The Assessment of Aruba's Shoreline Pollution: A Comparison between the South Coast and the North Coast.

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"An important lesson"

It is 6:40 in the morning and the sky is leisurely getting brighter as the sun is emerging from the sea. I am currently at Warirui, completely isolated from everyone, if it wouldn't be for the few goats lazily grazing on the hills behind me. I am about to start my beach assessment, but I first indulge myself in admiring the astonishing beauty of the nature surrounding me. The fresh morning air fills my lungs and awakens my mind. The wind is howling loudly, filling my ears with its incessant blowing, so intensively that it covers every other sound, even my own thoughts. All is filled with the loud voice of the wind, except one other sound can be perceived: the fierce roaring of the great breaking waves. After I gave myself the time to absorb my surroundings and the sun is slowly departing the distant horizon water line, I prepare myself to begin my assessment. Gradually, though fairly rapidly, the realization of the pollution on this seemingly pristine and wild paradise strikes me strongly and abruptly awakens me from my idyllic dreaming. Unfortunately, or should I actually say fortunately, my research has strongly confronted me with the dark side and reality of the consequences of the modern 'gifts' of our consumeristic society.

Although the mournful modern situation of marine pollution has permanently marked me, something else has been extremely important to me during my stay in Aruba. Thanks to the program my path has been crossed by several incredible people, who have inspired me and have helped me to realize an extremely important truth, which will be my companion for the rest of my life. It would be impossible to mention them all, but nonetheless I should at least mention a few. There is Eric, with his great generosity and inspirational motivation in encouraging a change through education. There is Kimberly, who loves her sea and would do anything to protect it, even though this might mean getting stung by a Lion Fish. There is Tatiana, who adores and promotes the preservation of the silent protector of Aruba: the mangroves forests. There is Giovanni, who, although he has a busy life, has always found the time to help in trying to maintain a clean environment, as he cares about our beloved nature. There is Anthony, whom with his dog and boat never loses a chance to show the true face of Parkietenbos. There is Ghislaine, who is always there for you and approaches the situation from a different angle.

What all these people have in common, and the many more I could not mention, is their inspiring inner strength and motivation that allows them to keep fighting for what they believe is right. Schools, books and documentaries are excellent to spread knowledge and awareness relative to the current environmental situation; however, it is often forgotten to mention how many people are trying to make a change, to improve the situation with the means that are available to them and who are trying to spread the necessary knowledge and awareness.

So I would like to conclude by thanking you all for inspiring me, making me grow and preparing me for the next chapter of my life. A chapter that I will be facing with a serious mind, as the current environmental situation is not a joke. However, I will be facing it with a smile in my heart, since I carry you all within me and because you taught me that, although sometimes the problems might seem insurmountable, one should never forget to play his or her own part in being the change one hopes to see in society.

The Assessment of Aruba's Shoreline Pollution:

A Comparison between the South Coast and the North Coast.

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1. Introduction

Because of the low production costs of plastic products, the vast majority of them are disposable, based on a one time use. The problem with this consumeristic behaviour is linked to the almost indestructible morphology of plastic fabrics. They contain toxins that can be dispersed in the surrounding environment and can enter marine organisms affecting the food chains and therefore, humans (Stevenson 2011). In addition, plastic products do not undergo biodegradation, but on the contrary they fragmentize into smaller particles through photo-oxidative degradation (Shah, et al. 2008). These characteristics of plastic imply that once plastic waste enters the environment it can remain in it for centuries; indeed, some scientists believe that almost all the plastic created since its invention in 1940, apart from the burned plastic, is still on the planet, either on the sea floor, floating in the oceans and seas, stranded or buried on shorelines, or thrown in landfills (Derraik 2002; Stevenson 2011).

Moreover, it is known that plastic litter has buoyant characteristics, which allow it to float and be easily transported by oceanic currents, permitting it to reach even the remotest areas in the world (Howell et al. 2012). This has been shown by the presence of plastic litter in the five major gyres in the world, which are places of convergence of different oceanic currents (Howell et al. 2012). Since the acknowledgment of the issues related to plastic pollution

in the environment, this debris has been monitored and classified into three groups: macro-debris (>2.5cm), meso-debris (25-2mm), and micro-debris (<2mm) (Shah et al. 2009). The two main sources of origin for plastic pollution can be classified as land-based and ocean-based (Stevenson 2011).

It is known that more than 260 species are affected by plastic debris and these effects often result in the death of the animal through ingestion or entanglement (Hammer et al. 2012; Stevenson 2011). It seems that the most severely affected species are sea birds and sea turtles, which are local to Aruba (Hammer et al. 2012). Plastic litter is accumulating on the shorelines all over the world and it arrives from both land and sea. In coastal states and islands, as for instance Aruba, whose economies are based on tourism, the accumulation of plastic on the shorelines can negatively affect their economy (Stevenson 2011). In addition to the aesthetic problems caused by macro-debris accumulation, there is also a health hazard both for humans and wildlife.

This research examines the current situation of pollution on the shores of Aruba, with a particular emphasis on plastic litter. It focuses on the systematic comparison of litter concentration between the north coast and the south coast. Beach litter assessments were performed in order to address the following questions: What is the pollution level of Aruba's shoreline? What percentage of the trash collected was plastic? Is there a difference in pollution concentration between the north coast and the south coast? The main focus on this research is placed on macro-debris and meso-debris. A very nice side effect of this research has been that in the process of collecting data, all beaches studied were cleaned. This paper will predominantly focus on the overall results obtained from the field research conducted so far, as an in depth analysis has yet not been performed.

2. Study Area

The research was conducted on Aruba, a small island in the Caribbean that is part of the Kingdom of the Netherlands. The water masses that enter the Caribbean Sea come from

the South Atlantic and North Atlantic Ocean (Gyori et al. 2001). As it is in Figure 1,

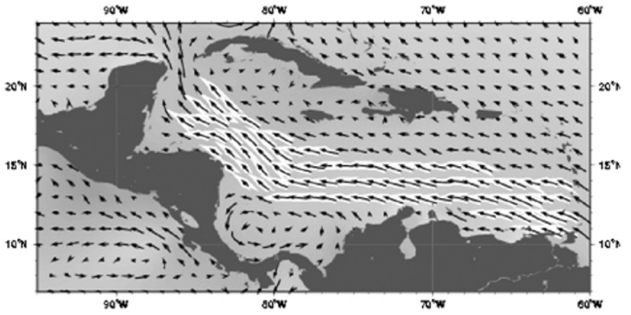


Figure 1. *Map of the Caribbean Current* (Gyori et al. 2001).

the Caribbean Current (in white), has a north-westward motion that moves through the Caribbean Sea into the Gulf of Mexico (Gyori et al. 2001). The water of the Caribbean Current arrives from the Equatorial Atlantic Ocean, which passes via North Brazil, Venezuela and Guiana Currents (Gyori et al., 2001). For the accuracy of this research it is important to take oceanographic currents into account, due to the buoyant nature of plastic debris. Moreover, it is the north coastline of Aruba that is directly exposed to the Caribbean Current and is windward; whereas the southern one is sheltered from direct exposure to the currents and is leeward.

For these reasons it can be assumed that the southern coastline's pollution is predominantly land originated. The northern shoreline's pollution, on the other hand, is assumed to originate in marine pollution, since this shoreline is more directly exposed to wind and sea currents. In addition, the southern beaches are the ones most subject to tourism,

local beachgoers and water activities. The northern pocket beaches, however, are more difficult to reach due to rougher conditions of the sea. They are only used by few beachgoers (e.g. surfers and bodysurfers or sightseeing tourists) and will therefore be defined as rural beaches.

The research was performed exclusively on sandy beaches. A total of 10 sites were chosen, 5 on the south coast and 5 on the north coast (see Figure 2). On the south coast, where sandy beaches are abundant, the five sites were chosen in order to cover the entirety of the coastline. Starting from the north, the five sites on the southern coastline were: Arashi Beach (12°36'37.93"N 70°03'12.18"W), Eagle Beach (12°33'2.53"N 70°3'24.98"W), Surfside Beach (12°30'43.76"N 70°01'52.70"W), Mangel Halto (12°27'50.64"N 69°58'09.71"W) and Rodger's Beach (12°25'03.28"N 69°53'03.85"W). On the north coast, due to the limited natural availability of sandy beaches and more difficult accessibility the 5 sites were chosen mainly based on feasibility. Starting from the north, the five sites on the north coast are: Lighthouse Dunes (12°37'01.13"N 70°02'43.85"W), Warirurí (12°33'32.32"N 6959'17.81), Dos Playa (12°30'19.85"N 69°55'0747"W), Grapefield Beach (12°27'32.02"N 69°52'46.35W), and Boca Grandi (12°26'22.23"N 69°52'25.99"W).

Figure 2. *Map of the 10 sites covered during this research distributed around Aruba.*

At each site on the south coast a length of 152m was analysed, with the exception of Mangel Halto (110m). The sites had varying widths and for each site the area from the water front until the end of the beach was analysed (Arashi: 35m; Eagle Beach: 40m; Surfside Beach: 20m; Mangel Halto: 40m; Rodger's Beach: 20m). The end of the beach is commonly defined as the beginning of vegetation or the presence of man-made constructions (e.g. a parking lot or wall). On the north coast, due to the limited availability of sandy beaches, the sample areas covered are more various (Lighthouse Dunes: 152x15m; Warirurí: 87x37m; Dos Playa: 102x37m; Grapefield Beach 101x40m; Boca Grandi 152x44m).

3. Methods and Analysis

Shoreline pollution is an increasingly acknowledged modern issue, for this reason the UNEP (United Nation Environmental Program) in cooperation with the IOC (International Oceanic Commission) have developed a standardized procedure for shoreline litter assessment, in order to facilitate monitoring and data collection (Cheshire et al. 2009). The methodology for this research is based on the assessment guidelines formulated by the UNEP and IOC in combination with the NOAA (National Oceanic and Atmospheric Administration) ones.

Once on site, for the assessment of macro-debris, the researcher and collaborators followed a specific skirmish walking pattern perpendicular to the water front, with a distance of about 2m between each surveyor (see Figure 3). If the researcher

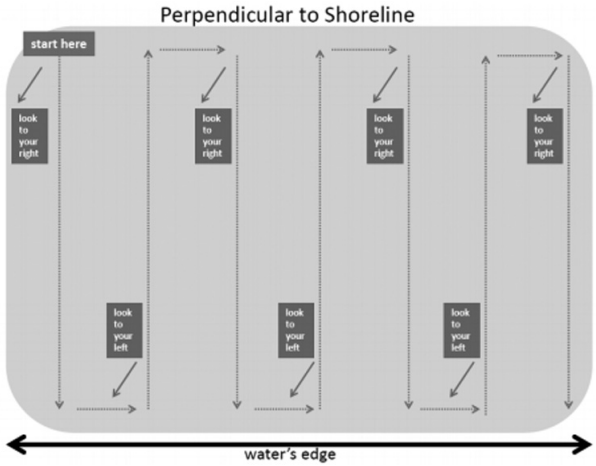


Figure 3. *Walking pattern perpendicular to water front used during assessments.*

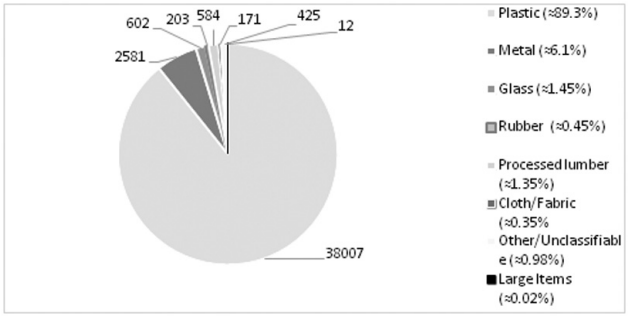
was alone he covered the entirety of the area following the same procedure. While walking, every single item of litter larger than 2.5cm was collected in trash bags. After collection, the litter was sorted and analysed, which involved counting all the items collected. Items were defined and classified according to material. They were also weighed using a Samsonite scale (max. weight supported: 40kg). If an item was too large or heavy to remove it from the beach, it was marked to prevent double counting, and noted down. For site characterization and shoreline debris analysis, modified NOAA's data sheet were used. For the recording of each location the GPS (Global Positioning System) tracker GARMIN eTrex 10 was used. Each site was covered once between February 7th and March 4th, 2015.

A meso-debris analysis was performed on each site as well. The meso-debris (25-2mm debris) analysis consisted of collecting sand samples from a 50x50cm square at a randomly chosen point along the high tide wrack line in the surveyed transect. The sand was 10cm of sand were scooped in order to fill a 20-liter bucket. Subsequently, the sediments were sieved through a 2mm mesh stainless sieve and washed with fresh water to remove the remaining sediments. The remaining samples are placed in a container with salt water, mixed and left to rest for two hours. This same procedure will be repeated twice in order to separate floating matter, presumably plastic debris, from the not-floating ones. Subsequently, manually and visually separate them and identify every non organic material, also from the non-floating material, which will be subsequently identified and weighted. This procedure enabled a later extrapolation of the density concentration of meso-debris on the surveyed transects. Such procedures have been recommended by Hidaldgo-Ruz et al. (2012), who have reviewed the currently existing methodologies on meso-plastic debris and micro-plastic debris. However, it was partially adapted to the means and material available to us.

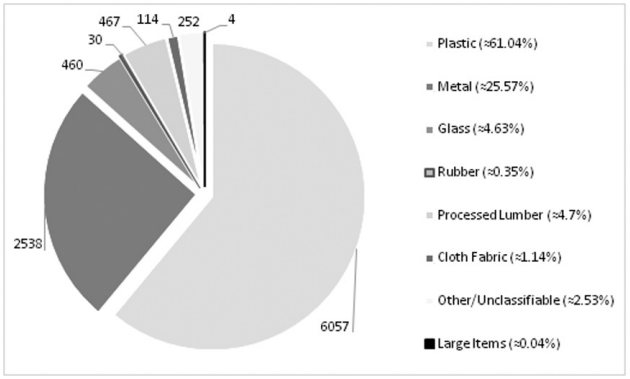
Once all the sites had been surveyed, a second round of assessments was conducted on the exact same locations between March 7th and April 1st, 2015. Each site was reassessed 28 days after the previous assessment, both for macro- and meso-debris, in order to compare the results to the previous measurements. The only difference in methodology for the second round of assessments is that each transect was subdivided in two different sub-transects: 0-15m from the waterfront and 15m until the end of the beach (15m+). The goal of this method was to determine whether there is a correlation between trash concentration and distance from the water front.

4. Preliminary Results

This section will focus on the preliminary results of the macro-debris analysis only, as the meso-debris sorting and analysis is yet to be completed.



Graph 1. *Overall concentration of material found and their abundance during the total of the 20 beach assessments performed*



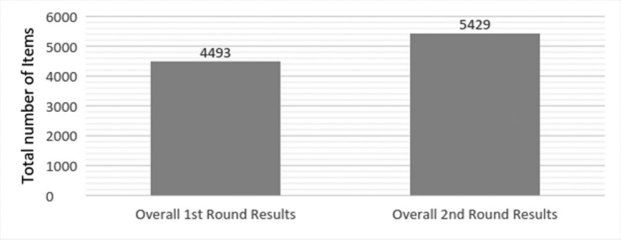
Graph 2. *Overall concentration of materials and their abundance found on the southern coastline after two rounds of assessments.*

In total, 243.53kg of trash were removed from the studied areas on both the northern and the southern coastline of Aruba. The 243.53kg of trash consisted of 42,585 items that have been collected, weighted, sorted and counted. As it is possible to observe in Graph 1, by far the most abundant material found was plastic, which corresponds to 38,007 items out of the total of 42,585 items collected. This means that approximately 89.3% of all the trash collected was plastic. The overall most abundant plastic items found were plastic fragments (15,320). The second most abundant material found was metal, mostly beer caps found on the southern coastline (2,380 beer caps out of the total of 2,581 metal items found). There is a considerable difference between the amount of plastic and the amount of metal found. All the other items combined account for only around 4.6% of the total trash collected.

4.1. South Coast

From the south coast a total of 47.61kg of trash were collected, consisting of 9,992 items. Graph 2 shows that the most abundant type of trash found is plastic with an overall 61.04% (6,057 items), followed by metal, which is the second most abundant type of trash found representing 25.57% (2,538 items) of the total. Graph 2 also shows that the other materials found, together account for only 13.39% of the total trash collected (1,327 items). When looking at the most abundant items found during the studying of the south coast it becomes evident that the majority of the trash found can be related to the careless behaviour of some beachgoers. This can be seen by the fact that 5 out of 6 of the most abundant items are linked to smoking, drinking and eating activities. The most abundant items found are: cigarettes (2,560), beer caps (2,380), plastic fragments (659), plastic straws (605), plastic bottle or container caps (543), and plastic food wrappers (445). A more detailed list of the items found can be found in Appendix I.

When comparing the overall results of the first round of assessments performed on the south coast with the ones obtained from the second sets of measurements on the same locations, it is possible to observe that there was a slight increase in the trash concentration and abundance found (see Graph 3). Indeed, a comparison of the two sets of results shows that during the second round of assessments there had been an increase of approximately 9.4%. As a matter of fact, the results from the first

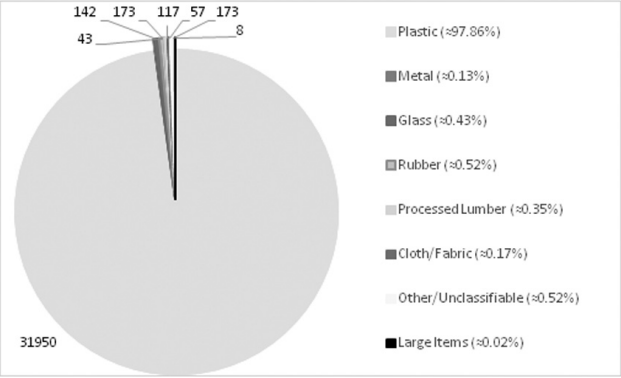


Graph 3. *Comparison of the total number of items found during the 1st and 2nd round of assessments performed on the south coast.*

sets of measurements showed a total of 4,493 items collected, whereas from the second collection the total number of items found was 5,429, marking an increase of 936 items.

4.2. North Coast

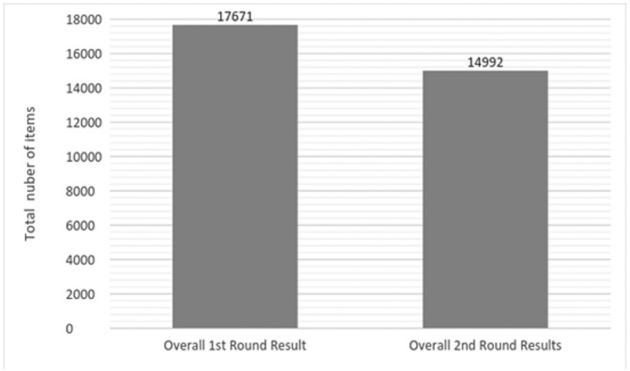
From the overall results of the north coast it is possible to immediately notice that the numbers are high, especially compared to the ones of the south coast. From the north coast, a total of 195.92kg of trash was collected (32,663 items).



Graph 4. *Overall concentration of materials and their abundance found on the north coastline after two rounds of assessments.*

Graph 4 unmistakeably shows the great disproportion of trash materials found on the north coast. Plastic accounts for approximately 97.86% of all trash found on the north coast, which in items is 31,950 out of 32,663. All the other materials combined are the equivalent of around 2.14% out of the total (713 items). The second most abundant materials after plastic, with an even score, are rubber and other/unclassifiable material with each have 176 items and respectively account for around 0.52% of the total. They are then followed by: glass ≈0.43% (142 items), lumber/building material ≈0.35% (117 items), cloth/fabric ≈0.17% (57 items), metal ≈0.13% (43 items), and large items ≈0.02% (8 items). On the north coast, when taking into consideration the 6 most abundant items, it is possible to observe a great divergence from the first most abundant item found and the remaining 5, but they are all made out of the same material: plastic. The mostly found items were plastic fragments (14,661). These are followed in decreasing order by: beverage and container caps (6,285), straws (2,880), plastic rope/net pieces (1,698), bags (1,922), and plastic utensils (1,034). For more detailed information on items found and their abundancy on the north coast please consult appendix II.

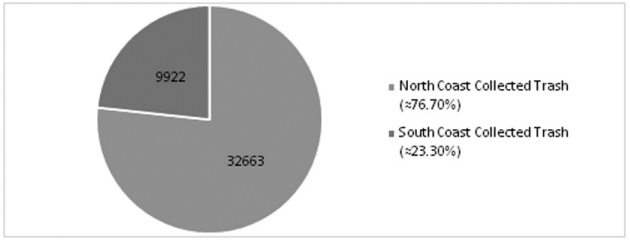
On a more positive note, when comparing the overall results of the first and second set of assessments performed on the north coast, it is possible to notice a moderate decrease in the inclusive weight and number of items collected during the second set of surveys, as it is visible in Graph 5. Graph 5 shows that there was a decrease of around 8.2% in the trash found during the second series of assessments, which is equivalent to a reduction of 2,679 items.



Graph 5. *Comparison of the total number of items found during the 1st and 2nd round of assessments performed on the north coast.*

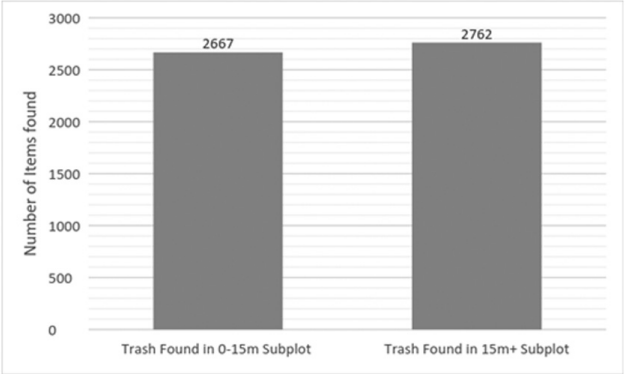
4.3. Comparison of the Northern and Southern Coastlines.

It is evident that there is a great difference between the results found from the northern and southern coastline. The overall trash collected from all the sites on the north coast accounts for 195.92kg, equivalent to 32,663 items, around 76.70% of the total trash collected. The total litter removed from the southern coastline, on the other hand, weighed 'only' 47.61kg (9,922 items) and accounted for around 23.30% of the overall trash collected (see Graph 6).



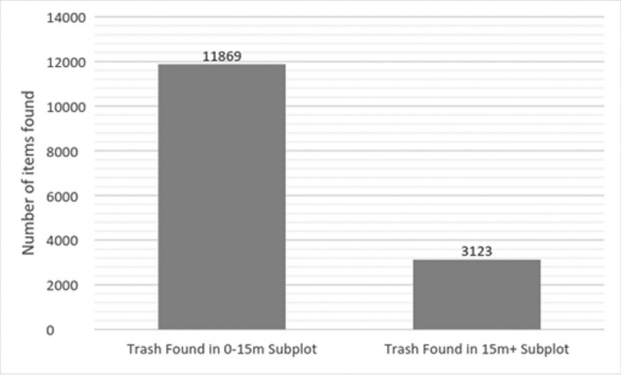
Graph 6. *Overall comparison between the trash collected from the north and south coast of Aruba after all the performed assessments.*

Another clear distinction among the different coastlines' results is where the majority of the trash was found with respect to the water front, which was possible because during the second round of assessments each plot was subdivided in two subplots: 0-15m from the shoreline and 15m+ from the shoreline. When observing the total results from the urban coastline it is possible notice only a minor difference, of 95 items, between the two



Graph 7. *Overall difference in number of items found between the 0-15m and 15m+ from shoreline subplots from all the south coast covered sites.*

subplots (see Graph 7). On the other hand, when comparing the overall results obtained from the combination of both subplots covered on the north coast, a considerable difference emerged (see Graph 8). To be more precise, there was a difference of 8,746 items. The vast majority of the trash was found in the subplots closer to the shoreline (0-15m), which account for 11,869 items, 79.16% of the overall trash collected from all the second round of assessments on the north coast. In contrast, in the subplots located further from the water front (15m+), the total items recovered were 3,123, which is 20.84% of everything that was found in the second sets of measurements.



Graph 8. *Overall difference in number of items found between the various subplots (0-15m and 15m+ from shoreline) from all the north coast covered sites.*

5. Discussion and Preliminary Conclusion

Throughout this research it has become evident that there is a great discrepancy between the amount of trash found on the north coast and south coast of Aruba. Compared to the rural coastline, much less trash was found on the urban coastline. It is clear from the south coast results that all trash collected is the outcome of improper waste disposal by the beachgoers, who have been observed to be both locals and tourists. This means that the majority of, if not all, trash found there is land based. This may be assumed because 5 out of 6 of the most-found items on these sites are related to smoking, drinking and eating activities. This demonstrates that is fundamental to raise awareness among beachgoers and that the use and production of unsustainable food and drinking products should be decreased. The only kind of trash that cannot be directly related to such activities are plastic fragments of which the abundancy can be explained by the fragmentation degradation properties of plastic. Moreover, the researcher observed that a high concentration of trash accumulated around the palapas, where people rest in the shade.

On the north coast, the scenario is very different. Although the most abundant material found is plastic, as on the south coast, there was much more trash collected. It is evident that the vast majority of litter is brought in by the sea, having marine based origin. This was shown by the second round of assessments performed, which provided evidence that the vast majority of trash ends up at the wrack line, where also all the seaweed and algae brought in by the sea accumulate on the beach. Although the trash found on the north coast does not originate in Aruba, it is accumulating consistently and affecting Aruba's coastal ecosystem. Nonetheless, it has to be said that 4 out of the 6 most abundant items found are related to one time use objects (bottle/container caps, straws, bags and plastic utensils), which emphasizes the importance of using more sustainable objects, such as glass bottles and reusable bags. The most abundant objects found were plastic fragments, which can have a severely detrimental impact on the marine ecosystem as they can be easily ingested by animals. It is also important to note that once plastic enters the marine food chain, it will affect humans as well, as we are connected to the marine food chain by eating fish.

From the preliminary results it is concluded that plastic is by far the most abundant material found among the southern and northern shorelines of Aruba. The assessments have shown that Aruba's beaches are facing an environmental issue related to trash abundancy. Moreover, the results raise concerns regarding public health and safety, as many hazardous items are to be found on both the south coast and the north coast, such as glass fragments, condoms, hygiene pads, syringes, medical waste, etc. For more detailed information, consult Appendix I and II.

Further analysis of the data collected will shed light on the trash concentration ratio of both the macro-debris and meso-debris for each site covered. So far, this research has underlined the importance of raising awareness and educating the local population and tourists about the debris that results from unsustainable consuming activities and

the importance of beach clean-ups for both coastlines. Even though the trash found on the north coast is probably the result of poor waste management of other countries, or from marine pollution caused by cruise ships and fishing vessels, Aruba has to manage the waste that is accumulating on its northern shores, as this waste is affecting Aruba's coastal ecosystem. This research has resulted in the removal of 243.53kg of trash (42,585 items). Sadly, this is only a small portion compared to the greater picture of the entirety of Aruba's coastal current situation; which can change only if awareness is raised and regular clean-ups are performed.

6. Acknowledgments

I would like to sincerely thank Eric Mijts and Jocelyn Ballantyne for their incredible work in setting up the Aruba Research Program. They gave a rare opportunity to bachelor graduating students like me, to grow and develop at an academic and personal level by allowing us to set up and perform our own field work research thesis. You opened a window into the future, as you have allowed us to experiment first-hand the beauty and challenges of doing field research in, for some of us, an unknown environment. You made it possible to personally experience if what we thought we would like to do in our coming future is really the direction we want to follow.

I also want to thank my supervisors Tatiana Bekker and Maarten Eppinga for their inspirational support and guidance. I would like to thank all the people in the Aruba research program and, who have made my research and stay in Aruba a wonderful and possible experience. I would like to specially thank Giovanni Jacobs for his help and dedication in assisting me with the majority of the beach assessment I have performed. I would also like to show gratitude towards all the other students who have helped me during my assessments: Rikkert Loosveld, Kimberly van Loom, Sil Scholte and Florianne Sollie. I am also extremely grateful to the collaboration of Arikok National park, through Sherman Lee, who have allowed me and supported me in performing my research in their area of jurisdiction. I am also thankful for Zaida Everon, of Colegio Arubano, who has allowed me to use their facilities and have made the analysis of my data possible.

I would like to conclude by thanking my family for always supporting and motivating me in following my dreams and passions

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APPENDIX I. Overall Debris Data Sheets of the South Coast

DEBRIS DATA: (continued on back)

ITEM	MTERIAL			TOTAL
PLASTIC				
Plastic fragments	Hard	Foamed	Film	
Food wrappers	176	3	266	445
Beverage bottles	36			36
Other jugs or containers	17			17
Bottle or container caps	543			543
Cigar tips	60			60
Cigarettes	2560			2560
Disposable cigarette lighters	8			8
6-pack rings	1			1
Bags			168	168
Plastic rope/small net pieces	60			60
Buoys & floats				0
Fishing lures & line	33			33
Cups (including polystyrene/foamed plastic)	179	12		191
Plastic utensils	208	7		215
Straws	605			605
Balloons			109	109
Personal care products	16			16
Toys				
Fragments	618	14	27	659
Other:	279	12	40	331
Overall	5399	48	610	6057
METAL				
Aluminum/tin cans	43			43
Beer caps	2380			2380
Metal fragments	23			23
Other:	92			92
Overall				2538
GLASS				
Beverage bottles	53			53
Jars	1			1
Glass fragments	406			406
Other:	0			0
Overall				460

ITEM	MATERIAL	TOTAL
RUBBER		
Flip-flops	4	4
Gloves		
Tires		
Rubber fragments	18	18
Other:	8	8
Overall		30
PROCESSED LUMBER		
Cardboard cartons	8	8
Paper and cardboard	196	196
Paper bags	6	6
Tissue/napkins	214	214
Lumber/building material	22	22
Other:	21	21
Overall		467
CLOTH/FABRIC		
Clothing & shoes	17	17
Gloves (non-rubber)	0	0
Towels/rags	5	5
Rope/net pieces (non-nylon)	62	62
Fabric pieces	30	30
Other:	0	0
Overall		114
OTHER/UNCLASSIFIABLE		
Firework	176	176
Plaster	14	14
Wine cork	16	16
Condom	6	6
Hygiene pad	15	15
Battery	4	4
Stuffed animal	1	1
Razor blade	1	1
Duct tape	3	3
Baby diaper	2	2
Hand grenade Col Smoke Red L70A1	1	1
Bullet case	9	9
Phone charger	1	1
Swimming goggles	1	1
Tampon	2	2
Overall		252

LARGE DEBRIS ITEMS (> 1 foot or ~ 0.3 m)				
Item type	Status (sunken, stranded, buried)	Approximate width (m)	Approximate length (m)	Description / photo ID #
Lumber plank	Buried	0.15	3.61	
Lumber plank	Buried	0.12	1.16	
Lumber plank	Buried	0.12	1.32	
Wooden pallet	Buried	1.5	1.5	

APPENDIX II. Overall Debris Data Sheets of the North Coast.

DEBRIS DATA: (continued on back)

ITEM	MATERIAL			TOTAL
PLASTIC				
Plastic fragments	Hard	Foamed	Film	
Food wrappers	194	1	670	865
Beverage bottles	121			121
Other jugs or containers	534			534
Bottle or container caps	6285			6285
Cigar tips				0
Cigarettes	20			20
Disposable cigarette lighters	127			127
6-pack rings	19			19
Bags			1622	1622
Plastic rope/small net pieces	1698			1698
Buoys & floats	46			46
Fishing lures & line	74			74
Cups (including	934	6		940
Plastic utensils	1016	18		1034
Straws	2880			2880
Balloons			7	7
Personal care products	363			363
Toys	220			220
Fragments	12709	1951	1	14661
Other:	400	33	1	434
Overall	27640	2009	2301	31950
METAL				
Aluminum/tin cans	7			7
Beer caps	8			8
Metal fragments	10			10
Other:	18			18
Overall				43
GLASS				
Beverage bottles	39			39
Jars	6			6
Glass fragments	94			94
Other:	3			3
Overall				142

ITEM	MATERIAL	TOTAL
RUBBER		
Flip-flops	131	131
Gloves	5	5
Tires	1	1
Rubber fragments	25	25
Other:	11	11
Overall		173
PROCESSED LUMBER		
Cardboard cartons		0
Paper and cardboard	2	2
Paper bags	1	1
Tissue/napkins	7	7
Lumber/building material	105	105
Other:	2	2
Overall		117
CLOTH/FABRIC		
Clothing & shoes	46	46
Gloves (non-rubber)		0
Towels/rags	3	3
Rope/net pieces (non-nylon)	4	4
Fabric pieces	4	4
Other:		0
Overall		57
OTHER/UNCLASSIFIABLE		
Medical waste	64	64
Syringe	80	80
Brush	2	2
Bullet case	2	2
Light bulb	9	9
Led ceiling lamp	1	1
Filter mask	1	1
Sawing needle	8	8
Baby diaper	3	3
Condom	1	1
Hygiene pad	1	1
Plane's seat arm rest	1	1
Overall		173

***LARGE DEBRIS ITEMS* (> 1 foot or ~ 0.3 m)**

Item type (vessel, net, etc.)	Status (sunken, stranded, buried)	Approximate width	Approximate length (m)	Description / photo ID #
Wooden Pallet	Stranded/buried	1.2	Unknown	
Tire	Stranded	0.20	0.70	Intact
Plastic bucket	Stranded	0.35	0.50	Intact
Plastic tube	Stranded/buried	0.12	0.60	Emerging from the sand
Tire	Stranded	0.27	1	At the wreck line
Plastic tube	Stranded/buried	0.027	1.37	
Plastic box	Stranded	0.3	0.5	Broken
Wooden pallet	Stranded	1.02	1.22	