Seychelles

Circularity Assessment Protocol (CAP): Plastic Leakage Results and Recommendations

A Report to the World Bank

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Executive Summary

Circularity Assessment Protocol (CAP): Plastic Leakage in the Seychelles

This report documents the work conducted by the Center for Circular Materials Management in the New Materials Institute at the University of Georgia in agreement with the World Bank. Background information was gathered from February 2019 – June 2019. Field work was conducted March 25 through April 5 in the Seychelles. The work was led by Professor Jenna Jambeck with two research engineers, Amy Brooks (PhD student) and Kathryn Youngblood (Staff Engineer). This work presented here supports the strengthening of the baseline data on plastic use (packaging) and leakage and provides related recommendations to the Government. This issue is directly associated with the social and behavior aspects of use and disposal by local communities which will facilitate policies and interventions specifically targeted at behavioral change. This data presented here informs actions and policies. Additionally, this work can help to raise awareness in the community and government on the issue of plastic waste management and leakage and support the longer-term global objective of reducing plastic leakage.

Items that had "value" especially from the levy program and value from the material itself tended not to leak out, e.g., PET bottles and aluminum cans. The ban on single-use plastic retail bags seems to be working – there were little to none found in the environment. What was found though, was a few of the non-woven geotextile reusable bags, which are still quite light and shaped in general like a single-use bag. There was the perception that these bags were not plastic, but they are plastic. However, it was still only a few that were found in the environment. Small plastic food bags were still found in the environment in Anse Royale and a few on Beau Vallon beach.

The ban on expanded polystyrene (EPS) to-go ware seemed to be working. Very few items (maybe only one) made of EPS were found. The new to-go ware is made of pressed board, but the government should examine them closer to determine if they are lined with plastic. Containers and materials that don't have value, like film good wrappers, small clear bags for food, and single use-individual cartons (e.g., Tetra-Pak), were commonly found in the litter.

The density of litter was highest in more urban areas, but hidden on back streets usually. Of the aggregated sites, Anse Royale had the highest density of litter at 3.12 items/m^2. The next most dense was Gand Anse, followed by Victoria, where many streets were quite clean since they are swept by the municipality. This area also had very clean gutters, which is often where trash can aggregate if it is not collected or cleaned.

Litter also often appeared by a store (refinement of the density calculations and mapping of stores and infrastructure will provide even further insight on this). Or litter densities were higher where no

one was looking, watching or areas cleaned. The walking path in Anse Royal behind a neighborhood and near the schools/university had the highest density of litter for the transects. Figure 3 shows a map of the litter densities over 100m segments and also the locations of stores and infrastructure within the transects. The beaches that were visited, were relatively clean. Beau Vallon (0.12 items/m^2) and Cote D'Or (0.04 items/m^2) had very little litter in comparison to the other sites.

The government and administration were very supportive in addressing this issue and meeting with the research team to share information. Since three times as many tourists come as residents live in the Seychelles, hotels and rental properties could be significant sectors in contributing to waste and recycling. This was explored further in meetings with two major hotel chains.

The landfill included waste pickers that appear to be marginalized and were previously called "scavengers" – they said this might change after this work was conducted, the proper term is to call them "waste pickers" – supplying some sense of dignity. Open plastic burning was observed at the metal and construction waste management area. This does not appear to be a common theme in the area though**.**

Based upon the data collection, field work, interviews, and results some recommendations can be made.

1. NGOs appeared to be interested in partnering to spearhead educational campaigns around proper waste management on the islands and could be good partners in these types of campaigns.
    a. Anti-littering campaigns, recycling promotion (if appropriate), the reasons for plastic/product bans (protect the ocean/env.), single-use plastic reduction, etc.

2. Communicate a clear waste management plan with specific dates and milestones to community stakeholders, e.g., the implantation of the glass levy
    a. E.g., a workshop involving stakeholders could be hosted to get input and information from all relevant island perspectives on island waste management

3. Hotels could be a leader in upstream waste reduction and waste segregation efforts (overall high waste generation rates, some hotels are engaged and interested in waste management and plastic)
    a. E.g., The government could consider ways to promote waste reduction and segregation to hotels and tourist related businesses

4. A more detailed citizen survey be undertaken by experts in waste management in partnership with students at the University of the Seychelles, which would also develop local research capacity.

5. Promote the use of the mobile app *Marine Debris Tracker* to continue data collection and monitoring on the islands by NGOs, the University, etc.
    a. e.g., Areas of litter hotspots could be "adopted" by community groups

b. Data could be easily collected and available instantly to government on the outer islands where more cleanups are occurring (Alphonse, Aldabra, etc.) and there is a lack of continuous data.

6. Consider that PLA "compostable" plastic, will only biodegrade in an industrial compost facility, not in the open environment or the ocean, so this material is still a plastic pollution item if littered.

7. Consider the development of a Marine Litter Action Plan (use the data in this report (plus more is desired) as a baseline to compare against in the future after further interventions). Outer islands seem to be deposition sites for plastic, so developing a plan for the removal of that litter could have a positive impact.
    a. Litter reduction, monitoring of outer islands, Drone technology, etc.

8. Even if solid waste management is perfected for domestic waste in the Seychelles, unless global and nearby sources are addressed, plastic will continue to wash ashore on the outer islands.
    a. Further work is needed to understand the sources, fate and transport in the ocean, and management from a regional perspective in order to address plastic marine litter in the region.

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Introduction

Background

This report documents the work conducted by the Center for Circular Materials Management in the New Materials Institute at the University of Georgia in an agreement with the World Bank. Background information and a literature review was conducted from February 2019 – June 2019. Field work was conducted March 25 through April 5 in the Seychelles. The work was led by Professor Jenna Jambeck with two research engineers, Amy Brooks (PhD student) and Kathryn Youngblood (Staff Engineer).

The Republic of Seychelles faces all the typical challenges of Small Island Developing State (SIDS) that suffer disproportionately from the effects of climate change. Seychelles is highly susceptible to natural disasters such as floods, storm surges, tropical cyclones and landslides, which is further exacerbated by impacts of climate change and more specifically, sea level rise. Seychelles is particularly susceptible to rising seas since many of the 115-strong archipelago islands are low-lying elevated reefs that are less than 16 feet above sea level. Flooding is the most significant risk in the main islands of the Seychelles, accounting for 88% of the average losses estimated per year due to disasters (earthquakes, flooding and tropical cyclones). Such disasters result in almost US$2.8 million direct losses per year, with over US$ 640,000 in emergency costs.

Management of waste (solid and hazardous) is another significant challenge faced by Seychelles. Primarily as a result of systemic issues such as land scarcity, lack of economic resources and expertise in the field of waste management. Seychelles currently generates about 73,000 tons of waste per year, and with a high economic and population growth, it is expected to increase by 50% by 2030. Marine plastic debris swept across with the ocean currents primarily from South-East Asia is also a major contributor to the countries waste management which is big cause of concern, especially for the marine environment and fisheries.

This project was conducted in the context of a number of related initiatives, including:

- A current World Bank project in the Seychelles is documenting the solid waste management (SWM) infrastructure to understand the impact of disaster on coastal SWM and infrastructure. It aims to provide a diagnostic designed to define potential interventions for policy reform, alternative options for mitigating the forecasted climate and weather related risks and strengthened institutional capacity for managing the risk. The study is employing a multi-sectoral integrated and holistic approach to stimulate informed decision making and targeted stakeholder engagement.
- In parallel, the European Union is supporting the Government in preparing a strategic document (Solid Waste Master Plan) that will ensure that the management of solid waste in

an integrated manner through the right policy, infrastructure, and capacity (financing and human resources) to implement advanced, solid waste management programs that will respond to the needs of the country for the forthcoming 25 years.

- The Bank is also developing a coastal resilience and coastal management plan that will likely include nature-based components in combination with gray infrastructure to address changing coastal morphology, and erosion, etc. and potentially using hybrid or upscaling coral restoration. Other available resources include an open disaster risk assessment with open geospatial data, hazard exposure and vulnerability, new fluvial flood maps, watersheds and rivers, and data on coastal inundation.

Literature Review

Solid Waste Management

As a small island, Seychelles biggest challenge when it comes to waste management is space - Seychelles has extremely limited land available for storage of solid waste. Landfilling rates are increasing annually, with the primary landfill on the main island of Mahe expected to reach full capacity within the next decade (USYS TdLab Transdisciplinary Case Study 2016). Increased tourism and economic growth are tied to rising waste generation rates and the rapid use of valuable landfill space. Simultaneously, the limited waste quantity on a small island nation makes the economics of recycling challenging (Talma and Martin 2013). Government policy does allow for recycling of PET bottles and aluminum cans; a one Seychellois rupee levy is charged to importers when these items (or in the case of PET bottles, preforms) enter the country. Revenue from the levy is partially used to fund redeem centers, businesses where bottles and cans can be returned for a small payment. While regular citizens can, and do, save their bottles to bring to the return center, the success of this system is largely dependent on the informal sector (USYS TdLab Transdisciplinary Case Study 2016).

For other household waste, collection occurs at roadside communal bins where residents deposit waste; the hilly topography of the island makes collection at the household level impossible. Currently this work is contracted out to a company called STAR. Individual households do not typically pay a collection fee for their waste, although business do pay to transport and landfill their waste (USYS TdLab Transdisciplinary Case Study 2016). There is no separation of recyclable waste in the waste collection system, so bottles and cans often end up in the landfill where they are sometimes retrieved by informal waste pickers. In additional to collection at the bins, the government also pays contractors to sweep populated streets and beaches daily, although the system for collecting this waste once swept is unclear.

The government of the Seychelles has been proactive in policy around plastic pollution, primarily through the mechanism of controlling what materials are allowed to be imported to the island. Plastic bags, plastic utensils, and polystyrene boxes are all illegal to import, manufacture, distribute, or sell in

the Seychelles (Environmental Protection Act 2016). However, they are challenged in finding affordable alternatives that may or may not degrade in the environment; many products selected to replace plastics are compostable, not biodegradable, and there is no system for collection or processing of industrial-scale composting on the island.

In addition to government action, some local corporations have included waste management and reduction efforts in their corporate social responsibility programs; Seychelles Breweries, for example, has set a goal of zero waste to landfill by 2015, including for their operations processes. SeyBrew also has a successful return scheme for glass bottles produced by the company which was established in the 1970s; two additional rupees are paid when purchasing a bottle, and the bottle can be returned to any vendor of SeyBrew for a return of the deposit (Talma and Martin 2013). The system is effective both socially, as the return locations are plentiful and easily accessible, and environmentally, largely because it is not a recycling program, but a reuse program – SeyBrew washes and refills the bottles.
Despite progressive policy and some corporate engagement, landfilling rates in the Seychelles continue to increase at a rate of up to 30% each year (USYS TdLab Transdisciplinary Case Study 2016). There are still vast quantities of consumer plastics entering the island national on an annual basis, of which only a small fraction is currently recycled.

Marine Litter

While mismanaged solid waste on land contributes to marine litter in the ocean (Jambeck, Geyer et al. 2015), marine litter also washes ashore to add to the burden of domestic waste management in locations around the world. Marine litter often washes ashore on remote islands, these islands become deposition sites for plastic based upon floating plastic and ocean currents. Some of the highest density plastic on land has been found on remote islands like Midway (Hawaii Atoll), Easter Island (Chile, Pacific) and Henderson Island (South Pacific) (Ribic, Sheavly et al. 2012, Hidalgo-Ruz and Thiel 2013, Lavers and Bond 2017). The Seychelles is comprised of about 115 islands in the India Ocean, including Aldabra, a UNESCO World Heritage site since 1982 (UNESCO) where floating plastic washes ashore, but has not been previously characterized. In February and March 2019, Clean Up of the island began with the Aldabra Clean Up Project (Aldabra Cleanup Project 2019), a project involving the Seychelles Islands Foundation, The Queen's College, Oxford, students from the University of Oxford and young volunteers from the Seychelles. The project is reportedly quantifying the amount and types of plastic on the atoll and looking for a sustainable way to process it, as well as raise awareness on the situation in Aldabra and promote the reduction of plastic waste more broadly (Aldabra Cleanup Project 2019). This work will begin to help identify sources of marine litter in the Seychelles from outside the country, but more data and collaboration is needed with local authorities to determine the best way to manage the plastic marine litter collected and how to address the global sources of the plastic washing ashore.

Some data has been collected on sources of plastic ending up on the Seychelles shores from other locations. In 2013, Alphonse Island, one of the outer islands in the Seychelles was investigated in detail for marine litter quantity, composition and sources. A total of 4,743 items were found, with a total mass of 142 kg (Duhec, Jeanne et al. 2015). Small plastic fragments were most commonly found item (by count) making up 26% of the collected items. Other relatively abundant items were identified as 'Hard plastic' (18%), 'Plastic caps' (13%) and 'Foam sheets' (11%). 96% of the marine debris collected was made of plastic, with fishing items making up only about 2% of what was found. About 38% of the debris can be traced back to a land-based source, with then 43% attributed to general/unknown sources and the remainder being maritime (Duhec, Jeanne et al. 2015). While much of the plastic pollution was land-based, given the lack of significant local population, the litter had to drift in from other locations. The research (including modeling) shows that the litter on Alphonse likely originated in South East Asia, with Somalia and other parts of eastern Africa as other sources that will likely grow. Other items came from the India/Sri Lanka region, and also potentially, Madagascar (Duhec, Jeanne et al. 2015).

Another comparable study on a remote island not in the Seychelles was on St. Brandon's Rock (SBR), in the Indian Ocean, located approximately 1380 km away from the Seychelles. The researchers collected more items than in Alphonse, approximately 50,000 items, 79% of which was plastic. They identified Southeast Asia, the Indian sub-continent, and the countries on the Arabian Sea as most probable sources. Items were similar to those found on Alphonse Island as well: flip-flops, energy drink bottles, and compact fluorescent lights (CFLs) were noted (Bouwman, Evans et al. 2016).

Overall, it is important to note that even if solid waste management is perfected for domestic waste in the Seychelles, unless global and nearby sources are addressed, plastic will continue to wash ashore on the outer islands. A better understanding of these sources, fate and transport in the ocean, and management from a regional perspective is important for the sustainability of the Seychelles for addressing plastic marine litter in the region.

Knowledge Gap

While the above activities focus on policies and infrastructure, a typical gap of knowledge tends to be associated with community and societal behavior regarding understanding and acceptance of the solid waste management cycle (including plastic waste). While strategic and policy changes can be instituted by Governments, successful (effective, efficient and timely) implementation is directly related to consumer and social attitudes and behavior, including their understanding, commitment and ownership. Additionally, the international community is increasingly recognizing that there is a new environmental paradigm – movement away from the Cradle-to-Grave methodology to the Circular Economy, which is a new way of thinking, designing, using and remaking waste materials rather than its disposal.

Filling the Gap

Professor and Director Jenna Jambeck and her team at Center for Circular Materials Management in the New Materials Institute at the University of Georgia have developed a Circularity Assessment Protocol (CAP), which is a standardized assessment protocol used to collect community-level data to inform country level statistics and national policies. The CAP characterizes seven community components: 1) inputs, 2) consumption, 3) product design, 4) use, 5) collection, 6) end-of-cycle management (including collection and waste management), and 7) plastic leakage into the environment. Various influencing factors drive this system including governance, economics, policy and legislation (e.g., bans, taxes, extended producer responsibility). Furthermore, multiple stakeholders exist at every level of the CAP influencing the complex system and these include citizens, government, industry, NGOs and academia. While the hub and spoke model illustrates the CAP (Figure 1), it is a complex system with components inherently interconnected to each other and to life-cycle impacts beyond each component. While the CAP is a framework approach to addressing marine litter originating from land-based sources, it can also include data collection for marine or water-based sources through parallel research questions, and the quantity of leakage from this sector will be characterized during litter assessments (e.g., if fishing gear is an issue, it is typically evident on litter surveys on land as well).

The framework supports points of intervention and actions, including guidance on most effective impact to improve circularity. The CAP can help to inform a community by giving them a baseline assessment to work from and direct potential actions to take to improve the areas that most need it (and that are affordable).

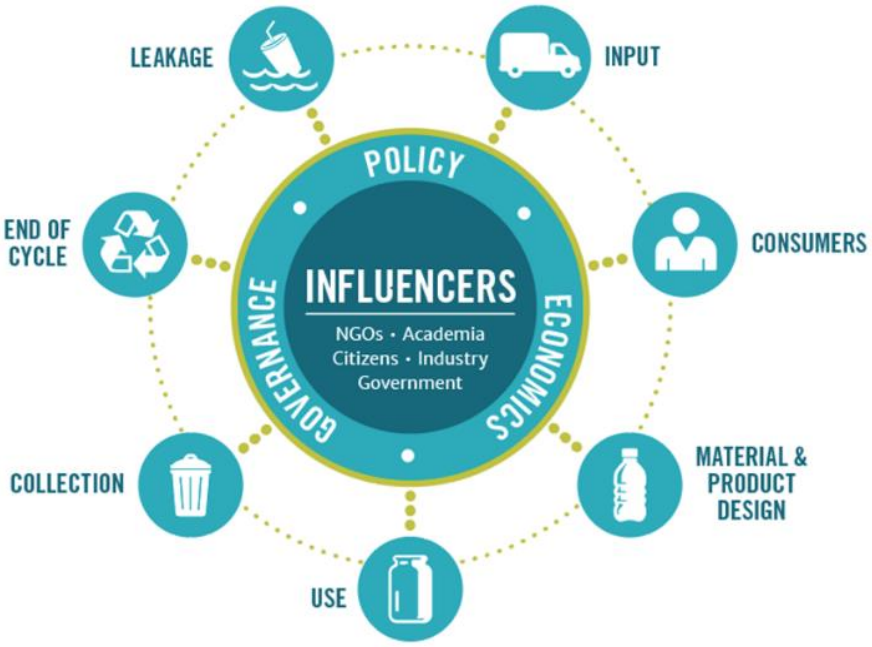

Figure 1. Circularity Assessment Protocol Concept

While the current Bank and EU activities are at the strategic policy level and support the Government to define policies and good practices related to solid waste management and waste infrastructure, this report will allow a focus on the understanding of solid waste and plastic management *through a social lens*. This will provide an understanding of peoples' behaviors (both local and transient) which will inform policy through

i. strengthening information and awareness campaigns
ii. incentivizing NGOs, small-scale industry/ commerce, etc.
iii. crowd-sourcing data collection which will support future monitoring of plastic and litter

While the assessment of Solid Waste Management in the Seychelles conducted by ETH Zurich in 2016 previously cited here did include some consumer surveys, these surveys were generally limited to consumer awareness and purchasing patterns. This work notes the "need for a more detailed understanding of environmental awareness and waste perception.".

Objectives

This work supports the strengthening of the baseline data on plastic use (packaging) and leakage and provide related recommendations to the Government. This issue is directly associated with the social and behavior aspects of use and disposal by local communities which will facilitate policies and interventions specifically targeted at behavioral change. The assignment will generate data which will inform actions and policies. Additionally, such an assignment will raise awareness in the community and government on the issue of plastic waste management and leakage and support the longer-term global objective of reducing plastic leakage.

Methods

Site Selection

The CAP site selection protocol was applied country-wide to find sampling locations in the Seychelles. In order to randomly choose sampling locations, population density data from LandScan™ (https://landscan.ornl.gov/) was extracted and analyzed with Geographic Information Systems (GIS). The locations of field sampling areas were then limited to the most densely populated fifth of the islands.

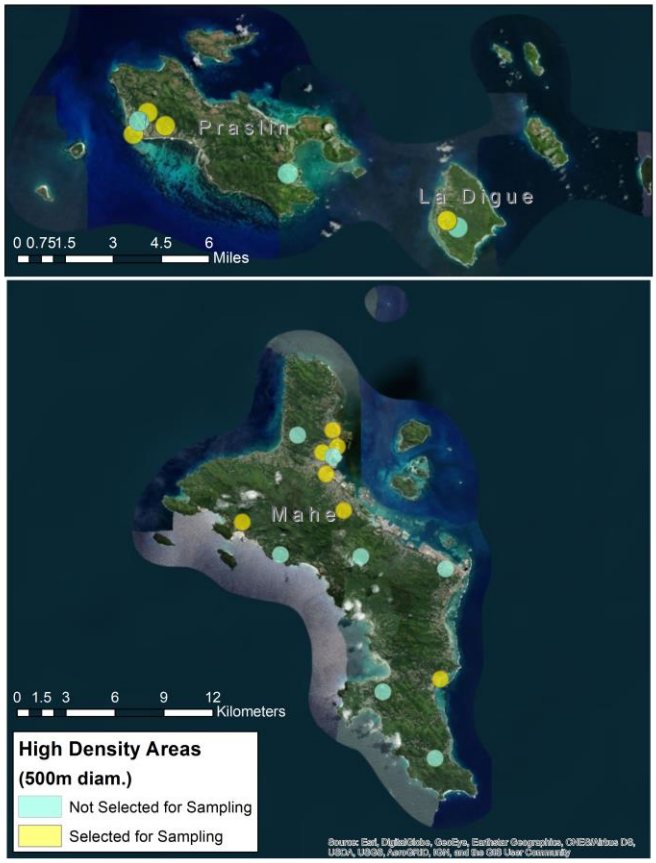

Figure 2. High Density Population Areas Identified for Sampling (30 transects selected from these areas).

From the most densely populated areas, circular areas 1km in diameter were randomly generated for field sampling. Within each community identified as having the densest population, the CAP team conducted a minimum of three (3) 1m x 300m transects in outer communities, and nine (9) in the capital of Victoria (one cut short to 200m). Coverage of the most densely populated areas of each community was dependent upon the distribution of the population. In the original proposal, it was specified that only two communities would be studied, but in the population density analysis, three communities of focus were identified on Mahe and one each on Praslin and La Digue, so a total of 6 communities were characterized, plus one beach on each island (See Appendix).

Field work

The field work was conducted on March 25 though April 5, 2019. Data collection consisted of collecting quantitative GPS/mapping data of statistically relevant locations using Marine Debris Tracker (for litter/leakage). Litter items such as food wrappers, cigarettes, cups, straws, bottles, etc. were logged (and not collected). Stores that fell in the transects were mapped and for each transect, if there was a store, the team entered the store to find out what they were selling, especially plastic packaged items and single use plastic items. When permission was granted, photos were taken. Cafés, coffee shops and to-go food places, as well as vendors including street vendors and informal

vendors were mapped in each transect as well. For solid waste management infrastructure, trash cans and recycle bins and their status (how full, filled with what, photographs, etc.) were mapped, as well as any other infrastructure managing waste, recycle centers, landfills, junk shops, waste pickers, and any other formal or informal waste or recycling activities.

Qualitative data was collected by conducting semi-structured interviews with people involved in solid waste management (government or community leaders, or those directly managing waste formally or informally), non-governmental leaders, and other community members and leaders. In addition, a survey was developed for hotels, so that data could be gathered on tourism waste generation and perspectives. Survey questions for the hotels were:

1. Do you see plastic waste on the beach near your hotel? Does it wash up here or is it littered, and if so, by whom?
2. Is the beach near your hotel cleaned regularly? If you finance this, could you tell us the cost to your institution?
3. How large is your institution? How many tourists stay with you on a typical day? Do tourists have an awareness of recycling and plastic pollution?
4. Do you have estimates on waste produced per day or per week at your establishment? What is the economic cost to your establishment of disposing of your waste? What company manages your waste disposal operations?
5. Do you have any current efforts to recycle or reduce waste? What are your biggest obstacles to reducing and recycling waste?

Data analysis

Quantitative data was analyzed using GIS (e.g., ArcGIS) and Excel. For each transect, data analyzed includes the number, location and characteristics of litter items found, the number and location of stores and vendors selling plastic packaged items, the origination of major brands sold in the communities, the number, the location and status of trash cans or recycle bins, the number and the location of to-go food and coffee shops. Lastly, the density of litter (items per unit area) was calculated for 100m sections of each transect to examine density changes over distance in each sampling transect and to correlate with potential sources of litter in each transect as well. Qualitative data was analyzed with NVivo software and coded to highlight the trends of common themes mentioned by interviewees in a grounded theory thematic analysis. Specific comments and quotes that illustrate the community issues and awareness about the issue were documented and are presented in this report.

Results

Quantitative Data

Mahe

Nine 300 m^2 litter transects were completed in Victoria including the following: an urban center of town with a variety of shops, restaurants, and tourist attractions, a commercial district adjacent to fish market, a street near pier and tuna processing facilities, and the outskirts of town not typically cleaned by street sweepers. Transect data for litter was also collected in three 300 m^2 transects along Beau Vallon beach, the main tourist area of the island. Three 300 m^2 transects were also completed in the community of Anse Royal, including the urban center of town along main road, a street adjacent to University of Seychelles, and a small short cut path off main road often used by both university and primary school students. In the luxury tourist area near NYS Village, another three transects were completed including one 300 m^2 beach front transect, and two transects through commercial areas including a canal leading to a large mangrove swamp.

Table 1. Litter Items and Density in Mahe Sample Sites

Item	Count	Percent of Total	Litter Density (count/m^2)
Victoria			**1.26**
Cigarettes	845	24.7 %	
Metal Bottle Caps	731	21.4 %	
Plastic Food Wrappers	628	18.4 %	
Plastic or Foam Fragments	286	8.4 %	
Plastic Bottle or Container Caps	256	7.5 %	
Total	**3,421**		
Anse Royale			**3.12**
Plastic Food Wrappers	918	32.7 %	
Metal Bottle Caps	636	22.7 %	
Plastic or Foam Fragments	354	12.6 %	
Cigarettes	223	7.9 %	
Plastic Bags (for food items, not retail)	173	6.2 %	
Total	**2,807**		
NYS Village			**0.91**
Plastic Food Wrappers	294	35.9 %	
Metal Bottle Caps	166	20.3 %	
Plastic or Foam Fragments	81	9.9 %	
Plastic Bottle or Container Caps	68	8.3 %	
Glass Bottle	33	4.0 %	
Total	**819**		
Beau Vallon			**0.12**

Plastic or Foam Fragments	55	49.5 %	
Plastic Food Wrappers	15	13.5 %	
Plastic Bags (for food items, not retail)	6	5.4 %	
Foam or Plastic Cups	5	4.5 %	
Straws	5	4.5 %	
Total	**111**		

Praslin

Three (3) 300 m^2 transects were completed along the main street in Grand Anse, adjacent to both commercial and residential properties. In addition, three 300 m^2 transects were completed along Cote D'Or Beach, near tourist accommodations and a bay where fishing boats dock.

Table 2. Litter Items and Density in Praslin Sample Sites

Item	Count	Percent of Total	Litter Density (count/m^2)
Grand Anse			**1.50**
Plastic Food Wrappers	400	26.7 %	
Metal Bottle Caps	353	23.5 %	
Plastic or Foam Fragments	238	15.9 %	
Cigarettes	218	14.5 %	
Paper and Cardboard	82	5.5 %	
Total	**1,499**		
Cote D' Or			**0.04**
Plastic or Foam Fragments	15	40.5 %	
Plastic Food Wrappers	10	27.0 %	
Plastic Bottle or Container Caps	3	8.1 %	
Fishing Lures and Line	2	5.4 %	
Metal Bottle Caps	2	5.4 %	
Total	**37**		

La Digue

Three (3) 300 m^2 transects were completed along the main road in the commercial center. Three 300 m^2 transects were also completed along the path and beach front in Anse Source d'Argent, one of the most popular tourist destinations on the island.

Table 3. Litter Items and Density in La Digue Sample Sites

Item	Count	Percent of Total	Litter Density (count/m^2)
La Passe			**0.61**
Plastic or Foam Fragments	66	8.51%	
Paper and Cardboard	36	4.64%	
Cigarettes	30	3.87%	
Plastic Food Wrappers	17	2.19%	

Straws	17	2.19%	
Total	**223**		
Anse Source D'Argent			**0.25**
Metal Bottle Caps	136	17.53%	
Plastic or Foam Fragments	134	17.27%	
Cigarettes	108	13.92%	
Plastic Food Wrappers	99	12.76%	
Glass Bottle	17	2.19%	
Total	**553**		

Qualitative Data

Field Work

The following activities were conducted while in the field to collect qualitative data for analysis. The team toured the landfill facilities and conducted informal interviews with waste pickers working on landfill face to collect PET bottles and aluminum cans. The team conducted interviews with various government stakeholders from the Ministry of Environment and Climate Change involved in crafting policy around plastic bans and enforcing illegal dumping and littering activities. The owners of the redeem centers in Anse Royale and Victoria were interviewed about quantities of plastic removal, business operations, obstacles to further expansion, and potential areas of improvement. The team interviewed non-profits active in efforts to reduce plastic pollution. Cultural attitudes around waste and best practices around conservation messaging and environmental education were discussed with the Blue Economy Research Institute at the University of Seychelles. The management of a hotel in Beau Vallon and an eco-lodge on another part of the island were interviewed about waste management practices, obstacles to improvement, and the impact of plastic pollution on tourism. Opportunistic informal interviews were conducted with fishermen at a fish market in Victoria on prevalence of plastic pollution and their waste management practices. Brand assessments of commonly littered items in grocery stores in Victoria, Anse Royal, Grand Anse and La Digue were conducted and further insights are given in the section on Product Sourcing and Packaging. A redeem center on La Digue was visited and informal opportunistic interviews were conducted with waste pickers at the redeem center to understand the volume of plastic recovered.

Thematic Analysis

This thematic analysis does not attempt to provide a representative picture of attitudes towards waste management in the Seychelles; rather, we used a grounded theory methodology to look for themes that emerged over the course of seven semi-structured interviews conducted with stakeholders of waste management on the island. These included two government officials, two hotels, two non-governmental organizations, and one redeem center. To protect anonymity on a

small island, names will not be used; quotations selected are not necessarily representative of any one group but are given here to provide key insights or demonstrate a key perspective on waste management on the island.

NGOs and Redeem Centers have spearheaded many of the education efforts around plastic pollution and proper waste management that have occurred on the island. There is frustration around government policy on waste management, specifically recent bans of plastic items which were replaced by plastic alternatives, without including an education component.

- "It takes a little bit of educating people… but [the government has] never done anything to educate people as to how we use [recycling bins]."
- "When the ban just happened, the ministry was really going on out about this biodegradable thing, this compostable thing, and people think if you just chuck these plastic cups on the road, they'll just biodegrade then."

The lack of emphasis on education efforts from the government side could perhaps be driven in part by a negative characterization of the willingness of the Seychellois population to manage their own waste as expressed by various government officials. Note that we did not find examples of extensive, monitored educational campaigns lead by the government to support this perspective.

- "I don't know if they understand what plastic is and most of the time they are not willing to understand."
- NGOs are ready and willing to partner and support government educational efforts. Lack of collaboration has historically led to frustration.
- "They're not using the help of NGOs. Amongst the NGOs in Seychelles, environment related ones are the biggest group... They could get us to do a lot of stuff with them, and they don't."

Government inaction over the glass levy has led to frustration and mistrust.

- "They're collecting the money, but the glass is going into the landfill. Nothing is happening to the glass yet… except putting the levy. So I'm hoping they use the money from the levy to buy the [glass crushing] machine. But, wait and see."

Government views on the future directions of waste management – moving towards waste to energy – do not align with those of redeem centers and NGOs and are in fact in some cases contradictory. The lack of a clear plan presents a challenge to NGOs in particular, which are serving as the primary source of waste management education on the island.

- "The last conversation we had with them was we want an incinerator, but we also want to separate waste. What do you want? Do you want to produce more waste to feed your incinerator or- ...If you want us to separate our waste, then reduce our waste."

The hotel sector appears quite willing to collaborate on downstream solutions like cleanups, but engagement with upstream waste reduction is varied.

- “We have really good collaboration with the hotels. When we cleaned up near a hotel, they'll always sponsor drinks and snacks because people love that.”
- “They even complain about the plastic bottles in the restaurants…. We put more recycling bins in public areas… Because guests like it.”
- “Our guests are here for a resort experience. They don’t care about recycling

Multiple stakeholders mentioned that the rise of consumerism in the Seychelles and the associated rise in waste generation rates is tied to a stigma around being about to consume plastic products as a sign of economic prosperity.

- “They think everything from overseas is better…I think it's also like they feel a bit privileged. So, maybe they can afford [it].”
- “One of the kids who have the reusable bottles is being teased for being poor… It's sort of almost seen as a status thing like if your family is a bit more wealthy, then you can afford to come with plastic bottles.”

Waste management is not seen as a respected profession in the Seychelles. Stigma or perceived stigma against both waste pickers and street sweepers emerged in interviews across multiple stakeholders. This could have interesting interactions with Seychellois decisions to litter and with the perception that people are unwilling to manage their own waste. Multiple stakeholders mentioned the waste picking community was doing this work only because they were addicted to drugs or alcohol.

- “To be honest I think its [waste picking] due to the drug problem… You know heroin on average these people need about two fixes a day and on average a fix is about 500, 600 rupees…Where else would you find 500, 600 rupees a day?”
- “It's like somebody's paid to do this. Now [littering] is providing income to Indian workers… collecting our waste on the side of the road. It's Indian people sweeping the roads.”

Product Sourcing and Packaging

A total of 78 stores were observed and mapped in the field work transects. Of those 78, five stores were entered and a brand audit and in some cases, semi-structured conversations, with the store owners were conducted. Some photographs were taken of popular products, that then were also observed in the litter and leakage of plastic on the islands (see Appendix). Many of the products sold in the stores surveyed are coming from the Middle East, South Africa, Southeast Asia, and Europe. Carton style (e.g., Tetra Pak) containers were heavily prevalent and in interviews, the government expressed specific challenges with regulating this type of packaging. But it is not currently recyclable

on the islands. All of the stores offered the non-woven reusable bags that are still plastic though (see the Appendix for representative photos).

Six grocery and convenience stores were assessed for the brand and material type of common product types. In total, 94 items were recorded, including brand, manufacturer, manufacturing location, and material type. Products included in the assessment included the three brands with the most shelf space from each product category; product categories included beverages (primarily PET soda bottles and TetraPak juice containters), personal care products (soaps and shampoos), and snack foods (potato chips, biscuits, candies, and yogurt containers, which we noted as a commonly littered item in our litter transects). As shown in Figure 3, brands observed in Mahe, Praslin, and La Digue originate from global companies. (Note: Company headquarters location is generalized to center point of the country).

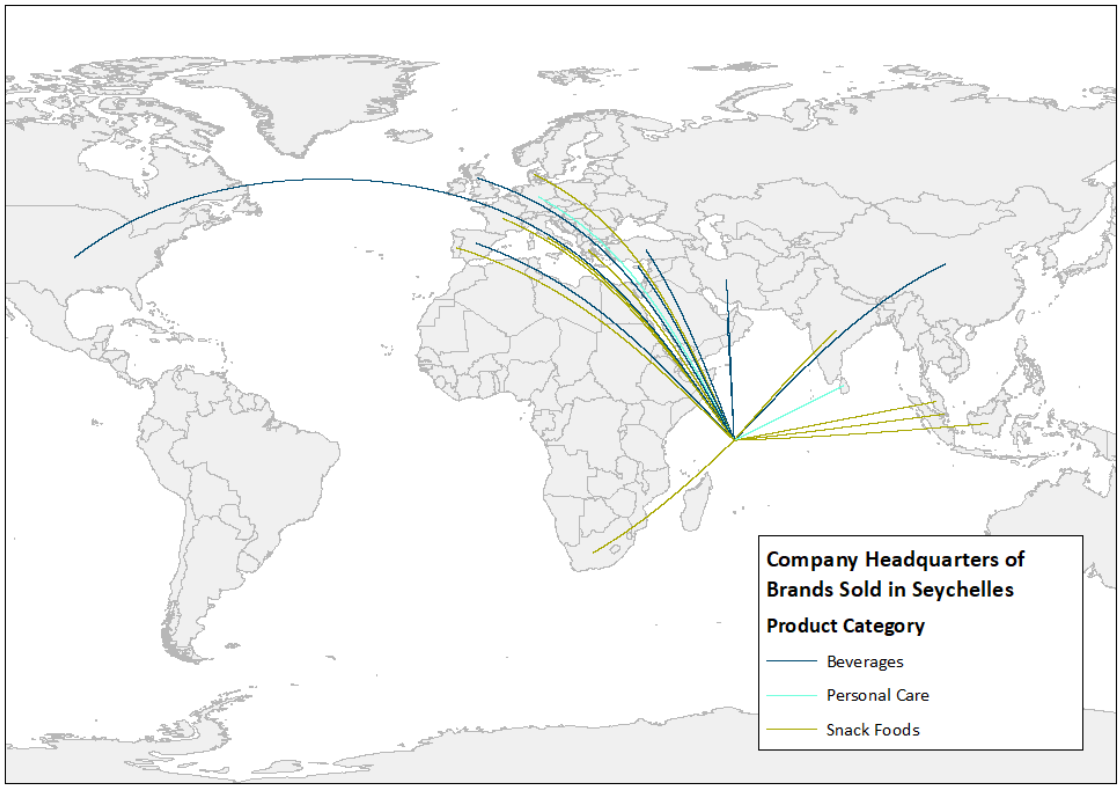

Figure 3: Brands observed in stores in Mahe, Praslin, and La Digue originate from companies around the world. Many brands found in the Seychelles are headquartered in Europe and Southeast Asia.

Snack foods are primarily originating from Southeast Asia, Europe, and South Africa; beverages are primarily originating from Europe, the United States, and the Middle East; personal care products originate from Europe. Across the snack food and personal care product categories, multilayer packaging which includes a layer of plastic was the most common packaging type. In the beverage category, soda was found to primarily be packaged in PET bottles, while juices were packaged in

TetraPak multilayer containers. While this study is not intended to characterize all product imports into the Seychelles, it offers an interesting illustration that the flow of plastic into the Seychelles stems, in this case, exclusively from external sources.

Hotel Surveys

A total of 102 hotels were sent the survey questions provided in Methods section (list in Appendix). A total of 11 hotels responded, although not all of them answered each question. When asked if plastic litter was a problem and if it was coming from people or washing up, three hotels said that their beach was mostly clean overall. These same three properties mentioned that their beach was cleaned by a company or them if any plastic litter is observed. Three (3) properties said that the source of litter is both people and washing up, 3 properties said that people (especially those partying on weekends and at night) were the main source, and 2 properties said that litter washing up was the main source.

When asked if they cleaned their own beach and how much this was, six hotels responded that the beaches were cleaned, but by the government, 3 replied that they cleaned their beaches in a landscape contract themselves, one replied that it was cleaned, but didn't say by whom and one hotel mentioned the beach was cleaned once a year in collaboration with an NGO. When asked if their customers were aware of the plastic pollution issue, 8 of the 11 respondents said they were, several mentioned their customers ask about waste separation and recycling, and one hotel mentioned they were plastic-free and their customers were aware of why. One hotel said awareness was around 50% and the two others didn't comment on awareness.

When asked what the waste generation rates were, no numbers were given except for three hotels, one of them being a very small hotel with self-serving apartments (and not restaurant), so waste generation rate is low. The quantities of waste per hotel per tourist per day are 0.56 kg/person/day (small apartment hotel), 4.07 kg/person/day, and 3.33 kg/person/day (the last two are full service hotels with restaurants. It should be noted that these are self-reported results and therefore could have bias and inaccuracies; however, these values do fall into observed quantities and trends with higher occupancy and higher star rating hotels often generating more waste.

As for the hotel programs, nine of the hotels gave an answer, and of these nine, all said they had some sort of program or awareness. Minimally, the plastic and aluminum were taken by staff to be recycled (and get the redemption). There were some comments on the lack of options for recycling more, and more easily, as well as lack of awareness by the general population about solid waste management and recycling. Two hotels mentioned feeding vegetable scraps to pigs. A couple comments quoted below.

- *Unfortunately, as far as I am aware of, there is no recycling system in Seychelles except for selected plastic bottles of Seybrew and local mineral water bottles. The very fact that there is no waste separation system is a major obstacle. In fact our guest are very invested in the waste recycling, they separate their waste on a daily basis [?] but unfortunately our system is not adapted. This having been noted we try as much as possible to avoid plastic material in our daily operations.*

- *Recyclables are sadly not collected /sorted by the local agency so our staff members take all plastic bottle to the local plastic recycling depot to collect the refund. Sadly there is no glass, paper/cardboard, aluminum, food or green waste recycling on La Digue (or even in Mahe as far as I am aware). This is very sad considering that a lot of items are unnecessarily going into landfill.*

- *Yes it will be nice to have a system in place but unfortunately we do not because all trash is mixed (plastic, papers, glass ect….) But the good thing is since the government introduce an increase on empty pet bottles and glass bottles, you would rarely see these item in the trash. To me plastic bags is our biggest problem.*

Discussion

Items that had "value" especially from the levy program and value from the material itself tended not to leak out, e.g., PET bottles and aluminum cans. The ban on single-use plastic retail bags seems to be working – there were little to none found in the environment. What was found though, was a few of the non-woven geotextile reusable bags, which are still quite light and shaped in general like a single-use bag. There was the perception that these bags were not plastic, but they are plastic. However, it was still only a few that were found in the environment. Small plastic food bags were still found in the environment in Anse Royale and a few on Beau Vallon beach.

The ban on expanded polystyrene (EPS) to-go ware seemed to be working. Very few items (maybe only one) made of EPS were found. The new to-go ware is made of pressed board, but the government should examine them closer to determine if they are lined with plastic. Containers and materials that don't have value, like film good wrappers, small clear bags for food, and single use-individual cartons (e.g., Tetra-Pak), were commonly found in the litter. The top item is food wrappers, so the sources are the stores and convenience stores, and then subsequently the people eating the snacks. While the government could require these "sources" (stores, etc.) have clearly marked trash cans in front of them, there is not enough evidence to say if that will help or not at this point. Tetrapack juice containers are heavily littered, this is because they don't have any value unlike the bottles and cans, so they are easily leaked. Street sweeping appears to be a superficial fix, some street sweeping was observed where the waste was then put just away from the sidewalk, in the woods, and even closer to waterways by putting off the street or sidewalk. The collection bins for residents could be monitored better – they seemed to be overflowing in certain areas and dogs getting in them to spread waste around, etc.

The levies are definitely working for PET bottles and cans, these items are being recycled and are not ending up littered. People are anxiously awaiting the glass levy to turn into a glass recycling program. Recyclers are stockpiling glass and have been for some time. Unlike PET and aluminum levy, which are based on numbers of bottles, the glass levy may need to be weight-based since having full bottles to return of glass is challenging. The Seybrew glass bottle reuse program works very well (outlined in detail in Literature Review) and should continue. Expansion of it to other drinks would be good, the glass return scheme seems to work better than recycling for glass. Although a lot of bottle tops are littered (those are metal).

Litter also often appeared by a store (refinement of the density calculations and mapping of stores and infrastructure will provide even further insight on this – correlation to be completed with future iterations of the data and potential publication in a journal). Or litter densities were higher where the areas were not serviced by municipal staff, e.g., street sweeping. The walking path in Anse Royal behind a neighborhood and near the schools/university had the highest density of litter for the

transects. Figures 4 through 7 show a maps of the litter densities over 100m segments and locations of stores and infrastructure within the transects. The beaches that were visited, were relatively clean. Beau Vallon (0.12 items/m^2) and Cote D'Or (0.04 items/m^2) had lower litter densities in comparison to the other sites. The list of all transects and images of all maps are available in the Appendix.

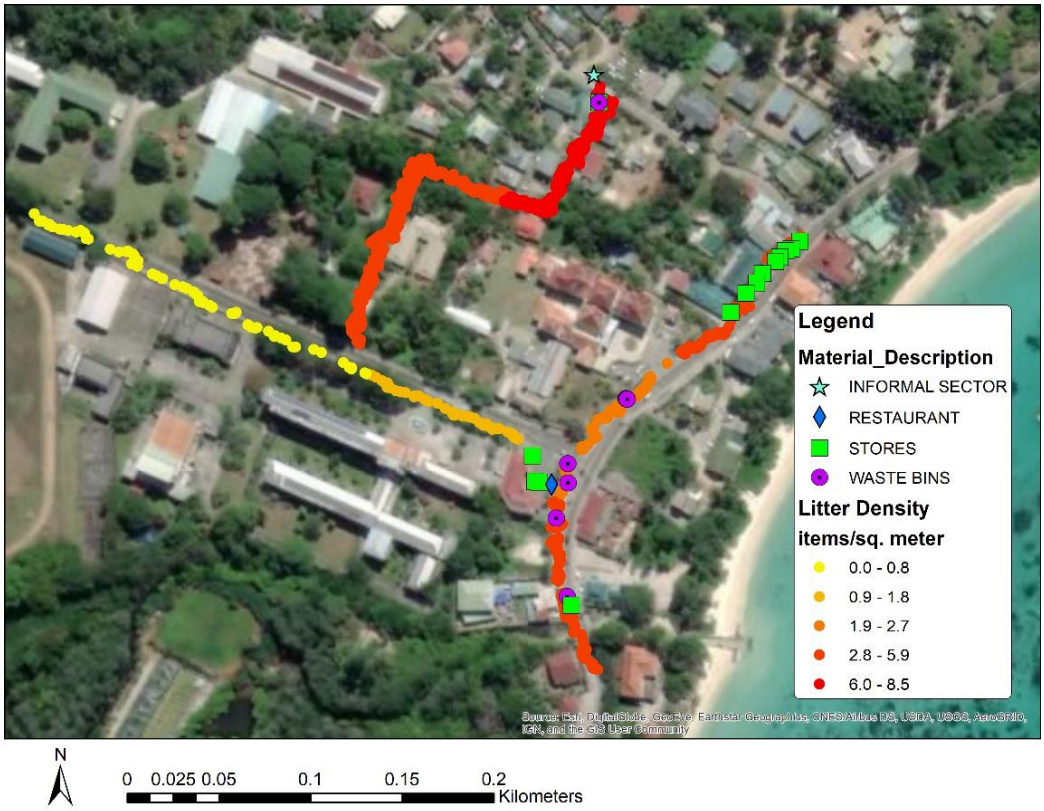

Figure 4. Litter densities (all items) for example transects in Anse Royale shown in 100m segments.

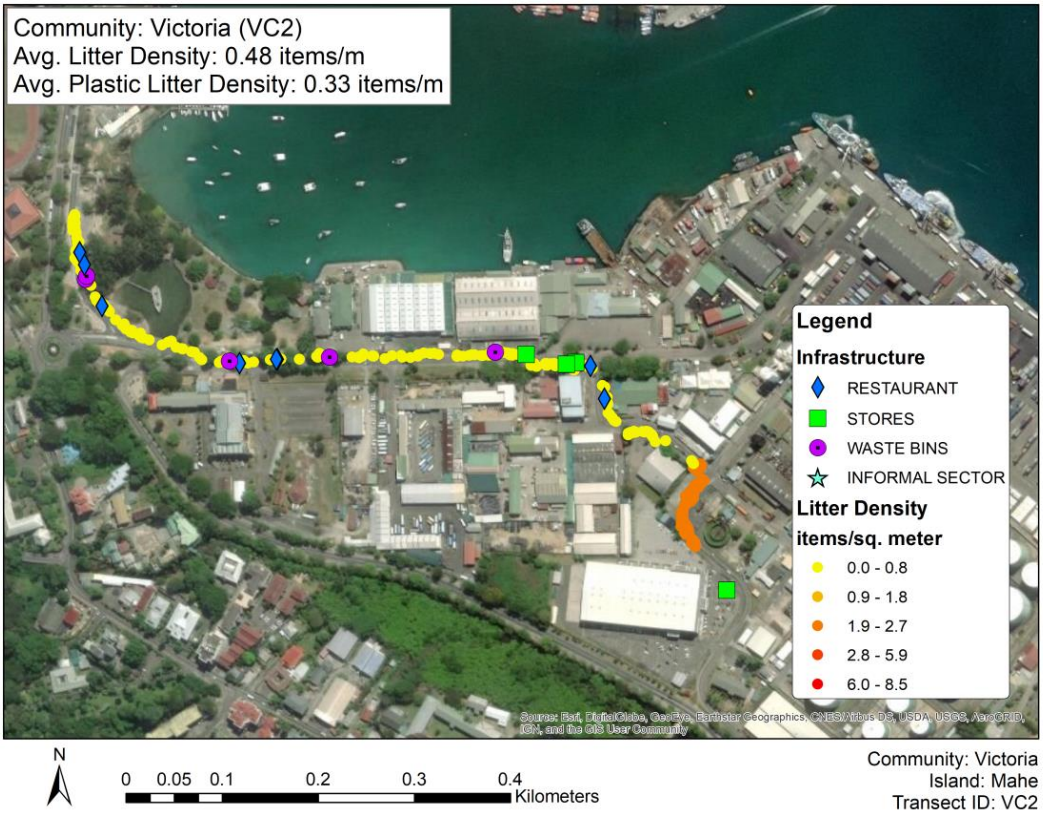

Figure 5. Litter densities (all items) for example transects in Victoria shown in 100m segments.

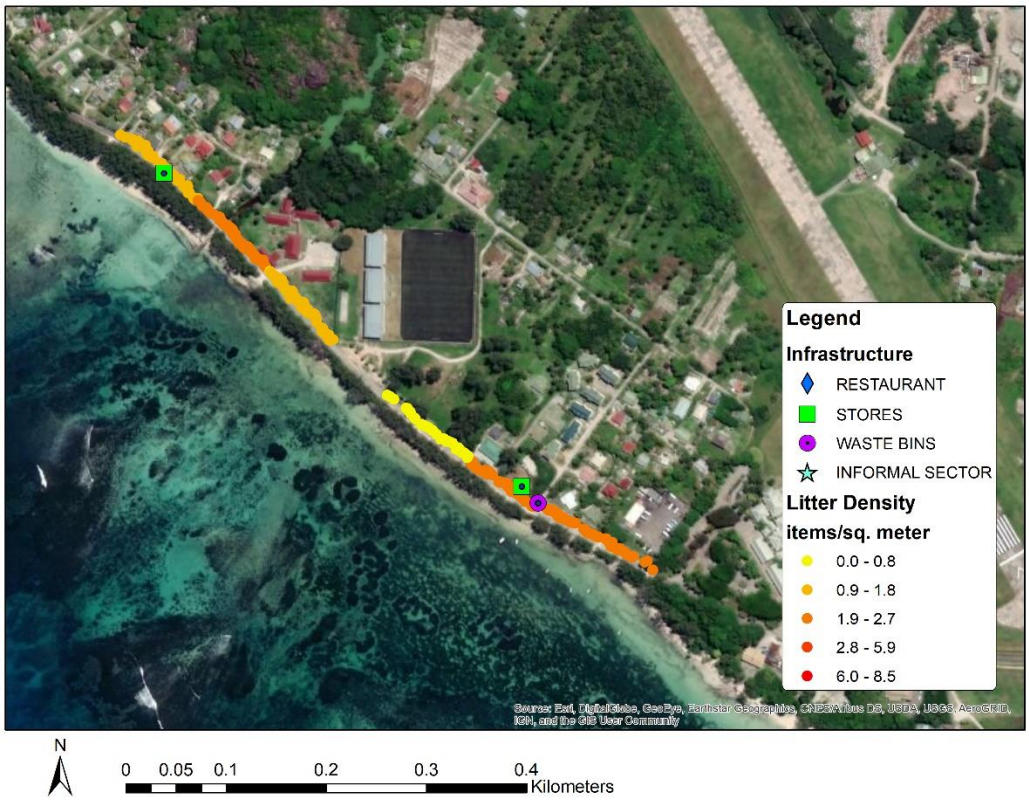

Figure 6. Litter densities (all items) for example transects in Grand Anse shown in 100m segments.

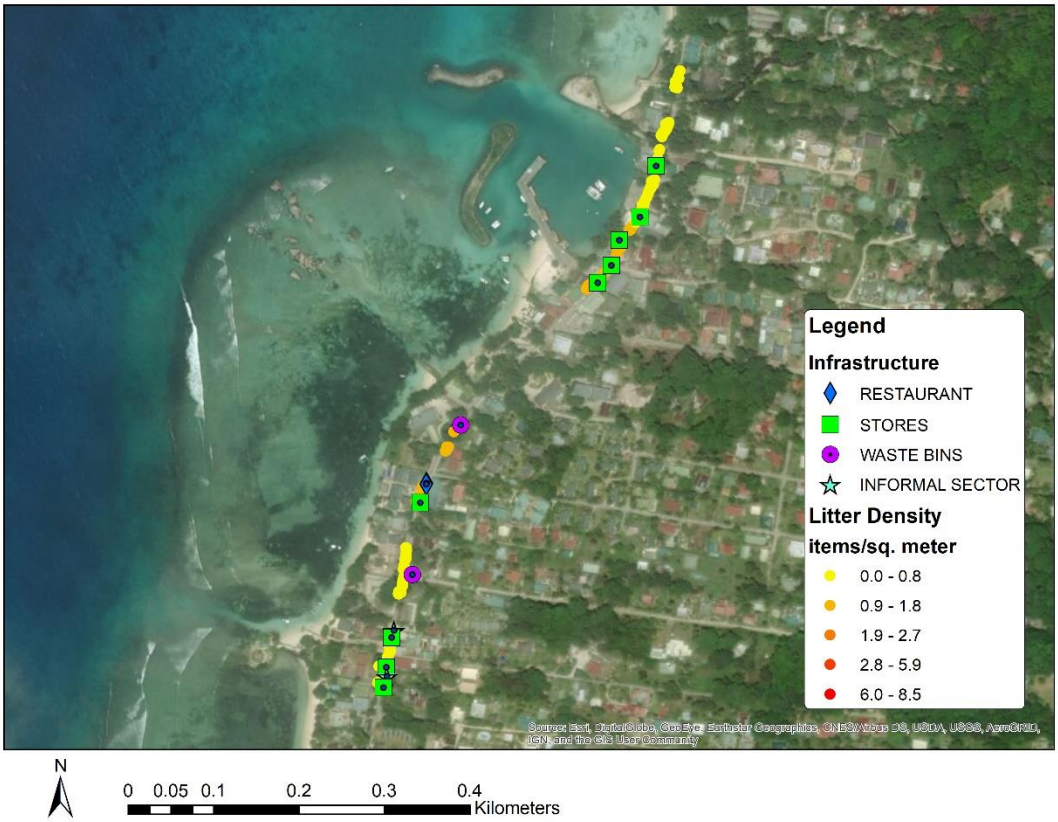

Figure 7. Litter densities (all items) for example transects in La Digue shown in 100m segments.

The density of litter was highest in more urban areas. Of the aggregated sites, Anse Royale had the highest density of litter at 3.12 items/m^2. The next most dense was Grand Anse (1.50 items/m^2), followed by Victoria (1.26 items/m^2), where several streets were quite clean since they are swept by the municipality. Areas in Victoria also had clean gutters, which is often where trash can aggregate if it is not collected or streets not cleaned. In comparison, litter density (with different methods, but giving results in items/unit area) in Mar Del Plata, Argentina was found to be 14.27 items/m^2 (Seco Pon and Becherucci 2012), which is more than 3 times higher than the Seychelles highest density. Preliminary and unconfirmed results (as of the initial publishing of this report) of work in India and Bangladesh (similar methods) show densities of approximately 2.5 to over 4 items/m^2, however, there are more dumpsites and waste accumulation zones documented in India and Bangladesh as well. The density of debris collected from SBR as outlined in the Literature Search was 0.74 items/m of shore length (Bouwman, Evans et al. 2016) (comparable to this data since the transect for this work is 1 m wide), while on Alphonse Island, the density was higher, 4.7 items/meter (Duhec, Jeanne et al. 2015). Both SBR and Alphonse Island densities were greater than what was found in Beau Vallon on Mahe and on the beaches on Praslin and La Digue. However, the urban litter densities in the communities were greater than what was observed at any of the beaches measured for this project, and closer to what was found in Alphonse Island. While not confirmed yet, densities over 1 item/m^2 could result in people easily observing litter (based upon the expert opinion of the researchers in this

case). More research needs to be conducted on what density of litter constitutes a less aesthetic feel to citizens and tourists.

The landfill included waste pickers that appear to be marginalized and were previously called “scavengers” – they said this might change after this work was conducted, the proper term is to call them “waste pickers” – supplying some sense of dignity. Open plastic burning was observed at the metal and construction waste management area. This does not appear to be a common theme in the area though.

The government and administration were very supportive in addressing this issue and meeting with the research team to share information. Since three times as many tourists come as residents live in the Seychelles, hotels and rental properties could be significant sectors in contributing to waste and recycling. This was explored further in meetings with two major hotel chains.

Summary and Recommendations

Based upon the data collection, field work, interviews, and results some recommendations can be made.

1. NGOs appeared to be interested in partnering to spearhead educational campaigns around proper waste management on the islands and could be good partners in these types of campaigns.
    a. Anti-littering campaigns, recycling promotion (if appropriate), the reasons for plastic/product bans (protect the ocean/env.), single-use plastic reduction, etc.

2. Communicate a clear waste management plan with specific dates and milestones to community stakeholders, e.g., the implantation of the glass levy
    a. E.g., a workshop involving stakeholders could be hosted to get input and information from all relevant island perspectives on island waste management

3. Hotels could be a leader in upstream waste reduction and waste segregation efforts (overall high waste generation rates, some hotels are engaged and interested in waste management and plastic)
    a. E.g., The government could consider ways to promote waste reduction and segregation to hotels and tourist related businesses
4. A more detailed citizen survey be undertaken by experts in waste management in partnership with students at the University of the Seychelles, which would also develop local research capacity.

5. Promote the use of the mobile app *Marine Debris Tracker* to continue data collection and monitoring on the islands by NGOs, the University, etc.
    a. e.g., Areas of litter hotspots could be "adopted" by community groups

6. Consider that PLA "compostable" plastic, will only biodegrade in an industrial compost facility, not in the open environment or the ocean, so this material is still a plastic pollution item if littered.

7. Consider the development of a Marine Litter Action Plan (use the data in this report (plus more is desired) as a baseline to compare against in the future after further interventions). Outer islands seem to be deposition sites for plastic, so developing a plan for the removal of that litter could have a positive impact.
    a. Litter reduction, monitoring of outer islands, Drone technology, etc.

8. Even if solid waste management is perfected for domestic waste in the Seychelles, unless global and nearby sources are addressed, plastic will continue to wash ashore on the outer islands.
    a. Further work is needed to understand the sources, fate and transport in the ocean, and management from a regional perspective in order to address plastic marine litter in the region.

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Appendix

List of the transects completed on each Island:

Island	Community	Transect ID	Date Sampled (YYYY-MM-DD)	Start		End	
				Latitude	Longitude	Latitude	Longitude
Mahe	**Victoria**	VC1-1	2019-03-27	-4.605098	55.461796	-4.606573	55.461595
		VC1-2	2019-03-27	-4.606573	55.461595	-4.609247	55.461049
		VC2-1	2019-03-26	-4.628918	55.460752	-4.627215	55.458653
		VC2-2	2019-03-26	-4.627226	55.459439	-4.627163	55.456871
		VC2-3	2019-03-26	-4.627165	55.456837	-4.625814	55.454943
		VC3-1	2019-03-26	-4.623034	55.452137	-4.622143	55.450575
		VC3-2	2019-03-26	-4.622105	55.450515	-4.621105	55.452115
		VC3-3*	2019-03-26	-4.621123	55.452225	-4.622344	55.451669
		VC4-1	2019-03-30	-4.622954	55.459855	-4.622715	55.457357
	Anse Royale	AR1-1	2019-03-28	-4.740509	55.516597	-4.739411	55.514243
		AR1-2	2019-03-28	-4.740052	55.515839	-4.738816	55.517012
		AR1-3	2019-03-28	-4.739522	55.518006	-4.741647	55.517005
	Beau Vallon	BV1-1	2019-03-26	-4.612049	55.429639	-4.613303	55.428004
		BV1-2	2019-03-26	-4.613572	55.427745	-4.614779	55.425782
		BV1-3	2019-03-26	-4.615042	55.425354	-4.615725	55.423014
	NYS Village	NY1-1	2019-03-29	-4.654851	55.398362	-4.653071	55.400237
		NY1-2	2019-03-29	-4.652708	55.400682	-4.65375	55.403071
		NY1-3	2019-03-29	-4.653966	55.404109	-4.654769	55.406495
Praslin	**Cote D'or**	CD1-1	2019-04-01	-4.319476	55.752552	-4.318291	55.750155
		CD1-2	2019-04-01	-4.318042	55.749729	-4.316933	55.748146
		CD1-3	2019-04-01	-4.316461	55.747681	-4.314771	55.745672
	Grand Anse	GA1-1	2019-03-31	-4.320287	55.68648	-4.32212	55.68839
		GA1-2	2019-03-31	-4.322619	55.688875	-4.324185	55.691259
		GA1-3	2019-03-31	-4.324639	55.699158	-4.324496	55.701811
La Digue	**La Passe**	LP1-1	2019-04-02	-4.356449	55.826067	-4.354933	55.827157
		LP1-2	2019-04-02	-4.353111	55.82677	-4.350479	55.827566
		LP1-3	2019-04-02	-4.34897	55.828971	-4.346685	55.829945
	Anse Source D'argent	AS1-1	2019-04-03	-4.367848	55.827302	-4.369175	55.826026
		AS1-2	2019-04-03	-4.36929	55.826018	-4.371395	55.827298
		AS1-3	2019-04-03	-4.371445	55.827353	-4.373132	55.829311

*VC3-3 was only 200m long, likely due to issues with the MyTracks app measurement on the ground (switched to analog measurements subsequently).

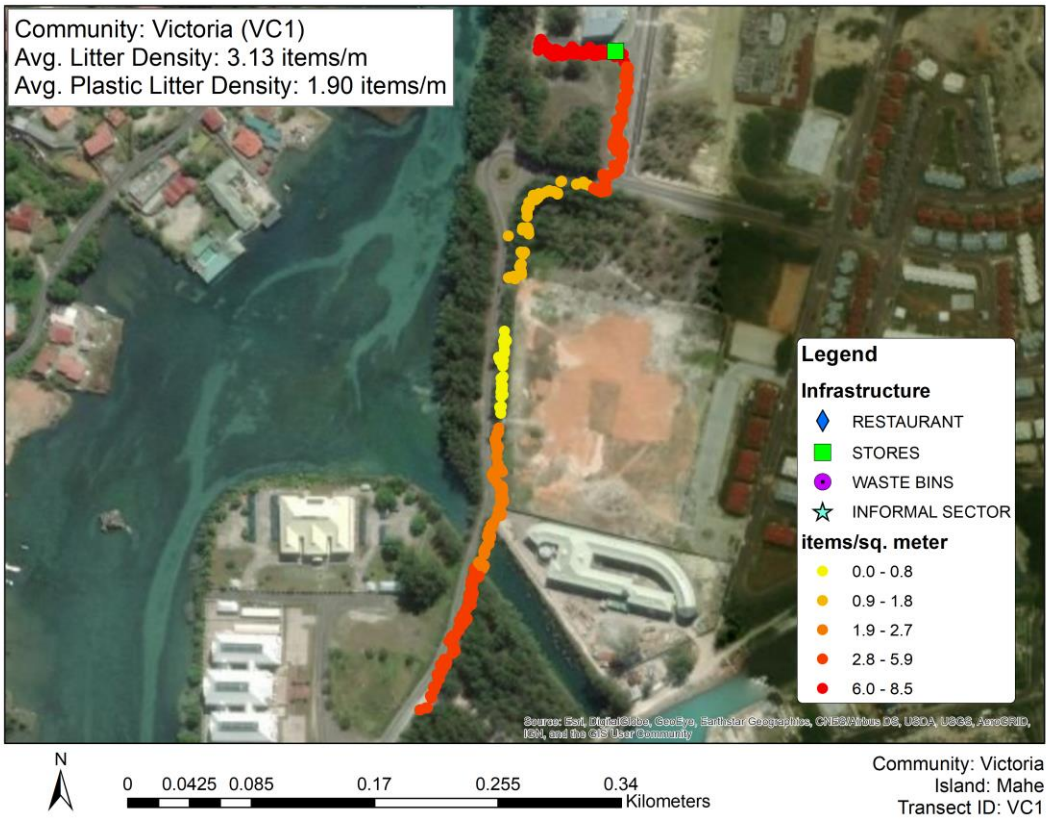

Figure A1. Victoria Transects VC1-1, VC1-2

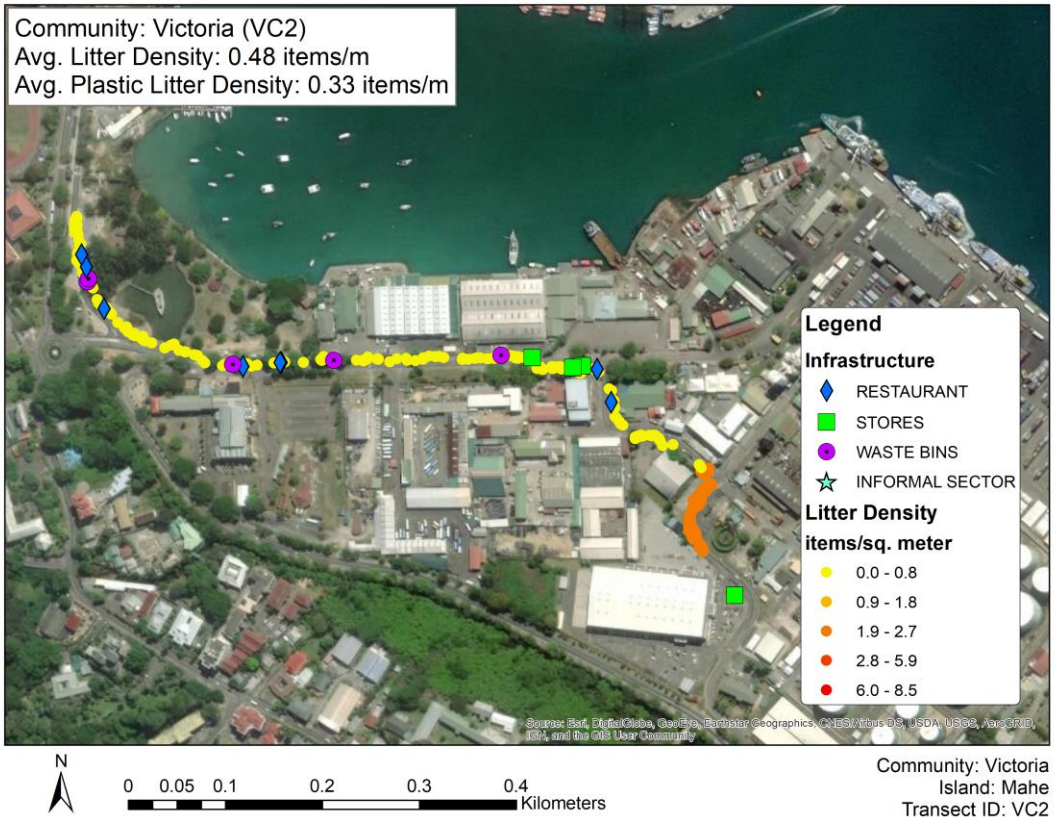

Figure A 2. Victoria Transects VC2-1, VC2-2, VC2-3

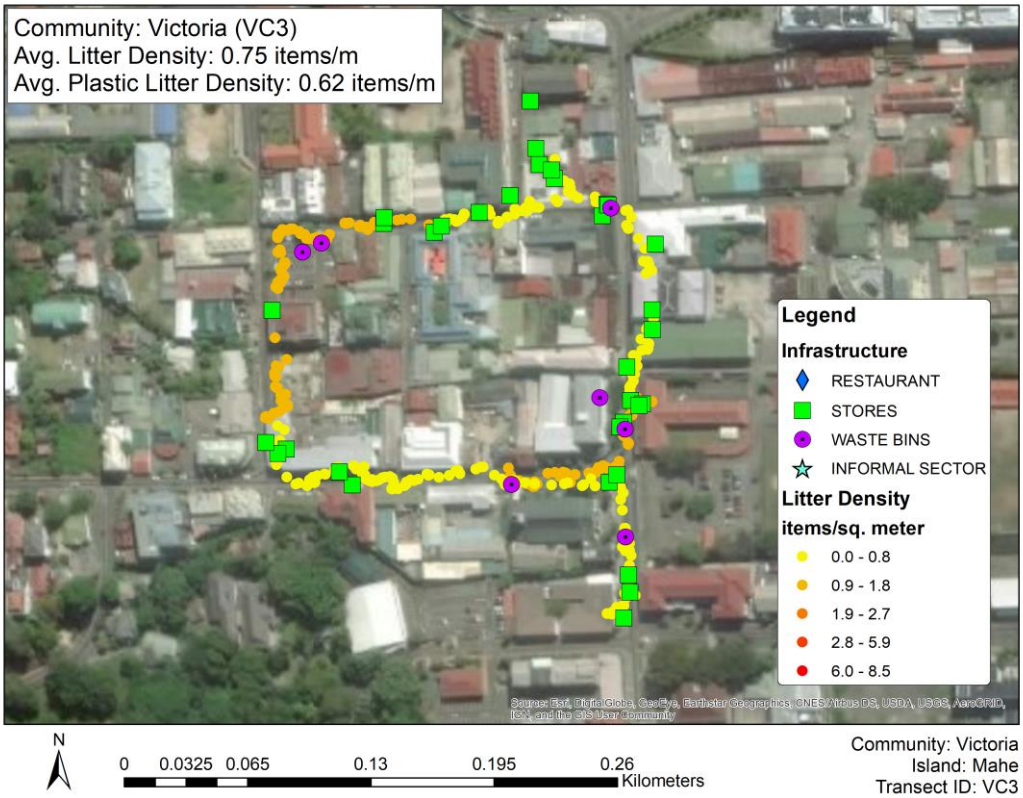

Figure A3. Victoria Transects VC3-1, VC3-2, VC3-3

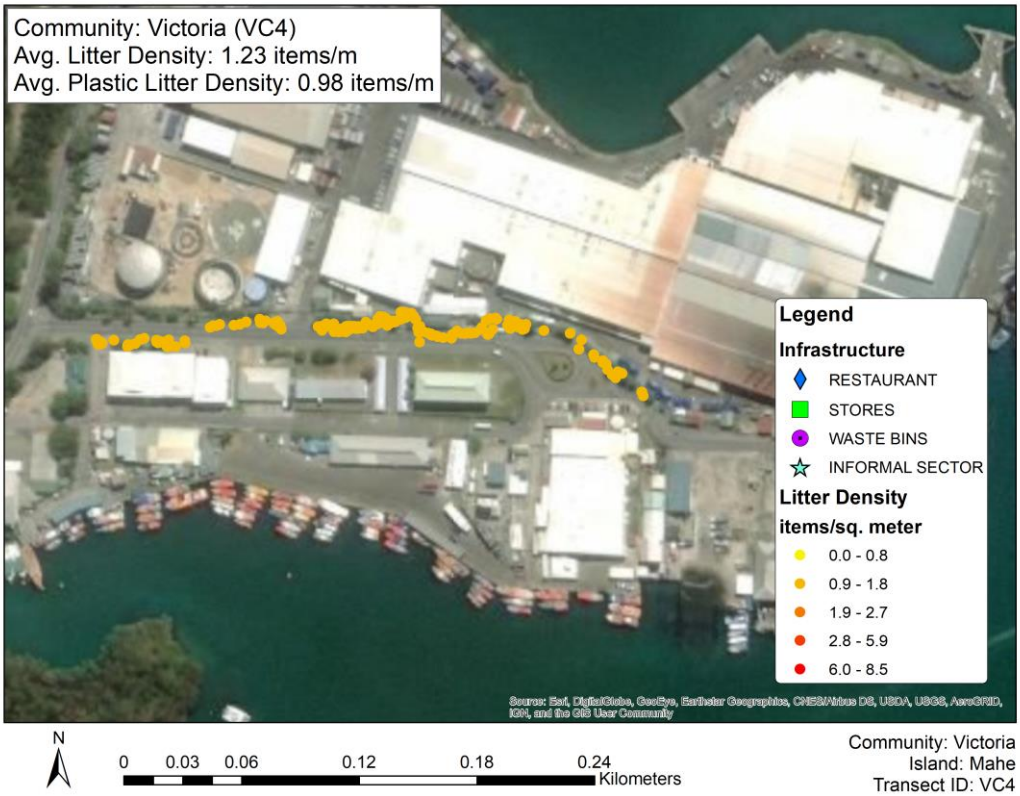

Figure A4. Victoria Transects VC4-1

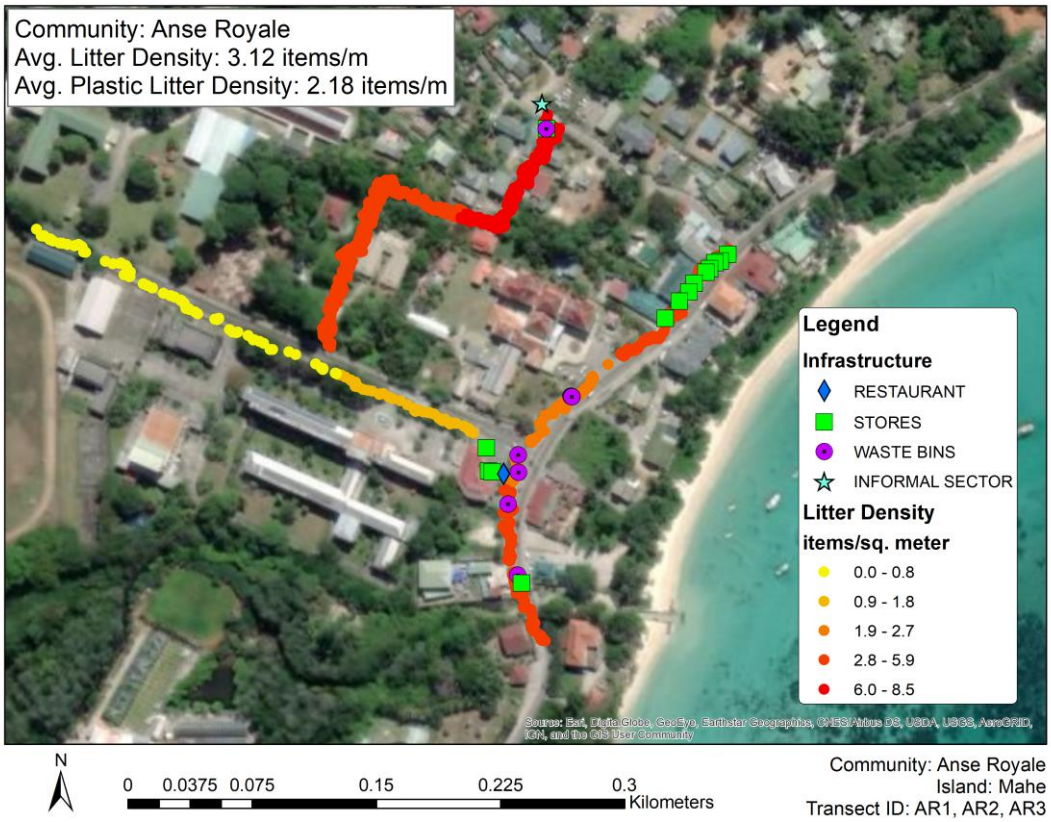

Figure A5. Anse Royale Transects AR1-1, AR1-2, AR1-3

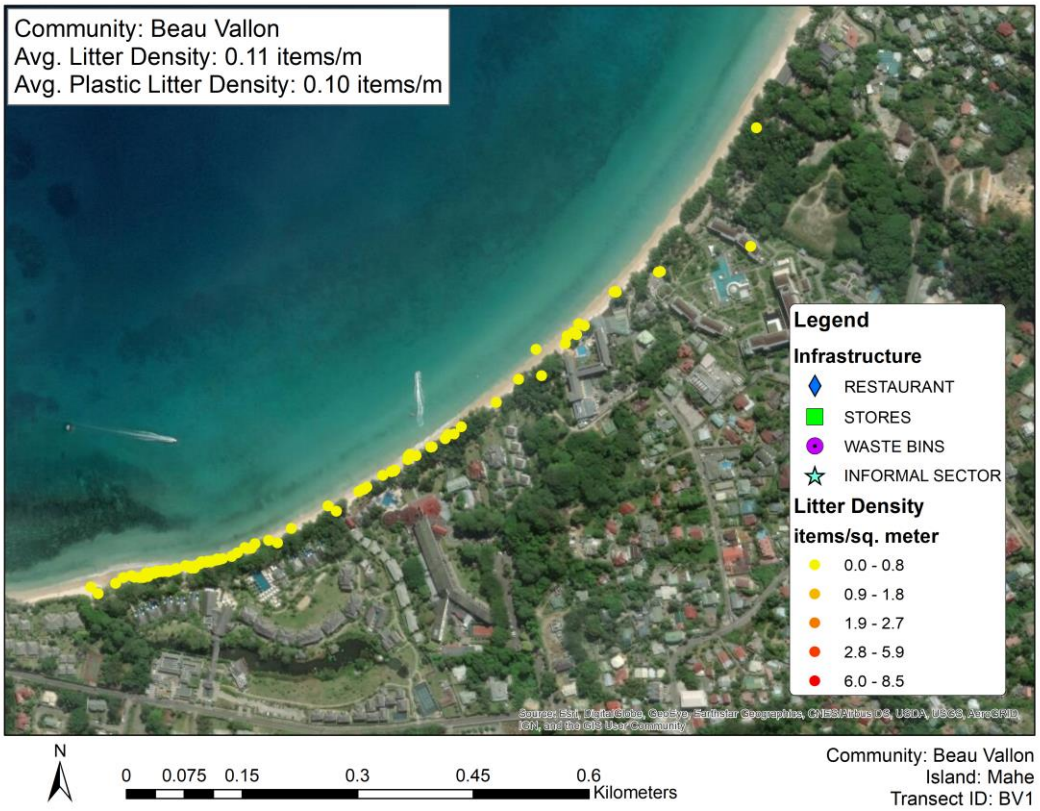

Figure A6. Beau Vallon Transects BV1-1, BV1-2, BV1-3

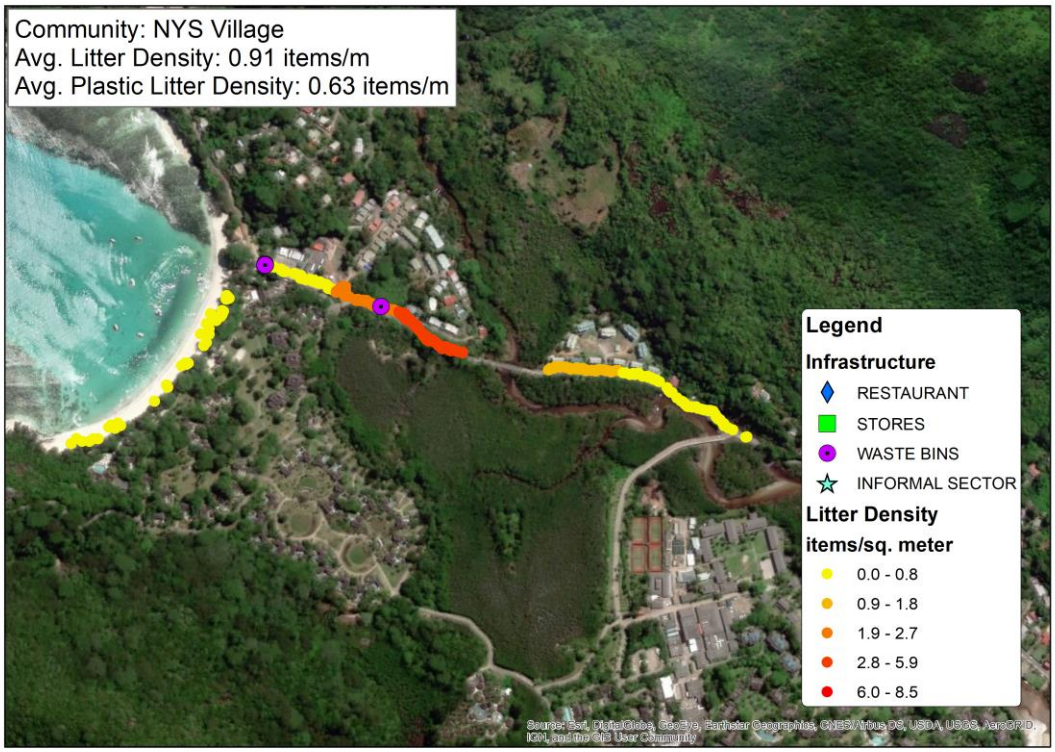

Figure A7. NYS Village Transects NY1-1, NY1-2, NY1-3

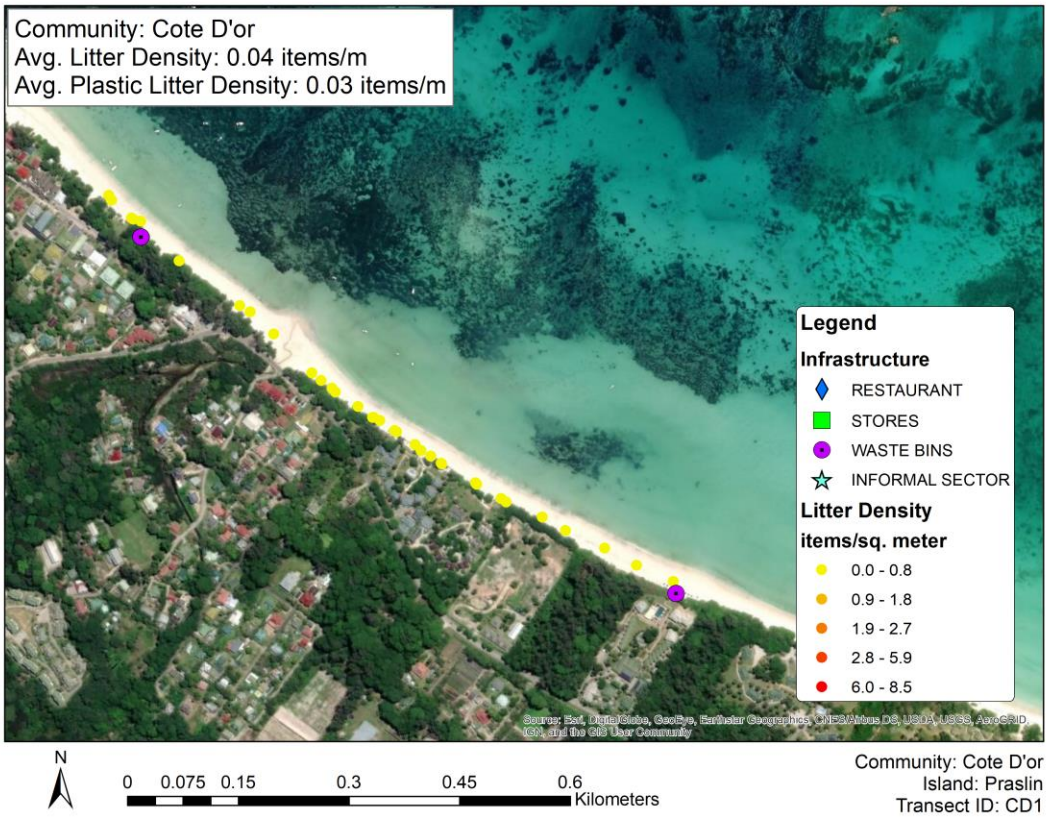

Figure A8. Cote D'or Transects CD1-1, CD1-2, CD1-3

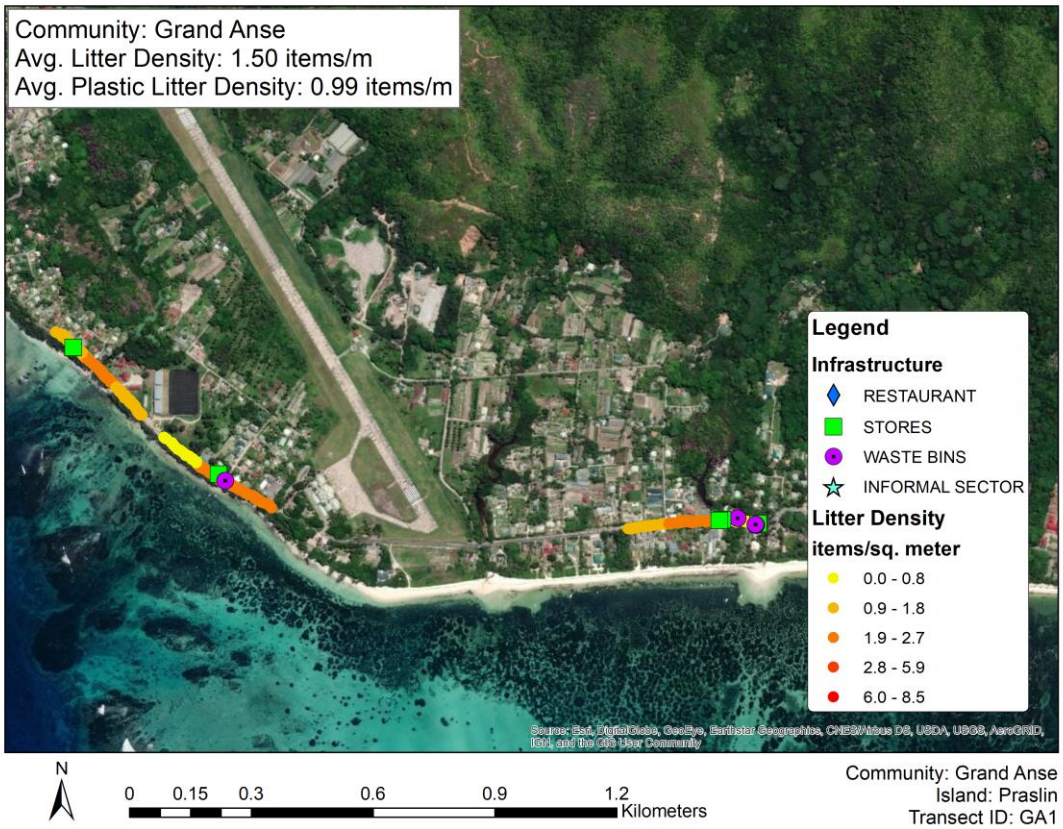

Figure A9. Grand Anse Transects GA1-1, GA1-2, GA1-3

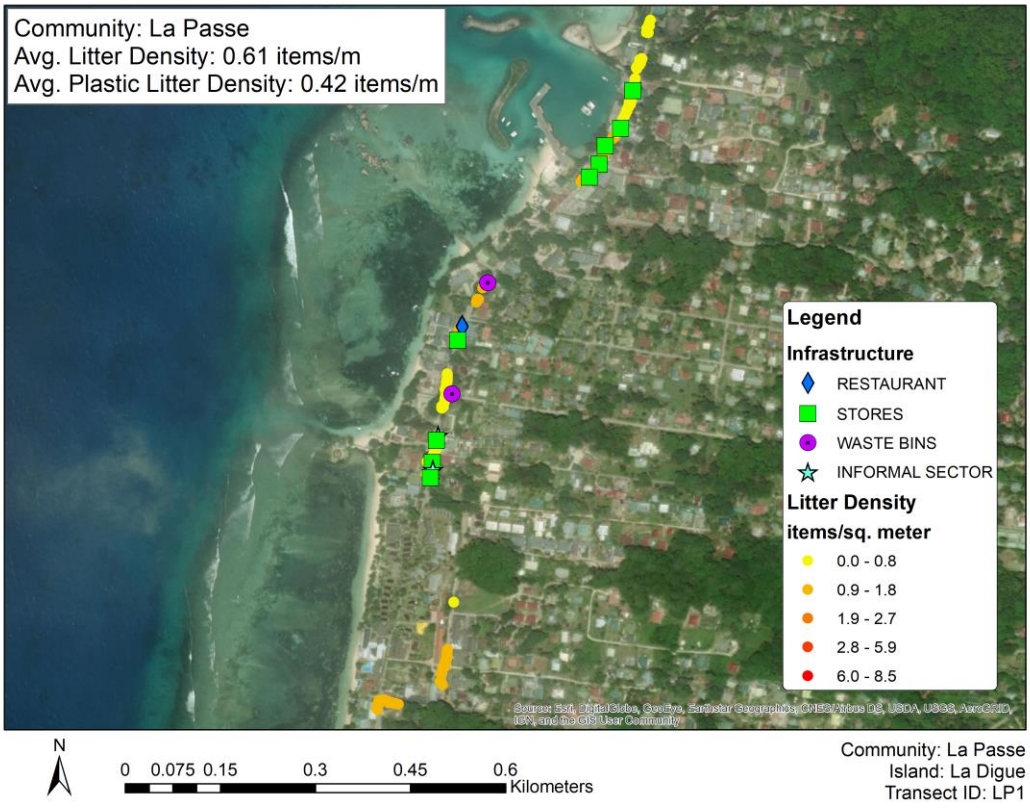

Figure A10. La Passe Transects LP1-1, LP1-2, LP1-3

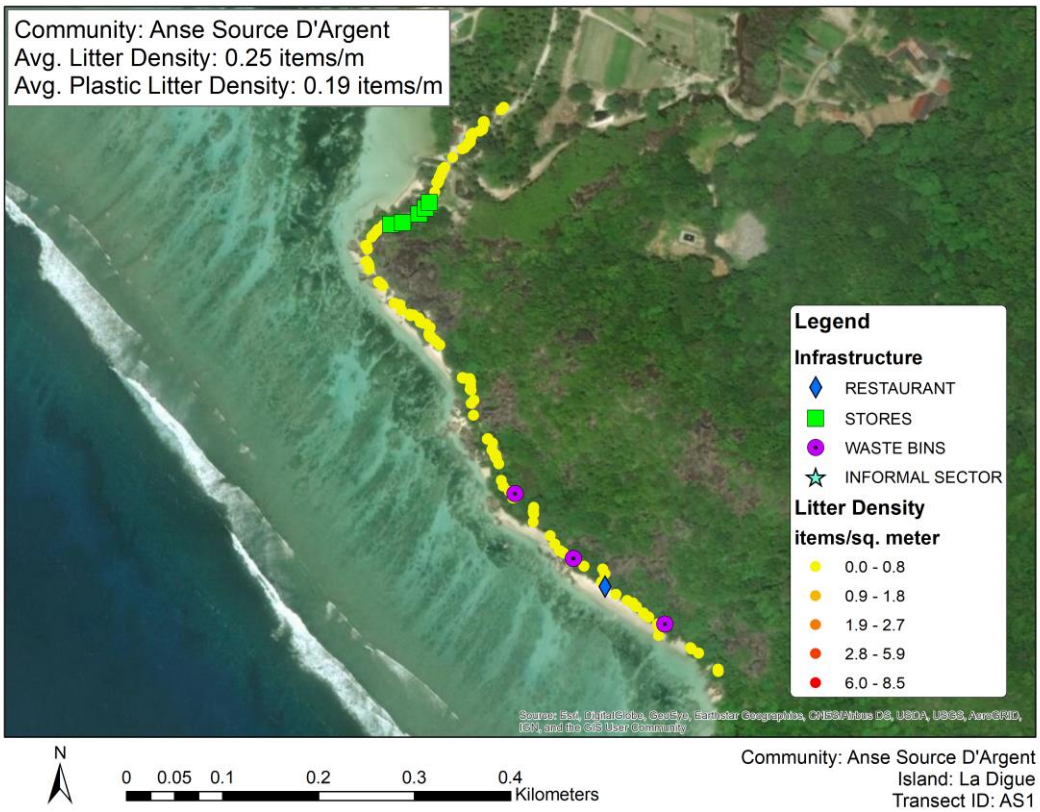

Figure A11. Anse Source D'argent Transects ASD1-1, ASD1-2, ASD1-3

Hotels contacted and sent the hotel survey (11 replies were obtained):

Name	Location	Response
Hilton Seychelles Northolme Resort & Spa	Victoria	None
Hilton Seychelles Labriz Resort & Spa	Silhouette Island	None
Four Seasons Resort Seychelles	**Baie Lazare**	**Yes**
Chateau Elysium	Beau Vallon	None
Le Meridien – Fisherman's Cove	Mahe	None
Berjaya Beau Vallon	Victoria	None
Coral Strand	Beau Vallon	None
Savoy Seychelles Resort and Spa	Beau Vallon	None
Anse Norwa Self Catering	Beau Vallon	None
Mer Riviere Self Catering	Beau Vallon	None
Ocean View Guest House	Beau Vallon	None
Seychelles Hospitality & Tourism Association (SHTA)	**Seychelles**	**Yes**
Le Pti Payot	Mahe	None
Georgina's Cottage	Beau Vallon	None
Lemongrass Lodge	**Beau Vallon**	**Yes**
Villa Roscia	Beau Vallon	None
Romance Bungalows	Beau Vallon	None
Clef des Iles	**Beau Vallon**	**Yes**
Seychelles Tourism Board	Seychelles	None
Bord Mer Villas	Beau Vallon	None
Sunglow Holiday Villa	Beau Vallon	None
Hanneman Holiday Residence	Beau Vallon	None
GT Properties	Beau Vallon	None
Coco D'or	Beau Vallon	None
Villa Des Roses	Beau Vallon	None
Augerine Hotel	Beau Vallon	None
Tropical Hideaway	Beau Vallon	None
The H Resort	**Beau Vallon**	**Yes**
Row's Villa	Beau Vallon	None
Surfers Cove	Beau Vallon	None
The Drake Seaside Apartments	Beau Vallon	None

Beach House and Choice Villa	Beau Vallon	None
Marie Laure Suites	Beau Vallon	None
Daniella's Bungalows	Beau Vallon	None
Bamboo River House	Beau Vallon	None
The Palm Seychelles	**Beau Vallon**	**Yes**
Forest Lodge Guest House	Beau Vallon	None
Avani Syechelles	Victoria	None
Auberge Chez Plume	**Mahe**	**Yes**
MAIA Luxury Resort and Spa	Mahe	None
Sailfish Beach Villas	Mahe	None
Sunset View Self Catering	Mahe	None
Le Jardin Des Palmes	Mahe	None
La Residence	Mahe	None
Alha Villa	Mahe	None
Kempinski Seychelles Resort	**Mahe**	**Yes**
Banyan Tree	**Mahe**	**Yes**
Demeure de Cap Macon	Mahe	None
Le Nautique	**Mahe**	**Yes**
La Villa Therese	**Mahe**	**Yes**
Le Relax Hotels	Mahe	None
East Horizon Self Catering	Mahe	None
Lanature Apartments	Mahe	None
Hotel La Roussette	Mahe	None
Residence Argine	Mahe	None
Reef Holiday Apartments	Mahe	None
Albizia Lodge	Mahe	None
Chez Payet	Mahe	None
Le Manglier Guest House	Mahe	None
Mountain View Villas	Mahe	None
Eden Bleu Hotel	Mahe	None
Eden Island Luxury Villas	Mahe	None
Le Bonheur Villas	Mahe	None
Carana Hilltop Villa	Mahe	None
Carana Beach Resort	Mahe	None

Petit Amour Villa	Mahe	None
Le Relax Hotels	La Digue	None
Patatran Village Hotel	La Digue	None
Le Domaine de L'Orangeraie Resort and Spa	La Digue	None
Moonlight Beach Villa	La Digue	None
Bamboo Chalets	La Digue	None
Cabanes Des Anges	La Digue	None
La Digue Island Lodge	La Digue	None
Casa de Leela	La Digue	None
Le Sur Mer Chalets	La Digue	None
Villa Pasyon	La Digue	None
La Digue Self-Catering Apartments	La Digue	None
Cocotier du Rocher	La Digue	None
Rising Sun Guesthouse	La Digue	None
Villa Veuve	La Digue	None
Kot Babi Guesthouse	La Digue	None
Coral Apartments	La Digue	None
My Angel	La Digue	None
Villa Verte	La Digue	None
Belle Amie Self Catering	La Digue	None
Villa Hortensia	La Digue	None
Liane De Mai	La Digue	None
Le Chevalier Bay Guesthouse	Praslin	None
Villa Admiral	Praslin	None
Castello Beach Hotel	Praslin	None
Chateau Sans Souci Hotel	Praslin	None
Seashell Beach Villa	Praslin	None
Hotel Villas de Mer	Praslin	None
Bliss Hotel	Praslin	None
Oasis Hotel Restaurant and Spa	Praslin	None
Belle Vacance	Praslin	None
Indian Ocean Lodge	Praslin	None
Britannia Hotel	Praslin	None
Palm Beach Hotel	Praslin	None

Yasad	Praslin	None
Peax Villa	Praslin	None
Villa St. Sauveur	Praslin	None

Photographic Examples follow of
Figures A12 – A19: Top items leaking into the environment
Figures A20 – A23: Images of products and solid waste management

Figure A12. General Litter and Cardboard Box

Figure A13. Plastic Items and Fragments, Including a “reusable” Non-Woven Textile Bag

Figure A14. Food Wrappers were one of the Top Items found, especially those made of film and multi-layer plastic.

Figure A15. Cartons and "Tetra-Pak" brand items were also common as drink containers found.

Figure A16. Plastic Bottle Caps were found among the vegetation and in the dirt or sand.

Figure A17. Metal Bottle Caps were common near stores selling the glass bottles that they came from.

Figure A18. Cigarettes were common items in the urban settings and some near the beach.

Figure A19. Foam fragments were one of the items found on the beach

Figure A20. Example of Non-Woven Plastic Reusable Plastic Bag that has Replaced Single-Use Plastic Bags

Figure A21. Carton and Straw Juice Packaging is Common (e.g., TetraPak) make Banning Straws Difficult

Figure A22. Items found in a Waste Bin, Cartons, Film Plastic of no Value, also two Aluminum Cans

Figure A23. Open Residential Waste Bins mean that Animals can get into them and cause Leakage