessels and the lack of solutions for waste management, lack of awareness and alternatives, and lack of accountability. The solution suggested includes water desalination systems on marine vessels; recognition

of good practices; subsidized rates for desalination systems/installment basis payments; and ERS compliance audit reports on liveaboards for license renewal. This would make an impact by tackling one of the main causes of ocean plastic pollution, which is often neglected.

Solution 4: National awareness campaign to ignite pride, share strategy, and promote successful waste management models.
This action plan focuses on the problem of plastic waste generated and accumulating on islands, including municipal waste, washed-up waste, and commercial waste. The solution suggested is to shift mindsets and create behavior change through a national awareness campaign by igniting pride in residents of Maldives. The campaign promotes a community-led approach using the Parley AIR strategy - avoid, intercept, redesign - with good messaging and to remove misconceptions while showcasing existing successful waste management models that could be replicated.

Solution 5: A program in schools to reconnect children with nature
It was discussed that the Maldivian communities were disconnected from nature and the ocean, and a lack of awareness of the health concerns related to plastic. Schools were also struggling to find the resources, technology, and parental support to move things forward. The solution suggested is to create a system in schools to engage children with the environment and integrate it into the curriculum and school syllabus. This would make an impact by involving the whole community of teachers, children, and parents, developing a passion for nature in future generations.

Solution 6: Enforcing the Global Plastic Treaty through businesses to reduce plastic imports
This action plan focuses on Maldives' dependency on imports from small importers (by global standards), imported products having unnecessary plastic packaging - particularly food items - and with and lack of alternatives existing in the country. The solution suggested avoids relying on recycling, as it is not as easy as it seems to be in Maldives. Instead, we should look at prioritizing a reduction in plastic packaging imports and aligning with other small island developing states (SIDS) to create a stronger voice via the Alliance of Small Island States (AOSIS). This would make an impact as glass bottle refill did exist before, and the Global Plastic Treaty can be used to fine companies to change the way they work. This solution would need input from the Ministry of Environment (President's Office), main importers who are sole distributors e.g. Coca-Cola, SME retailers (most impacted by potential policy), and the general public.

Solution 7: National Monitoring Programme for plastic pollution through citizen science
This action plan focuses on the lack of national monitoring, with fragmented efforts, no centralized database or policy regulation to monitor, a lack of coordination/framework and common protocols, and a lack of capacity at the island council level. The solution suggested is a coordinated approach that includes a citizen science program, monitoring by research institutes (e.g. MMRI) and NGOs, a database and framework to translate science/evidence to policy, National Bureau of Statistics/Ministry of Environment waste data, and a web platform with protocols, info, training, and connections. This would make an impact by standardizing protocols, allowing data sharing, coalition, national research groups, and rating for sustainability.

Maldives SHIFT Stakeholder Follow-Up Findings

Stakeholder meeting participants were asked to choose the three most important and most likely solutions to lead to success in tackling plastic pollution in Maldives from a list of fourteen options, as well as the three least important and least likely.

The five most important/likely to succeed solutions chosen, and main reasons why:

1. Expand access to in-home water filters and water refill stations - to tackle the sheer number of plastic bottles being used instead of tap water. This opens the conversation around public engagement on water safety being required.
2. More support for businesses to identify SUP-free alternatives available for import - with an emphasis on finding affordable alternatives, while educating companies on the benefits and making sure the government can help with this.
3. Increase education and awareness campaigns - to encourage people to make changes for the health of themselves, their community, land, and sea.
4. Expand the Single-Use Plastic Phase-Out Plan to include more items to be banned for import - there needs to be support from the government to help lower the amount of plastic coming into the country.
5. Establishing reuse systems with vendors (such as glass bottles being returned to producers) - encouraging businesses and individuals to reuse instead of trying to take all the rubbish away would make a significant difference to the volume of waste and transport challenges.

Table A1. The results from the survey when stakeholders were asked for the three most likely and least likely solutions to lead to success in tackling plastic pollution.

Solution	Total Most	Total Least
Additional tourist tax to contribute to waste management	0	22
Build waste-to-energy / incineration infrastructure	5	5
Develop recycling infrastructure for metals eg. aluminium	5	6
Develop recycling infrastructure for plastics	9	7
Encouraging individuals to bring their own cups and containers	1	15
Establishing reuse systems with vendors (such as glass bottles being returned to producers)	10	3
Expand access to in-home water filters and water refill stations	15	0
Expand availability of compostable alternatives and infrastructure	5	7
Expand the Single-Use Plastic Phase Out Plan to include more items to be banned for import	10	3
Extended producer responsibility to share cost of waste management	5	10
Increase education and awareness campaigns	10	5
More support for businesses to identify SUP-free alternatives available for import	11	3
Ongoing plastic pollution monitoring and assessment	4	4
Segregation of waste at the source	6	6

The five least important/likely to succeed solutions chosen, and main reasons why:

1. Additional tourist tax to contribute to waste management - there is already a tax in place and there needs to be accountability and awareness within the community to make a change.
2. Encouraging individuals to bring their own cups and containers - there needs to be more education before trying to implement something like this.
3. Extended producer responsibility to share cost of waste management - seems unlikely to get the producer on board at this stage, compared with other solutions.
4. Develop recycling infrastructure for plastics - for a country with limited land space, resources and through-put of items this seems like an unlikely option.
5. Expand availability of compostable alternatives and infrastructure - concern for the cost of these options and a lack of interest/education on why it is important.

Discussion points and feedback from local stakeholders at the Stakeholder Meeting have been incorporated into the CAP process to ensure the findings and proposed opportunities are specific to unique local challenges in Maldives. Hurdles were highlighted, additional solutions identified and priorities in the next steps were heard and recorded. Overall, the Stakeholder Meeting provided an excellent and unique chance for stakeholders from different sectors to share knowledge and connect.

Despite the significant challenges in the Maldivian context, stakeholders are engaged in and enthusiastic about finding new ways to reduce plastic pollution and protect their local environment.

Participants rated the workshops overall 4.3 / 5 with many wanting to collaborate further in the future.

Semi-Structured Interview Guide

Core Questions

This question set can be used as a starting place in most key influencer interviews and should be adapted based on additional community concerns.

Tell me more about your organization's work and your role.

Do you feel plastic pollution is a problem for your community?

- If yes, how does it affect your community?
- If not, why not?

Do you know about any efforts in your community to provide alternatives to plastic? *[You can provide examples to clarify if needed. Examples may include reusable bags, reusable food ware, compostable products, or others observed in-store surveys.]*

- If so, how have you seen the community respond to these alternatives?
- If not, are there alternatives you would like to see offered in your community? Why do you think it is difficult for your community to use that now?

What do you feel the level of awareness is around plastic pollution in your community?

Are there local policies on product packaging or waste management in your community or for your business? *[If this information is already known from background research, you can skip to the questions below.]*

- *[If policies don't exist,]* are there policies you think should exist in your community?
- *[If policies do exist,]* would you say this policy is enforced for businesses/residents in your community?

If you could wave a magic wand and change the way plastic is used or waste is managed in your community, what would you do?

Additional Questions for Government Officials

Some answers to these questions may already be known through background research. Where possible, it is helpful to clarify information obtained online with a local official. To shorten the process, you could summarize your current understanding of the system and ask for confirmation and clarification rather than following the questions below in a step-by-step way.

How and where is your waste managed? (e.g., landfill, recycling, etc. by % if possible)

Describe the current waste management system in your community or for your business.

- Who collects waste in your community for households? What is the frequency of collection?
- How is it collected (door-to-door, community dumpster, etc.)?
- Does everyone in your community have access to waste collection? If not, what are the biggest obstacles to reaching 100% collection?
- How is waste collection paid for in your community? If there is a cost to households, what is that cost? Is this cost prohibitive to members of your community receiving waste services?
- What does the waste collection look like for multi-family housing units? (Is it collected by private haulers? Is adequate collection capacity provided?)

- What does the waste collection look like for businesses and commercial properties? Is it collected by private haulers?

Is there recycling in your community? If so, describe this system. What percentage of waste is recycled in your community?

- What items are accepted for recycling in your community?
- Is your recycling single-stream or source-separated? If recycling is separated, what categories is it separated into?
- Do you have challenges with contamination in your recycling streams? What are typical contamination levels?
- Are there recycling education efforts in your community? Which groups are promoting recycling education? Are there any particular messages you have found very effective or not effective at all?
- Who collects recycling in your community? Is there informal sector involvement?
- How are recyclables collected in your community (door-to-door, community recycling bin, drop-off centers, etc.)?
- Do households need to sign up to access recycling services or is it automatic? What does the enrollment process look like?
- What is the frequency of collection?
- Does everyone in your community have access to recycling collection? If not, what are the biggest obstacles to reaching 100% collection?
- How is recycling paid for in your community? If there is a cost to households, what is that cost? Is this cost prohibitive to members of your community receiving recycling services?
- Is recycling more costly than landfilling in your community? Are you able to profit from the sale of recyclables?
- If there is informal sector involvement, describe this system. How does your community view the informal sector? How do you view the role of the informal sector?
- Do commercial properties like businesses and multi-family units participate in recycling? Is recycling required for commercial properties? If businesses do not participate in recycling, what do you think the obstacles to recycling are?
- Where are recyclables taken after collection?

Is industrial composting available in your community?

- If yes, how are organics collected and processed? Are biodegradable plastics accepted in this stream? Do you have challenges with contamination in the organics stream?
- If not, what are the biggest challenges with composting in your community?

What is the biggest source of waste in your community? (industry, tourism, households, etc.)

Does your community face challenges with illegal dumping? If yes, where does this typically occur? What types of materials are being illegally dumped?

Does street sweeping or gutter cleaning occur in your community? How often does this occur?

Do you have current data on waste generation per capita and waste characteristics in your community? If so, can you provide this to us?

<u>Additional Questions for Environmental Non-Profits</u>

This question set is specifically adapted for groups conducting cleanups and environmental awareness activities. There may be other non-profits that are key influencers in your community, and these questions may need to be adjusted accordingly.

How often do you organize cleanups in your community? What do participation levels in these cleanups typically look like? What age groups and types of people typically volunteer?
What types of debris do you most commonly find during cleanups?
Do you collect data during your cleanups? Could you share that data with us?
Are there environmental education messages that have resonated particularly well in your community or messages that have not worked?

Additional Questions for Waste Management Companies

What is the biggest source of waste in your community? (industry, tourism, households, etc.)
How do you haul waste? What type of vehicles do you use to haul waste?

- Who pays for waste hauling services? (Sometimes it is cities or private residences or businesses.)

Where is waste taken after collection? (transfer station to landfill, waste to energy facility, etc.)
[Landfill or dumpsite] Is waste taken to a designed landfill? Does it have environmental controls like a liner, leachate treatment system, and methane gas flares?

- Who manages this landfill (private company or municipality)?
- What is the tipping fee to dump waste (cost of dumping per amount)?
- Is the waste compacted and covered? If so, how often?
- On average, how much waste is this dump site receiving per week (or per day or month, etc.)?
- Does this landfill receive waste from outside your community as well?
- When was this site opened?
- How many more years is this site estimated to last for your community?
- Do you know where the waste will be put once this dump site is full?

Are there waste pickers who work on this dump site? If so, how many? What are they collecting?

- How does your community view the informal sector? How do you view the role of the informal sector?

Are there other landfills in your area? (i.e. for hazardous waste or construction & demolition waste)
What is the biggest difficulty with managing waste in your community?

Additional Questions for Hotels

Who are your guests? How many guests do you have on a typical night? In high season? Low season?
What plastic items do you provide to guests? (breakfast items, shampoo bottles, etc.)
Was there a time when you did not provide products in plastic? How have you seen things change?
How do you deal with waste produced in your business? Do you recycle or compost? If yes, are there challenges with recycling or composting? If not, why not?
Do you use any alternatives to plastic?

- If so, why did you switch? How have your guests responded?
- If not, do you have ideas for alternatives you could use? Why is it difficult for you to use that?

Do you feel environmental issues are a priority for your guests?

Can you provide estimates of waste generation (how often you empty your dumpster and dumpster capacity)?

Additional Questions for Stores and Restaurants

Who are your customers? How many customers do you have on a typical day? In high season? Low season?

What is the main source of waste generated in your business?

How do you deal with waste produced in your business? Do you recycle or compost? If yes, are there challenges with recycling or composting? If not, why not?

Do you use or sell any alternatives to plastic?

- If so, why did you switch? How have your customers responded?
- If not, do you have ideas for alternatives you could use? Why is it difficult for you to use that?

Do you feel environmental issues are a priority for your customers?

Can you provide estimates of waste generation (how often you empty your dumpster and dumpster capacity)?

Table A2: Full List of Debris Tracker Litter Items and Associated Material Categories

Material	Items
C&D Materials	Aggregate & Brick Bolts, Nails, and Screws Building Materials Lumber Other C&D
Cloth	Clothing Towels or rags Fabric Pieces Other Cloth
E-Waste	Batteries E-Waste Fragments Wire Other E-Waste
Fishing Gear	Buoys and Floats Fishing Line Other Fishing Gear Plastic Net or Net Pieces Plastic Rope
Glass	Glass Bottle Glass or Ceramic Fragments Other Glass
Metal	Aluminum Foil Aluminum or Tin Cans Foil to-go container Metal Bottle Caps or Tabs Metal Fragments

	Other Metal
Organic Waste	Food Waste Other Organic Waste
Other	Other Popsicle or lollipop Stick
Other Plastic Products	Bulk Bags Flip Flops or shoes Plastic String, Tape, or Packing Straps Rubber Bands Trash bag Tires Balloons Plastic toys or balls Car Parts Hard plastic jugs or containers Other Plastic
Food-Related Paper	Paper cups Paper food box or container Paper plates or bowls Compostable paper cups Paper food wrapper Compostable food box or container Napkins Other Food-Related paper

Paper	Office paper and newspaper Tags, tickets, and receipts Corrugated Cardboard Paper fragments Other Paper
Personal Care Products	Blister Pack or other pill packaging Cotton Buds Ear plugs Personal Care Product Sachet or packet Toothbrushes Toothpaste or Other Product Tube Flossers Feminine products Needles and syringes Other Personal Care Products
Food-related plastic	Foam cups Plastic cups Compostable plastic cups Cup Lids Plastic Bottle Aseptic cartons Mini alcohol bottles Plastic Bottle Cap Plastic Food Wrapper Condiment packet or container Plastic Grocery Bag Sandwich or snack bags Plastic Utensils

	Straws Foam to-go container or clamshell Plastic to-go container or clamshell Compostable plastic container or clamshell Other Food-Related Plastic
Plastic Fragments	Film Fragments Foam Fragments Hard Plastic Fragments Rubber/ tire fragments Other Fragments
PPE	Disinfectant Wipes Disposable Gloves Face Masks Other PPE
Tobacco Products	Cigarette Packaging Cigarettes Tobacco Sachets or packets E-cigarettes and vaping Plastic cigar/cigarillo tips Lighters Cannabis-related waste Other Tobacco Product