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Abundance, density, and influencing indicators of solid waste accumulation and mitigation solutions along coastlines on Isla Colón in Bocas del Toro Province, Panamá

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Abundance, density, and influencing indicators of solid waste accumulation and mitigation solutions along coastlines on Isla Colón in Bocas del Toro Province, Panamá



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Abstract

Solid waste accumulation is a significant issue in Latin America where poor infrastructure and management systems are present and with the exponential tourism growth in this region, the abundance of solid waste is also growing. This increase affects environmental, economic, and social factors such as pollution, a decline in tourism, and an increase in negative health effects. This study on Isla Colón, in the Province of Bocas del Toro, in western Panamá sought results on the abundance of solid waste along roadsides and beaches in the most populous and touristic locations. Approximately 2,160 meters squared were studied in Playa Bluff, Bocas del Toro town, and Boca del Drago utilizing quadrants to collect visible solid waste accumulation. 743 items of solid waste were collected, of which 62% were of plastic origin. Of the most prevalent composition of plastic; wrappers, plastic bottles, and unidentifiable fragmented plastics were the most. The mean density of solid waste on the study sites was 25.125 grams per meter squared. Approximately 344 items of solid waste are projected to be found every kilometer of the study sites. Traceability of corporations who produced the items and their production location were difficult to find. A mean of 14% of collected items were identifiable on their location or corporation. A history of the solid waste management system on Isla Colón as well as a history of Cerro Basura and their mitigation methods utilized were identified through available literature as well as a semi-structured interview with the leader of the organization. Further research should be conducted on the specifics of the solid waste management system in order to have successful management actions on Isla Colón.

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Research Question

What is the relative abundance, density, traceability, and other influencing factors of solid waste alongside beaches and roads in the most populated areas of Isla Colón (including Boca del Drago, Bocas del Toro, and Playa Bluff) and how is [Cero Basura](#), a local waste management organization, trying to fix the accumulation of solid waste onshore?

Introduction

Site Description

The province of Bocas del Toro is located in the western area of Panamá and borders the Caribbean Sea in the north, Costa Rica in the west and Chiriquí province in the south (*Figure 1*). It contains six main islands that lie between two bodies of water: Bahía Almirante and Laguna de Chiriquí (Collins 2005). It has a land mass of approximately 430 kilometers squared. 68% of the larger province is tropical forest, but also encompasses mangrove forests, seagrass meadows, and coral reefs on the archipelago within the province (Guzman et al. 2005, NISCP 2015).

Isla Colón is an island within the province of Bocas del Toro, Panamá and is 67.3 kilometers squared (NISCP 2015). It is located at 9.4166° N and 82.5208° W. The three most populous locations on the island are Bocas del Toro 9.4048° N, 82.2692° W, Playa Bluff, 9.4033° N, 82.2478°W, and Bocas del Drago 9.2456° N, 82.1937° W (Google Maps 2018). The sites above are on top of a stabilized beach ridge consisting of reworked coralline sands that have been created due to coral reef erosion (Wake et al. 2013). In 2010, the island had a population of 7,366 or approximately 109.4 individuals per kilometer (NISCP 2015). In 2004, the number of visitors to the island was 140,000 (CPDP 2004).

There is approximately 2890 millimeters of rainfall annually on Isla Colón and shows little signs of seasonality. However, there are two periods of high rainfall and two periods of low rainfall throughout the year (Guzman et al. 2005). Hurricanes in the area are rare because the province is outside the hurricane belt, however, because of its high rainfall characteristic, flooding is common (Lovelock et al. 2005).

The northern and eastern sides of the island are considered windward and the western and southern sides are leeward (McNeill et al. 2013). Leeward beaches generally have less debris accumulation and windward beaches tend to have greater debris accumulation as well as larger debris sizes (Garrity 1993). Modern surface winds in the Isla Colón region are generally from the northeast (NOAA 1993).

The coastal current comes from an easterly direction from Nicaragua and Costa Rica and moves south before eddying or spiraling at the northern part of Colombia (Greb et al. 1996). This westward circulation and southern Caribbean flow has been weakened from the progressive constriction of the Atlantic-Pacific seaway during the late Miocene (Collins et al. 1996).

The Panamá Canal is one of the most important inter-oceanic routes of the world and provides access from the Atlantic to the Pacific ocean or vice versa. One of the main shipping



Figure 1. Map of Bocas del Toro Province (Die 2012)

lanes in Bocas del Toro is from the Panamá canal to Puerto Limón in Costa Rica. Almirante is the largest port in Bocas del Toro and is currently operated by Chiquita Brands International. Besides exportation of bananas from the corporation, there is frequent ferry and boat taxi service from the port to the main islands in Bocas del Toro (CPDP 2004).

Solid Waste Worldwide and in Panamá

As the world progresses toward a rapid expansion in urbanization, population size, and an increase in agriculture needs, there are accompanying changes to the entire planet that invoke problems for the world to face. One of these issues is solid waste management: what do we do with it? Where do we dispose of it? How do we decrease the quantity of solid waste?

As the world develops further, there is an increase in solid waste mainly from urbanization, population, and agricultural growth (Filoso et al 2006). The traditional approaches to waste management of “flame, flush or fling” are outdated and have resulted in unsustainable societies and a rise in pollution (Seadon 2010). Worldwide, as solid waste volumes have begun to exponentially grow at a faster rate than population and urbanization growth, pollution is ever more abundant, which further leads to more social and ecological issues.

Uncollected solid waste contributes to increases in health hazards such as respiratory ailments, diarrhea, dengue fever, as well as leaching into freshwater (Hoornweg and Bhada-Tata 2012). Currently, about 40% of deaths worldwide are caused by water, air, and soil pollution (Pimental et al. 2007). Uncollected solid waste is usually the leading contributor to local flooding, air, and water pollution. Ecologically, uncollected solid waste leads to increases in greenhouse gas emissions which lead to various issues such as climate change, ozone depletion, and leakage of microplastics into habitats and other organisms (Hoornweg and Bhada-Tata 2012).

Out of the total global solid waste composition, organic waste is the most with 46% of all solid waste. Paper is 17%, plastic is 10%, and glass and metal are both 5% of the total global solid waste composition. In Panamá, 44% is organic, 25% is paper, 11% is plastic, 8% is glass, and 5% is metal (Hoornweg and Bhada-Tata 2012).

Plastic debris accumulates in terrestrial environments, in the open ocean, on shorelines of remote islands, and in the deep sea. Even though plastics only constitute 10% of solid waste, it represents a much greater proportion of the debris accumulating on shorelines (Barnes 2009). Nineteen different Latin American and Caribbean studies on debris accumulation on shorelines state that plastics were the most prevalent in composition (Ivar do Sul and Costa, 2007). Plastics have a longevity between hundreds to thousands of years and their life is more likely to be longer in the deep sea and non-surface polar environments. Plastic solid waste is a threat to wildlife through choking and starving events and is also a toxic chemical at the microplastic level (Barnes 2009).

Unsustainable Tourism in Bocas del Toro

Due to an inactive economy on Isla Colón from the 1930's to 1990's, a tourism economy began to emerge in order to create an active economy. As the Panamanian government

implemented neoliberal policies to promote tourism and other forms of foreign investment, there was rapid development in Bocas del Toro. Thus Isla Colón began to become an exotic tropical tourist destination and there was a sudden inflow of tourists to the province, but mostly to its islands (Bourque 2016). Currently, 140,000 visitors come to the island every year, however, there is a vision to have 1 million visitors by 2020 (CPDP 2004). Although the tourism industry on the island has generated economic benefits, there is an unjust and uneven distribution of wealth and jobs. Sociocultural, environmental, and land access implications have been generated from this influx of tourism (Bourque 2016).

Isla Colón has recently been experiencing rapid large population growth (Easson et al. 2015). This is most likely due to tourism and can be seen in *Figure 2*. (Cramer 2013). Isla Colón's tourism growth also grew due to the concept of lifestyle migration, or the idea of people, usually of affluence, moving from their country of origin to developing countries in search of a new lifestyle. This new destination usually has warmer climates, a lower cost of living, and a perceived higher quality of life (Spalding 2011). Isla Colón is a primary example of where the sunny, breezy beaches and beer are present. With recent studies showing an increase in population in coastal and mountain communities in Latin America such as México, Costa Rica, and Panamá, pressure to appease the incoming populous has put pressure on natural resources (Spalding 2013b). This economic growth potential is brought to attention even more by the Panamanian government who has adopted policies to attract foreign residents (Spalding 2013a).

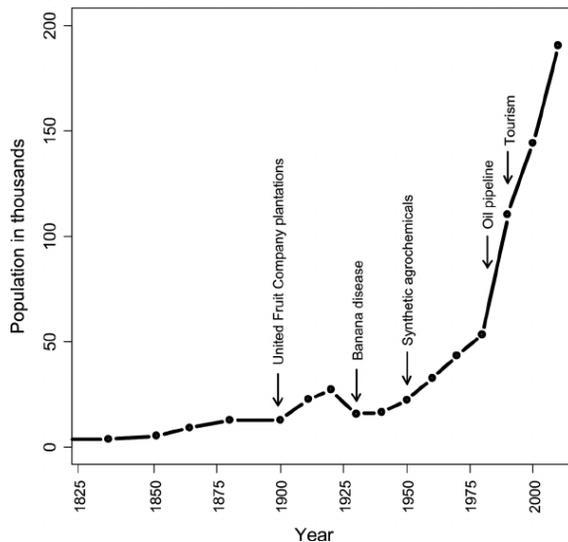


Figure 2. Population increase on Isla Colón (Cramer 2013)

There has been unsustainable tourism development on Isla Colón which in turn degrades the natural environment (Sitar et al. 2015). When there is a higher population, there is a higher amount of solid waste accumulation, especially if the waste management system holds weak infrastructure. Polluted beaches discourage visitors, leading to reduced jobs and revenue, and increased costs for beach and harbor clean ups (Alessi et al. 2018).

Unsustainable Solid Waste Practices in Bocas del Toro

Caribbean islands, as Hoornweg and Bhada-Tata (2012) state, are the largest per capita solid waste generation rates in the world. As Isla Colón is an island in the Caribbean, it aligns with the idea that there are high solid waste generation rates. There have been reports of “black water” outflow (sewage, uncollected solid waste and dumping) in Saigon Bay, which borders the main city on the island, Bocas del Toro (Easson et al. 2015). With the increase in population and economic activity, there is a higher demand for solid waste disposal, however, a (CPDP 2004). This demonstrates that the island does not have a strong solid waste infrastructure. These threats to the environment are poorly acknowledged because of a lack of

information on the solid waste management system as well as the amount of solid waste produced on Isla Colón (Spalding 2013b).

It is known that societies who have disregarded sustainable practices by wasting resources and putting stresses beyond carrying capacities, have seen the demise of such society. Thus, it is highly important that solid waste management be recognized by the community, by the government of Panamá, and by the tourists who loom, litter, and leave. Progressing towards a more sustainable waste management system is a significant step in creating a sustainable society (Seadon 2010). This step includes improved planning and policy making in the community of Isla Colón, which in turn will be a safeguard of sustainability of current anthropogenic activities (Spalding 2013b). However, these plans and policies cannot take a traditional reductionist approach, because that lacks flexibility and long term application. Instead, it should be one that looks at all aspects, environmentally, socially, and economically, in order to find an effective policy from all angles. This sustainable system will integrate feedback loops, embody adaptableness, put attention on the processes, and validate that waste is diverted from disposal (Seadon 2010).

Gaps in Research

There is a need for further research on solid waste management, especially long-term research in order to achieve precise and accurate data to create solutions that will affect Isla Colón for the better. Currently, there are generalizations, poor organization, and small sample sizes in available research on solid waste management on Isla Colón. There is little published research or analysis on uncollected solid waste on Isla Colón, Cerro Basura, or the history of successful and unsuccessful mitigation strategies utilized by the community on Isla Colón. The total amount of solid waste at all landfills on Isla Colón as well as the total amount of solid waste on Carenero and Bastimentos should be identified. Information and specifics on the landfills on the island and how they operate should be identified as well. Research should be carried out on these topics in order for a complete analysis on the solid waste management system on Isla Colón and because it is an increasing issue as tourism and solid waste increase in the area. Scientific data is essential to providing sound information about solid waste in order to have successful management actions (Ivar do Sul and Costa 2007).

Methodology

Methods: Abundance and other Influencing Factors of Uncollected Solid Waste

In order to identify the main sources of solid waste on Isla Colón, I researched the three most populated areas on the island and gather uncollected solid waste accumulation. These locations are Bocas del Drago, Bocas del Toro, and Playa Bluff. The precise GPS coordinates are below. Data was conducted from November 9th to November 20th, 2018.

I collected waste in two different substrates at each location. One was roadside uncollected solid waste and the other was uncollected solid waste along the vegetation area above the sand substrate along beaches. I collected every visible item of solid waste within a quadrant of 360 meters squared using protective gloves for safety and medical purposes. This method was

randomized in three locations on the island in two specific substrates by randomly choosing a 360 meter squared area. The length and width of each quadrant was different due to areas with shorter or longer vegetative areas alongside the beaches and roadsides. Each location studied was on public land because this would limit outside variables such as private businesses cleaning up solid waste on their private property. By collecting on public land, this ensures that the data collected can draw on factors that the municipal government oversees.

The main method utilized was derived from a study that investigated the best litter sampling methodology out of ten different methods on beaches. The method that showed the highest per meter squared of solid waste was Method 8, which was solid waste strictly collected at the vegetative line and above the sand substrate. This study also pointed out that the main advantage of this method is that it is simple and draws the most amount of litter, unlike methods studying strand lines. However, by and large, Velandar and Mocogni (1999) state how the choice of method utilized for a waste accumulation study depends on numerous other influencing factors and that the aims of the study in the end determine the method utilized. Because of this, I have decided to measure quadrants in vegetative areas above the vegetative line of various lengths and widths but equal to the same quadrant area size of 360 meters squared. This way, the same total area is constant at each location, however, due to different topographies at each location, I plotted different lengths and widths for each quadrant. I used Garmin GPS Map 64s to record each quadrant (Frazier and Touw 2014).

The roadside quadrant began at the side of the road and moved perpendicular to the road between 3-10 meters and move parallel to the road between 36-120 meters, equaling a 360 meter squared quadrant. The first quadrant in Boca del Drago was 9 meters wide by 40 meters long. The second quadrant in Bocas del Toro was 10 meters wide by 36 meters long. The third quadrant in Playa Bluff was 3 meters wide by 120 meters long. The sand substrate quadrants began at the vegetation line where the sand substrate meets the vegetation substrate. I chose my quadrants randomly and would find the longest width I was able to find before finding the length of my quadrants. I made 2 quadrants at each location, equaling a total of 6 quadrants of 360 meters squared equaling a total of 2,160 meters squared of studied area.

I then sorted the uncollected solid waste into specific categories which can be described in the methods chart (Appendix). I identified the number of each type of uncollected solid waste, where the product was initially produced or made if listed on packaging, as well as the corporation who produced the product if listed on packaging.

During my research, I came across large plastic bags already filled with solid waste. These bags were not collected or weighed because they are technically point sources and are dropped off by specific people on purpose. This solid waste also would add another variable to my study and because of so, data was not collected on it.

After sorting, I weighed the total amount of uncollected solid waste gathered using the CAMRY EL10 and was able to draw conclusions and comparisons on density of uncollected solid waste between the different locations on Isla Colón and other studies that used the same methodology alongside roads and beaches (Özdilek et al. 2006 and Burton 2000).

Methods: Effectiveness of Solid Waste Management in the Past and Present

In order to identify ways *Cero Basura* is mitigating solid waste accumulation from its past to the present, I interviewed the leader of the organization, Angel Gonzalez-Diaz. I conducted a semi-structured interview to Señor Gonzalez in both Spanish and English for approximately 90 minutes in length and audio recorded the interview so I was able to re-listen to it afterwards, providing precise and accurate representation.

Upon the interview, I introduced myself and my project and explained the content from my Interview Introduction and Guide (Appendix). After receiving consent to interview Señor Gonzalez through email, I asked for his permission to use my digital recorder.

Additionally, before this interview began, my project proposal was first approved by the Local and International Review Board (LRB/IRB), a panel of academics who ensured that my methods and questions would not cause ethical concerns or harms to the participants.

I conducted semi-structured interviews because it allowed the interviewer space for reciprocity as well as reflexivity. The semi-structured interview is able to provide researchers a way to attend to a lived experience and pursue questions from extant theory (Galletta 2013). This flexibility allows the interviewee for the discovery of information that is important to them that may not have been originally recognized by the researcher (Gill 2008). By utilizing a semi-structured interview approach, I had questions written but was able to move freely around to different topics and points the interviewee was saying.



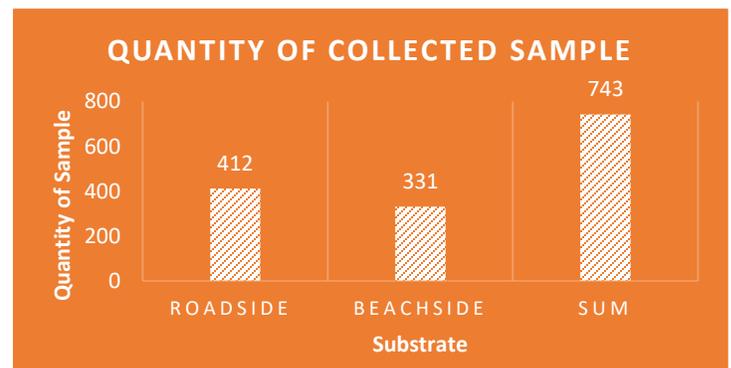
Figure 3. Map of Roadside and Beachside Study Sites (Google Maps 2018)

Results

Relative Abundance, Weight, Density, and Traceability of Uncollected Solid Waste

Abundance of Visible Solid Waste Accumulation

A total number of 743 visible solid waste items were found at all three study sites at both substrates (Graph 1). A total of 412 visible solid waste items were found along the roadside substrate and a total of 331 visible solid waste items were found along the beachside substrate. There was no

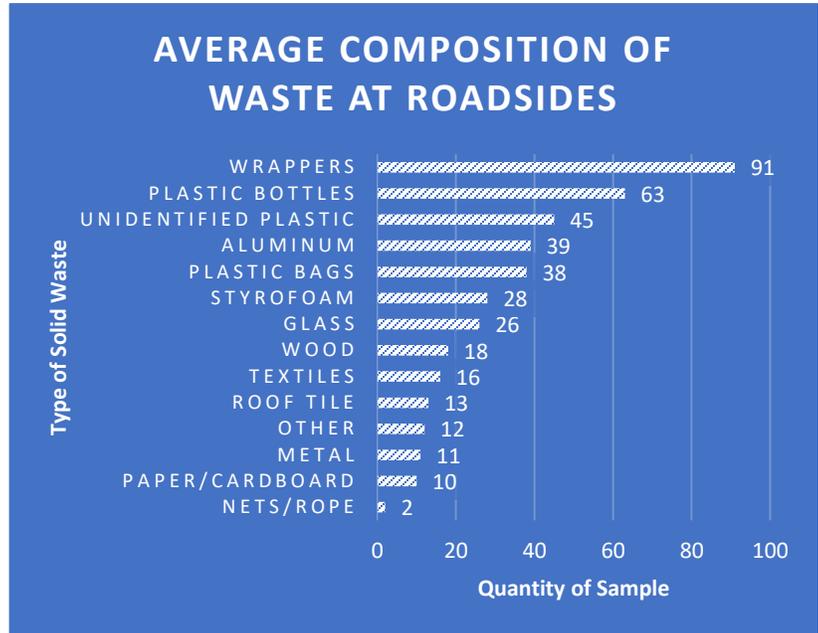


Graph 1. Quantity of visible solid waste items collected at different substrates

significant difference found between roadside and beachside solid waste accumulation substrates based on quantity.

Abundance and Identification of Visible Solid Waste Accumulation

The types of visible solid waste items were averaged between all three locations along the roadside substrate (Graph 2a). A total of 14 types of solid waste were found. The most collected type of visible solid waste item found was wrappers, or 22% of the total. Wrappers included all snack wrappers, water bottle wrappers, and other plastic wrappers. Plastic bottles were the second most collected item, consisting of plastic water bottles, soda bottles, and other types of plastic containers, which consisted of 15%, followed by unidentified plastic at 11%, which consisted of any debris items made from plastic that were not able to be categorized or identified. The types of visible solid waste items were averaged between all three locations along the beachside substrate (Graph 2b). The most collected type of visible solid waste item was unidentified plastic, consisting of 17% of the total. The second most was plastic bottles, 16%, and wrappers, 15% of the total. The mean of both substrates of all three locations was found (Graph 2c). The most collected solid waste item were wrappers, consisting of 19% of the total. Plastic bottles were second and consisted of 16%, and the following was unidentified plastic or 14% of the total. I further divided the 14 specific categories of solid waste into broad categories in order to show comparisons between solid waste material. Plastic wrappers, plastic bottles, unidentified plastic, plastic bags, and Styrofoam were categorized in plastic (Graph 2d).



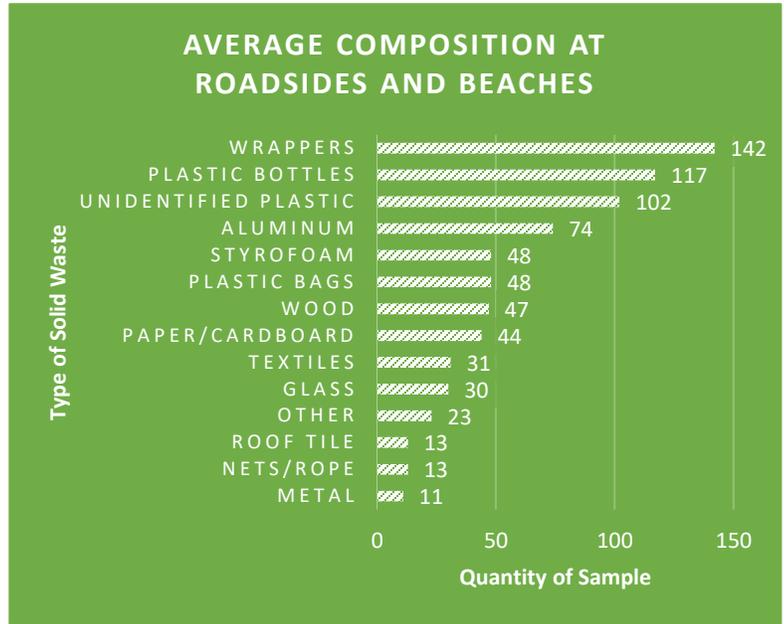
Graph 2a The average types of visible solid waste along the roadside substrate



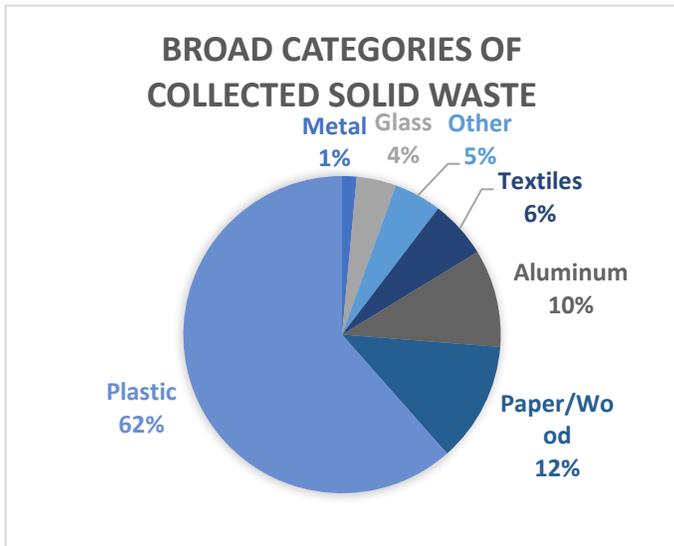
Graph 2b The average types of visible solid waste along the beachside substrate

Textiles consisted of nets, rope, and textiles, while paper, cardboard, and wood were also combined. Plastic held the most which consisted of 62% of the total, with paper/wood having 12%, and aluminum having 10%.

The weight was measured in kilograms at every study site after identification was conducted (Graph 3). The roadside substrate had a total of 31.02 kg which was higher than the beachside substrate which had 23.25 kg. The total sum of both substrates of all three study sites was 54.27 grams. No significant difference was found between the differences in weight between both substrates.

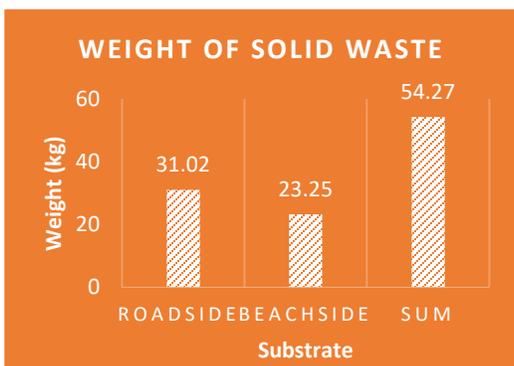


Graph 2c. The average types of visible solid waste collected at both beachside and roadside substrates in three locations on Isla Colón.



Graph 2d. The average types of visible solid waste collected and categorized into broad categories.

The density was found utilizing the weight of the solid waste and the study site area (Graph 4). The following numbers were found by dividing the weight by the total area studied. The density of the roadside substrate was 28.72 grams per meter squared and the beachside was 21.53 grams per meter squared, equaling a mean of 25.125 grams per meter squared.



Graph 3. Weight of collected solid waste at different substrates



Graph 4. Density of collected solid waste per area studied at different substrates

Traceability of Solid Waste Items

With the solid waste items collected, there were items found that were initially produced in various parts of the world, ranging from Indonesia to Ontario to various cities all over Panamá (Figure 4). The dropped pins are in the city where the product was produced even if only one solid waste item was found produced in that specific location. The quantity of solid waste items found in a certain area were not repeated in

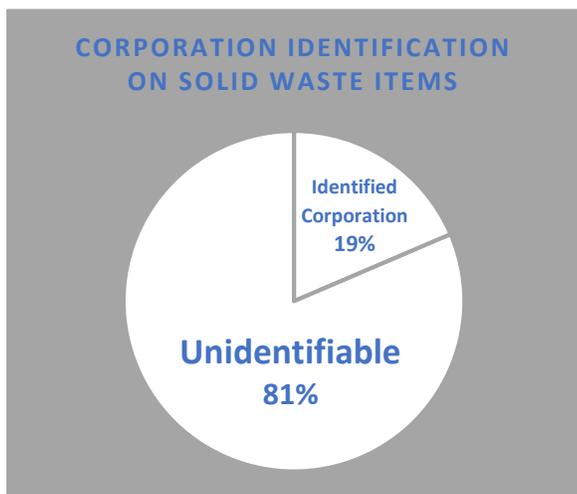


Figure 4. Map of Location of Solid Waste Items (Google Maps, 2018).

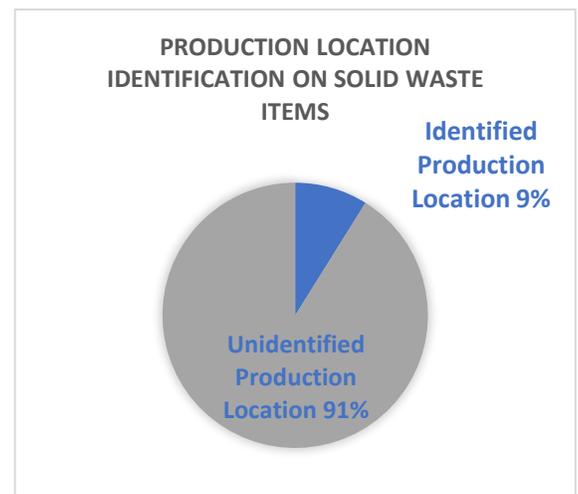
Figure 4, however, most items were produced in Panamá, El Salvador, and Costa Rica. Few items were found from Indonesia, Ontario, St. Louis Missouri, and New York. Within Panamá, items were produced the most in western Panamá in David, Chiriquí, Changuinola, Bocas del Toro, Boquete, and Almirante.

However, the identification of solid waste items was found to be significantly low. In Graph 5a, the identification of corporations on solid waste was 19%, while 81% of all items collected were unidentifiable. In Graph 5b, the identification of production location on solid waste items were even lower.

Only 9% of solid waste items were identified, while 91% of the items were unidentifiable. These unidentifiable solid waste items did not have any labels or had their labels damaged from other variables.



Graph 5a. Pie chart of identified and unidentifiable solid waste items collected



Graph 5b. Pie chart of identified and unidentifiable production location of solid waste items collected

Interview with Cero Basura Leader, Angel Gonzalez

History of Solid Waste Management of Isla Colón

During my 90 minute semi-structured interview with member and leader Angel Gonzalez, I was able to conclude information about the history of solid waste management on Isla Colón, as well as the islands Carenero and Bastimentos.

Señor Gonzalez, when arriving to the island 24 years ago stated that no one blinked an eye when restaurant and store owners threw their own garbage into the ocean. Working with PROMAR, a foundation for protecting the sea which he became a part of around 1988, he was able to stop community members from throwing their own solid waste into the oceans. This then led to beach clean ups, however, as time went on, Gonzalez began to work on other projects, such as a project with Bocas ALIANZA and Cero Basura (Section 2).

Currently there are four landfills on the island, one in Paunch and the other three scattered near Boca del Drago. The landfills are owned by private companies and collect waste from the whole island of Isla Colón, Isla Bastimentos, and Isla Carenero. The waste is either dumped at the landfill or incinerated.

The private companies, during Gonzalez's 24 years on the island, have stopped accepting solid waste due to a lack of funds from the municipality of Bocas del Toro and Panamá. During this time, Gonzalez and six other community members cooperated to create a solid waste management pickup and disposal system. The group created trucking routes to collect solid waste, a profitable system to collect the solid waste, and found workers to collect the solid waste as well as trucks. Each bag of solid waste created by a community member cost \$1.50 to dispose of to the new solid waste management system. The \$1.50 provided funds for the workers collecting the waste, funds for the private companies who owned the landfill, and paid for transportation to and from the landfill. This only happened for six months until the owner of the private landfill company realized that this was a profitable idea. They began to take over the solid waste management system and still operate it today.

Recently within the past 5 years, Gonzalez has also noticed an increase in plastic on the island, because it was not as mass produced and utilized as it is today in packaging, bottles, bags, and other plastic materials. This leads into his more recent work with Cero Basura and their proposals for banning plastics (Personal Communication 2018).

History of Cero Basura

Cero Basura, led by Angel Gonzalez, is an alliance of environmental organizations and volunteers from the community on Isla Colón that work to improve the solid waste management in Bocas del Toro. It currently has three employees and numerous volunteers. Currently, the organization is funded through the municipality and donors. Their funding goes directly to material and transportation costs such as banners, t-shirts, reusable bags, flyers, and boat trips to Bastimentos and other places.

The organization's first objective was to improve the quantity of solid waste, which when the organization began, was defined as a cleaning up waste on the island. They were able to do this by organizing beach clean-ups at different beaches on Isla Colón including Playa Bluff,

Playa Istmito, and Playa Estrella. The organization then began to realize that these beach clean-ups would just create more dependency on the organization from the community, instead of changing the values and habits of the community. They then sought this out and began thinking of ways to stop consumerism that leads to the creation of more solid waste. This concept led the group to draft proposals for prohibiting the selling and usage of solid waste producing items, such as plastic bags.

In order to accomplish this, they began spreading awareness of why plastic and other types of solid waste are bad for both the marine and land ecosystems, as well as induce health and safety hazards. They also put an emphasis on how solid waste effects the tourism industry negatively. This was one of their main talking points because the tourism industry is affected by almost every store, business, and community member on the island. These were carried out by holding meetings with supermarket owners and other civic engagement activities such as having informational stands/booths about Cero Basura, charity trivia, and environmental film nights. These activities were able to spread awareness of Cero Basura and their objectives of decreasing solid waste on the island as well as their proposals for banning types of plastic. Their proposals are submitted to the general meeting on Isla Colón which occurs every 15 days. The proposal is then submitted to the council of five people to be approved. After this, it is brought to the mayor in which he has the opportunity to approve or decline the proposal.

The first proposal, or the municipal agreement number 004, was beginning to be drafted about the banning of plastic utensils, straws, and Styrofoam plates, cups, and to-go boxes (Appendix). This new law was approved in April 2016 and began on the 22nd of January in 2017. Flyers and meetings with community members and restaurants were held (Figure 5). Gonzalez said that Styrofoam was harder to implement than the other materials banned because it is such a cheap material.

The second proposal, or the municipal agreement number 022 began on the 25th of April in 2018, but was approved in April 2017 (Appendix). The ban was to prohibit the selling and exchange of single



Figure 6. Cero Basura member spreads awareness of single use plastic bags

use plastic bags at restaurants, grocery, and other business utilizing plastic bags. The community is given time in order to change values before having to abide by the new municipal

agreement, however, after the law was enacted, economic sanctions or fines were given. In Figure 6, a member of Cero Basura spreads awareness of

the harmful effects of single use plastic bags. In Figure 7 is a flyer spreading awareness of the plastic bag ban.



Figure 5. Flyer about the ban of Styrofoam, plastic utensils, and straws.

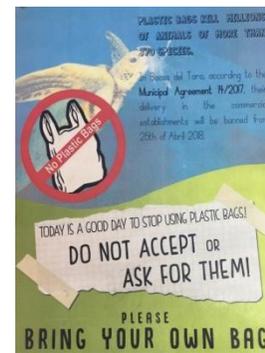


Figure 7. Flyer about the ban on plastic bags

Archipiélago de Bocas del Toro
LIMPIEZA DE PLAYAS, COSTAS, MANGLARES Y SUBMARINA 2018
Estadísticas

530 personas limpiaron playas, costas, manglares y sitios submarinos
449 personas limpiaron 12 playas y costas
50 personas limpiaron 3 manglares
31 personas limpiaron 3 sitios submarinos

Se extrajeron en total 3,945 libras de residuos
3,015 libras en las playas y costas
510 libras en los manglares
420 libras en los sitios submarinos

Se extrajeron en total 20,738 residuos sólidos de diferentes tamaños
1,048 residuos de vidrio (5.08 %)
1,037 residuos de foam (5.02 %)
1,604 latas de bebidas (7.77 %)
13,196 residuos plásticos (63.92 %)
3,863 residuos de otro tipo (metal, tela, caucho, carton, etc.) (18.71%)



Figure 8a. Results of people, weight, and quantity of solid waste items on the clean-up.

They have additionally conducted a large clean-up this year on September 23rd in 2018 in which a total of 530 people cleaned beaches, mangroves, and marine ecosystems and collected a total of 20,738 items of solid waste weighing approximately 3,945 pounds. *Figure 8a and 8b* are the results from the clean-up (Personal Communication 2018).

Bocas Alianza

Bocas Alianza is a non-profit coalition that brings together organizations and institutions that operate in the Province of Bocas del Toro and seeks to promote local development with the active participation of the community by sustainable use of natural resources. The organization is promoted by the International Union of the Conservation of Nature (IUCN) and the government of Norway. Bocas Alianza began in June 2004 and held its first meeting on the development of Bocas del Toro District Management Plan in December 2006. In January 2010, there was a presentation of the Bocas del Toro District Management Plan. The project is still currently recognized as in progress and part of it was to search and implement a proper disposal area for solid waste on Isla Colón. This project sought to find a landfill and recycling

The third proposal is currently an ongoing process which is to ban plastic bottles in stores and restaurants. Gonzalez is currently planning to split this municipal agreement into two sections. The first will be for banning plastic water bottles and the other into soda/other bottles. For water, he hopes tourists and other stores will begin selling large 5 gallon jugs of water instead of using single-use water bottles. He also hopes that for the soda bottles, stores will begin buying glass and aluminum cans instead of plastic bottles.

Cero Basura has also created other small projects including these proposals. They have created 6 refillable water stations in Bocas Town, Bocas del Toro, in which 1 liter of clean water costs \$0.50.



Figure 8b. Results of types and quantity of solid waste items on clean-up.

center for the areas of Bocas del Toro, Chiriquí Grande, Changuinola, and Almirante. Gonzalez and others in Bocas Alianza visited 25 possible landfill locations before narrowing the possibilities to three areas. The top three locations had roads that went directly through all four areas, making it easy access to all four districts. The EPA of Panamá came to finalize the decision between the top three locations left by looking at all social, economic, and environmental factors. The area they chose had a total of 30 acres of land and would be in Changuinola. This project was being funded by the National Council for Sustainable Development (CONADES) and the Inter-American Development Bank (IDB).

CONADES is a government run sustainability development program and the IDB is the largest source of development financing in Latin America and the Caribbean. The 7 million dollars in funds went to the design of the project, which not only included the collection and disposal of garbage in the four locations, but also environmental education and recycling programs. Little by little, CONADES began to stop inviting Bocas Alianza to the project and because there was no progress shown by the project, the IDB took back their funds. Gonzalez hopes to begin, implement, and finalize the project again soon (Personal Communication 2018).

Discussion

Substrates and their Correlation on Solid Waste Accumulation

Reviewing the data collected from Graph 1, 3, and 4, roadside substrate does seem to have a higher quantity, weight, and density than beachside substrate, however there is no significant difference. Both the roadside and the beachside substrates contain hundreds of items of solid waste, both have similar weights and densities, and also have the same top compositions of solid waste. The top three compositions are wrappers, plastic bottles, and unidentifiable plastic.

The substrates are most likely similar in solid waste accumulation because of the topography and area studied. There is only one main road on Isla Colón and this road happens to travel directly along the beachside substrate in Boca del Drago, Playa Bluff, and Bocas del Toro. Due to this, there really should not have been a significant difference in the substrates because both substrates are practically the same. The beachside substrate could technically be described as roadside substrate as well.

Tourism, Income, and their Effects on Solid Waste Accumulation

By reviewing Graphs 1-4, there is a trend of an abundance of solid waste on the island as well as several different compositions of it. This trend can be seen by the mean density found across the six locations which was 25.125 grams per meter squared. A sustainable and environmentally healthy beachside or roadside substrate would have 0 grams per meter squared of solid waste, and the average density on Isla Colón was 25.125 grams per meter squared. I am also able to extrapolate that every kilometer along the beachside or roadside substrates on the touristy sections of the island, there would be 344 items of solid waste found, whether it is fragments of plastic or large pieces of metal.

Through observational data, I did not see nor find any trash bins along the roads, beaches, or in the vicinity of Playa Bluff or Boca del Drago. In Bocas del Toro, there are several trash bins along Playa Istmito as well as in the town, however, they are usually full or even overflowing with solid waste. Due to a lack of empty trash bins at tourist locations on the island, it supports the idea that there is an abundance of solid waste at the studied locations. More trash bins are needed as well as more frequent trash removal is needed, as this may turn into accumulated solid waste nearby from other variables such as natural disasters.

Sellier (2009) articulates that the Bocas tourism industry has grown over 70% from 2006-2016 and Klytchnikova and Dorosh (2012) have said that there was a 111% increase in hotel rooms in Bocas del Toro from 2007-2012. A high influx of people to the island due to tourism development further depict a predictable story of an increase in solid waste generation (Mihai 2013). Due to a high abundance in solid waste from tourism increases, there are threats to the local environment. Because of this improper waste management system, there could be significant impacts on the environment as well as pollution generation (Hoang et al. 2017).

Plastic and its Issues

It is not surprising that plastic was the most common type of solid waste found in my study. 62% of the total collected solid waste was identified as plastic. This aligns very closely to the large-scale clean-up conducted by Cero Basura, in which of approximately 20,738 items collected, 63.92% was identified as plastic. Even though there is no analysis on the methodology of the Cero Basura clean-up, the results are similar to this study. Plastic bottles, aluminum, and fragments of unidentified plastic are the top three most common items found, whereas, wrappers, plastic bottles, and unidentified plastic were the top three found in this study.

Plastic production has increased over the past century as technology and consumerism advances. One study found that global plastic production had increased from 2 Mt to 380 Mt from 1950 to 2015 or nearly 200-fold (Geyer 2017).

Most composition studies on solid waste draw similar conclusions about plastics; that there is an undisputable prevalence of them (Ivar do Sul and Costa 2007). In a Caribbean and Latin American study on solid waste beaches, 82% of debris collected was in the category plastics. 60% of solid waste found on beaches in a Jamaican study were plastic. Another study in Mexico found that 60% of solid waste on beaches was plastic and another study found plastic to be the most abundant in Colombia, Puerto Rico, Mexico, Barbados, St. Lucia, and Dominica (Ivar do Sul and Costa 2007; Lara-Dominguez et al. 1994; Coe et al. 2017). Singh and Xavier (1997) also found the same conclusion at the British Virgin Islands, St. Lucia, and Dominica. In Curacao, Debrot et al. (1999) had 64% and Nagelkerken et al. (2001) had 47% of solid waste on beaches be plastic. Overall, there is an abundance of plastics in solid waste accumulation on beaches in the Caribbean. This may be because plastics are able to fragment into smaller pieces while still not decomposing for hundreds of years (Ivar do Sul and Costa 2007).

Wrappers were most likely the highest in quantity shown in Graph 2c because size and dimensions were not a variable in this study. Any size of any item of solid waste was counted as one, and wrappers—whether snack or bottle wrappers—are able to be fragmented much more quickly and easily than harder rigid plastics, such as a plastic water bottle. Plastic bottles were

rarely found broken, torn, or fragmented whereas almost all wrappers were torn and fragmented into smaller pieces of waste.

Density of Solid Waste Accumulation

Studies with the same methodology of solid waste accumulation along beaches and their density outcomes per meter squared were listed in Table 1 below. In addition to the statistic that the beaches studied on Isla Colón have 21.53 grams per meter squared, there is also 344 items of solid waste per kilometer. Along the Falkland Islands, specifically on Volunteer Beach, there are approximately 200 items per kilometer (Otley and Ingham 2003).

Table 1. Solid waste accumulation densities along beaches in different studies (Özdilek et al. 2006).

Study Period	Study Location	Mean beach litter amount, g/m ²
1990	Chatnam County, GA, U.S.	45
1993	Curacao, Caribbean	3832
1995	Transkei Coast, South Africa	101
1998	Orange County, CA, U.S.	16
2002	Volunteer Beach, Falkland Islands	19
2002	Japanese Beaches (Sea of Japan)	14
2002	Russian Beaches (Sea of Japan)	8
2003	Samandag Beaches, Hatay, Turkey	1251
2018	Isla Colón Beaches, Panamá	21.53

Traceability

By reviewing Graphs 5a and 5b, it is apparent that traceability is a difficult task. Tracing back to where a product is created as well as to the corporation who created it brings a separate point of responsibility. Who is responsible for the solid waste accumulation on the island. Is it the tourists, the community, the corporation who created the product, or the municipal government?

Other studies that try to trace where solid waste is produced and who it is produced by have come across similar issues as with this study. In the Latin American and Caribbean study on beach debris showed that approximately 10% of all items had its origin recognized (Garrity 1993). This aligns with this study as only 9% of items origins were able to be identified.

Identifying where solid waste items had come from and which corporation produced them is extremely difficult. This is due to marine or organism growth such as fungi or moss. Weather, currents, temperature, humidity, as well as human interference creates more and more damage and deterioration to the solid waste. Identifying the source of marine plastic pollution accumulating on ocean beaches is difficult as unidentifiable fragments of plastic predominate (Smith 2018).

Cero Basura's Solid Waste Mitigation Methodology

The knowledge provided from Angel Gonzalez in the semi-structured interview on Isla Colón's solid waste management system is not able to be generalized for other locations in Latin America or the world, but should be looked at as a case study that has had a successful solid waste management system. Every place in the world has different social, economic, political, and environmental factors which influence how a certain solid waste system functions. Therefore, this should demonstrate that every solid waste system should be analyzed differently.

Cero Basura overtime has utilized several types of solid waste mitigation methods. They have created proposals on banning types of plastic, conducted beach clean-ups, implemented potable drinking water fountains, held education outreach programs as well as other civic engagement activities, and created a proper waste management system when the previous one had gone awry.

These plastic ban proposals have been successful because of the way they are carried out. First, Cero Basura implements education outreach to the community through civic engagement activities as well as explaining their reasoning for the bans by holding meetings and talking to restaurant and grocery store owners, usually making an emphasis on how this would effect tourism positively.

After this, they create proposals banning specific plastics that create an abundance of solid waste on the island. These proposals are prepared officially, so that the only thing the council and the mayor on the island must do to approve them, is to sign them. This makes the process quick and simple for Cero Basura, the council, and the mayor. This process also happens to occur over a longer period of time and usually only about banning one specific type of plastic. Due to this, the public is not affected drastically. Little by little, Cero Basura has been able to lead up to bigger and harder issues, such as their next proposal on banning plastic bottles (Personal Communication 2018).

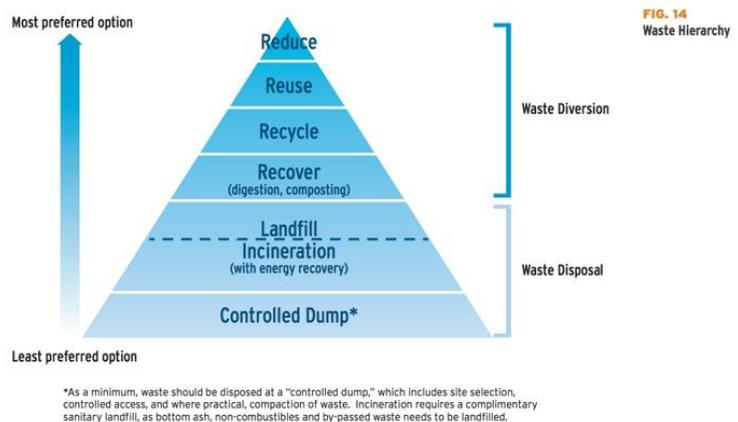


Figure 9. Waste Hierarchy (Hoorweg and Bhada-Tata 2012)

Reduce

According to the waste hierarchy in *Figure 9*, Cero Basura is on the most accurate path towards decreasing solid waste and leading the solid waste sector on the correct path. They are focusing on creating proposals that reduce the amount of plastic consumption in Bocas del Toro.

This top sector includes prevention, minimization, and reduction initiatives to reduce the quantity of waste at generation points by changing patterns of production and consumption (Hoorweg and Bhada-Tata 2012). By reducing waste, the greenhouse gas emissions from the creation of the material as well as the product manufacturing process are avoided. It also eliminates the emissions created from waste management.

After the next proposal that Cero Basura is currently drafting is proposed and approved about banning plastic bottles, I would suggest finding ways to reduce the next most common type of waste that is feasible, aluminum. Aluminum, usually in the form of soda and beer cans, are able to be reduced by the increase of the consumption of kegs. Returnable metal kegs can be reused and require less reliance on new manufactured materials (Brewers Association 2018). This idea leads into the next waste diversion method of recycling and reusing (Personal Communication 2018).

Recycle and Reuse

Cero Basura is currently not using the mitigation method of reusing waste, recycling, or recovering, however, these measures are currently not possible due to financial burdens. However, if certain recycling, reusing, or recovering methods were utilized, it would reduce the quantity of disposed waste and then return those materials created back to the economy (Hoorweg and Bhada-Tata 2012).

In a Ghana study in 2017, waste from different compositions of plastic were modified into bitumen which held great promise as an alternative recycling method for road construction (Appiah et al. 2017). This is a great way to create more economic stimulation from job creation and also clean-up waste.

I would suggest searching for ways to recycle the next most harmful and abundant type of waste, wrappers. TerraCycle, a recycling and upcycling company, has a free program which is currently being utilized by the Sustainability Office at Skidmore College. This specific program I would suggest Cero Basura to look into is the [Snack Bag Recycling Program](#), which Cero Basura would join for free, collect wrappers, ship to TerraCycle's recycling plant, and then repeat the process. By utilizing recycled boxes or bins on Isla Colón, Cero Basura would only need to implement the location of the bins, advertisement of what the bins are and what is allowed to go into them, and then collect the bins when they are full. TerraCycle pays for the shipping and handling of the recycled waste and even has other free recycling programs. This concept would should be researched thoroughly before implementation because the shipping footprint could affect the amount of greenhouse gas emissions more than simply landfilling the wrappers.

Recycling aluminum is able to be incentivized through bottle deposit laws. Creating recycling centers where community members are able to receive \$0.05 or \$0.10 back may incentivize people to recycle their cans or for community members to collect or pick aluminum cans out of the trash (Campbell et al. 2016; Personal Communication 2018). This recycling center initiative must be researched thoroughly before implementation due to social and economic factors. This study does not have any financial information or statistics on if this concept would be financially sustainable or feasible for Isla Colón.

Infrastructure on Solid Waste Management

I would suggest Cero Basura and the municipal government to focus on the improvement of the collection of solid waste. Currently there is no fixed schedule for garbage collection, either in the business sector or the houses. Gonzalez has stated that the garbage collection happens every day in the business sector, however, only once a week at most in the houses. The municipal government should create and define a strict waste disposal time and truck route in order to ensure clean streets. There should also be more jobs from the municipality dedicated to cleaning up solid waste along beaches, roads, and streets in order to improve tourism rates, safety, and health hazards. I would also propose more trash bins in areas so that tourists and the community do not litter, but instead throw their waste into designated trash bins. By and large, there must be a better infrastructure for solid waste management on the island (Personal Communication 2018).

Incineration

Currently, all of the solid waste collected on the island, as well as Carenero and Bastimentos are incinerated or dumped in a landfill at four locations on the island. There is currently no research on how the solid waste is burned and how much of it is burned and this makes mitigation methods difficult to analyze. The following are pros and cons to incineration of solid waste.

If the incineration method utilizes energy recovery, the incineration of solid waste is able to reduce the volume of disposed waste by up to 90%. This strategy is also considered preferable to direct landfilling, assuming that pollution control requirements and costs are adequately addressed (Hoorweg and Bhada-Tata 2012). Environmental and health impacts also strongly depend on the emission control technology as well as the incinerator design and operation (Geyer 2017).

If the incineration method does not utilize energy recovery, it is not a preferred option due to costs and pollution. Open-burning of waste is discouraged due to severe air pollution associated with low temperature combustion (Hoorweg and Bhada-Tata 2012). The smoke that is released from burning plastic and other solid waste compositions often contain toxic chemicals such as mercury, polychlorinated biphenyls (PCBs), dioxins, and furans, which are harmful to humans and the environment (Bourque 2016 and UNEP 2018). The toxic smoke is able to travel through the air and contaminate water, resulting in the bioaccumulation of those pollutants in humans and other organisms (Bourque 2016; Personal Communication 2018).

Landfill

The last preferred option for mitigating solid waste is a landfill or a disposal site. Landfills should specifically be engineered to protect against leakage from solid waste contaminating into groundwater and the environment. Landfill gas is also created from this method and is produced from anaerobic decomposition of organic matter. This gas, which is usually 50% methane, is able to be recovered and utilized for energy. However, proper landfilling is often lacking, especially in developing nations (Hoorweg and Bhada-Tata 2012).

Limitations on Solid Waste Accumulation Study

If this study or a similar study were to be replicated on uncollected solid waste accumulation along roadsides and beaches, I would suggest the researcher to fix or improve the following limitations.

The first and biggest component is that this study had a small sample size. Only 2,160 meters squared were analyzed at three locations, totaling six 360 meters squared areas sampled. The study was also completed during mid-November, only two months after the largest clean-up ever conducted on the island in September. This may have affected the abundance of solid waste in my areas of study.

Large solid waste items such as heavy pieces of wood or sheet metal also could have affected the weight and density results heavily by skewing them.

I also did not collect data on the large plastic bags full of solid waste. By not collecting this data, I was not including all solid waste found in the study site, however, I believe this could have skewed my data.

I would also like to point out that if another similar study were to be conducted, they should only collect at beaches instead of roadsides. This is because the beachside was technically the roadside at most of my study sites. There are also many more research articles and journals on beach debris than roadside debris.

Finally, human error when collecting solid waste fragments is another limitation. When collecting solid waste, I did not rinse nor dry my collected items, therefore adding more organic weight and skewing the weight and density of the research conducted. Another factor is that I was unable to retrieve certain items from the ground because they either became more torn or were lodged deep into the ground. This skewed the weight and density of solid waste down because not all items were able to be retrieved and scaled. Another issue was that along the Playa Bluff roadside study site, there was murky water of about 0.5 meters in width that followed the whole transect. This murky water could have skewed the amount of fragments found because I was unable to see and locate solid waste items in the murky water. As always, there is also human error on picking up solid waste and repeating the amount of solid waste items in tallying. I could have missed items along the quadrants or I also could have repeated items on my tally sheet while collecting data.

Limitations on Interview with Angel Gonzalez

By only interviewing one perspective on solid waste management on the island and Cero Basura, the information received was from a small sample size. This could have affected the data because he may or may not have left important details out. I also am a native English speaker, and Gonzalez is a native Español speaker. Due to this, there could have been a miscommunication because of the language barriers during the interview.

Conclusion

Final Remarks

It is apparent that uncollected solid waste along roadsides and beaches is abundant. Approximately 25.125 grams of solid waste are found every meter and approximately 344 fragments of solid waste are found every kilometer along roadsides and beaches in tourist locations on Isla Colón. This abundance is due to a 70% increase in the tourism industry from 2006-2016 as well as a disorganized solid waste management system (Sellier 2009). As for the most abundant composition of uncollected solid waste along beaches and roads, plastic is expectedly the source. Approximately 62% of 743 total items collected were considered plastic which aligns with other Latin American studies on beach debris accumulation. This study also found that traceability of solid waste near beaches is extremely difficult because most fragments of debris are unidentifiable. 81% of the total items collected had unidentifiable corporations and 91% of total items collected had unidentifiable production locations. Cero Basura is on the correct path towards mitigating solid waste through reducing solid waste by drafting proposals that prohibit the usage of certain plastics on the island. These results align with scientific data depicted in the Discussion portion of this research analysis and thus is evidence to support this research on solid waste accumulation along roadsides and beaches.

Further Research

In order to further support my data and analysis, additional studies should be conducted repeating the same methodology utilized in this study as well as other beach debris accumulation studies. The research conducted should fix and correct any limitations applied in this study which are depicted in the Discussion. In addition, field research on the specifics on the solid waste management system as well as solid waste in other areas should be conducted. The total amount of solid waste at all landfills on Isla Colón as well as the total amount of solid waste on Carenero and Bastimentos should be identified. Information and specifics on the landfills on the island and how they operate should be identified as well. The possibility of recycling centers, incinerators with energy recovery, and other mitigation methods should be researched and analyzed in Bocas del Toro.

Research should be carried out on these topics in order for a complete analysis on the solid waste management system on Isla Colón and because it is an increasing issue as tourism and solid waste increase in the area. Scientific data is essential to providing sound information about solid waste in order to have successful management actions (Ivar do Sul and Costa 2007).

Appendix

Municipal Agreement Proposals

Number 004: Plastic Utensils, Styrofoam, and Straws

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GACETA OFICIAL
GOBIERNO DE LA REPUBLICA DE PANAMA DIGITAL

Año CXVI Panamá, R. de Panamá jueves 08 de junio de 2017 N° 28296

CONTENIDO

MINISTERIO DE ECONOMÍA Y FINANZAS
Resolución N° 201-3553
(De martes 06 de junio de 2017)

POR LA CUAL SE MODIFICA LA RESOLUCIÓN NO. 201-4050 DEL 1 DE SEPTIEMBRE DE 2016, QUE PUBLICO LA LISTA DE AGENTES DE RETENCIÓN DEL IMPUESTO A LA TRANSFERENCIA DE BIENES CORPORALES MUEBLES Y LA PRESTACIÓN DE SERVICIOS, ITBMS, APLICABLE PARA EL PERÍODO FISCAL 2017.

AUTORIDAD DE LOS RECURSOS ACUÁTICOS DE PANAMA
Resolución N° ADM/ARAP 034
(De viernes 02 de junio de 2017)

POR LA CUAL SE DESIGNA AL LICENCIADO GABRIEL CABALLERO COMO DIRECTOR GENERAL, ENCARGADO DE LA DIRECCIÓN GENERAL DE ORDENACIÓN Y MANEJO INTEGRAL DE LA AUTORIDAD DE LOS RECURSOS ACUÁTICOS DE PANAMA DEL 7 AL 9 DE JUNIO DE 2017.

INSTITUTO NACIONAL DE CULTURA
Resolución N° 144-17 DGD/AC
(De miércoles 17 de mayo de 2017)

POR LA CUAL SE DECLARA ABIERTA LA XXXV VERSIÓN DEL CONCURSO NACIONAL DE ARTES VISUALES ROBERTO LEWIS PARA EL AÑO 2017 Y SE ESTABLECEN SUS BASES REGLAMENTARIAS.

CONSEJO MUNICIPAL DE ANTÓN / COCLE
Acuerdo N° CM-16-2017
(De miércoles 07 de abril de 2017)

POR MEDIO DEL CUAL SE CORRIJE EL ACUERDO NO. CM-37-2016 FECHADO DEL 28 DE DICIEMBRE DE 2016 "POR MEDIO DEL CUAL EL HONORABLE CONSEJO MUNICIPAL DE ANTÓN APRUEBA EL PRESUPUESTO DE RENTAS Y GASTOS PARA EL PERÍODO COMPRENDIDO DEL 01 DE ENERO HASTA EL 31 DE DICIEMBRE DE 2017."

Acuerdo N° CM-17-2017
(De martes 16 de mayo de 2017)

POR MEDIO DEL CUAL EL HONORABLE CONSEJO MUNICIPAL DEL DISTRITO DE ANTÓN A PETICIÓN DEL MINISTERIO DE VIVIENDA Y ORDENAMIENTO TERRITORIAL SE EXONERA A FAVOR DEL MEYDOT, SUS CONTRATISTAS Y/O SUB CONTRATISTAS LOS IMPUESTOS MUNICIPALES RELATIVOS A LA CONSTRUCCIÓN PARA LAS UNIDADES BÁSICAS DEL PROYECTO TECHOS DE ESPERANZA EN EL DISTRITO DE ANTÓN.

Acuerdo N° CM-18-2017
(De martes 23 de mayo de 2017)

POR MEDIO DEL CUAL SE MODIFICA EL ACUERDO MUNICIPAL NO. CM-11-2017 DEL 2 DE MARZO DE 2017, QUE

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MODIFICÓ EL PRESUPUESTO DE FUNCIONAMIENTO DE FONDOS DE INVERSIÓN DE OBRAS PÚBLICAS Y SERVICIOS MUNICIPALES DE LA ALCALDÍA DE ANTÓN PARA LA VIGENCIA 2017, APROBADO MEDIANTE ACUERDO CM-648-2016 DEL 28 DE DICIEMBRE DE 2016, BASADO EN INGRESOS PROVENIENTES DEL PROGRAMA DE INVERSIONES DEL GOBIERNO CENTRAL.

Acuerdo N° CM-19-2017
(De martes 23 de mayo de 2017)

POR MEDIO DEL CUAL SE MODIFICA EL ACUERDO MUNICIPAL NO. CM-10-2017 DEL 21 DE FEBRERO DE 2017, QUE APRUEBA EL PLAN DE OBRAS E INVERSIONES DE LA VIGENCIA FISCAL DEL AÑO 2017 FINANCIADOS CON LOS APORTES DEL IMPUESTO DE BIENES INMUEBLES.

CONSEJO MUNICIPAL DE BOCAS DEL TORO
Acuerdo N° 004
(De lunes 23 de enero de 2017)

CONSEJO MUNICIPAL DE SAN CARLOS / PANAMA
Acuerdo N° 11
(De martes 30 de mayo de 2017)

POR EL CUAL SE MODIFICA EL ARTÍCULO 1, NÚMERO 2 DEL ACUERDO 15 DE 20 DE JULIO DE 2016, POR MEDIO DEL CUAL SE MODIFICA EL ACUERDO NO. 66 DE 7 DE DICIEMBRE DE 2011 Y SE DICTAN OTRAS DISPOSICIONES PARA LAS CONSTRUCCIONES EN EL DISTRITO DE SAN CARLOS.

CONSEJO MUNICIPAL DE CHAMÉ / PANAMA
Acuerdo N° 8
(De jueves 18 de mayo de 2017)

POR EL CUAL SE MODIFICA EL PRESUPUESTO DE RENTAS Y GASTOS DEL DEPARTAMENTO DE DESCENTRALIZACIÓN PARA EL MUNICIPIO DE CHAMÉ.

AVISOS / EDICTOS

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REPUBLICA DE PANAMA
MUNICIPIO DE BOCAS DEL TORO
CONSEJO MUNICIPAL DEL DISTRITO DE BOCAS DEL TORO

ACUERDO No. 004
(DEL 23 DE ENERO DE 2017)

POR MEDIO DE LA CUAL SE REGLAMENTA EL USO DE PLÁSTICOS Y EL FOAM (STYROFOAM), DE BOCAS DEL TORO.

EL HONORABLE CONCEJO MUNICIPAL DE BOCAS DEL TORO, EN USO DE SUS FACULTADES LEGALES Y

CONSIDERANDO:

- 1.- Que el manejo de los residuos sólidos es uno de los problemas más acuciantes en relación con el desarrollo del turismo en el Distrito de Bocas del Toro, así como con la salud de la población y del ambiente que la rodea.
- 2.- Que el volumen de los residuos sólidos producidos en nuestro Distrito crece continuamente, en forma exponencial, y no parece haber un límite para este crecimiento.
- 3.- Que existe una dificultad manifiesta en contar con áreas para la disposición de los mencionados residuos, debido a la falta de terrenos adecuados, y, aunque los hubiera, el crecimiento del volumen de los residuos haría que, en un futuro cercano, la generación exceda la capacidad de disposición.
- 4.- Que entre los componentes más importantes de los residuos producidos se cuentan los plásticos y el foam (styrofoam), cuya característica principal es que demoran más de 200 años en ser degradados por la naturaleza.
- 5.- Que se hace urgente y necesario reducir el uso de productos manufacturados con los mencionados materiales para disminuir la producción de residuos sólidos.
- 6.- Que para paliar el efecto de los residuos sólidos se ha iniciado la campaña denominada "CERO BASURA EN BOCAS" conducida por el Consejo Municipal, la Alcaldía del Distrito de Bocas del Toro, las Juntas Comunales del distrito, las organizaciones No Gubernamentales del Distrito, destinadas a mejorar la situación de esta importante amenaza a la salud, el ambiente y el turismo de nuestro Distrito.

ACUERDA

ARTÍCULO 1.
Se prohíbe la utilización de cubiertos, vasos y platos, plásticos o de foam (styrofoam), de un solo uso, en todos restaurantes del Distrito de Bocas del Toro, cuando los alimentos y/o bebidas son para consumo en el propio local.

ARTÍCULO 2.
El Municipio de Bocas del Toro, a través del departamento correspondiente, será el encargado de vigilar el cumplimiento de esta prohibición, así como de aplicar las sanciones debidas.

ARTÍCULO 3.
Al mismo tiempo se le notifica a dichos establecimientos la intención, en el futuro inmediato, de prohibir también los cubiertos, vasos y platos, de un solo uso, de los materiales

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mencionados, en las comidas "para llevar", en cuanto se disponga de un sustituto a los mismos que sea amigable con el ambiente.

La prohibición detallada en el artículo anterior entrará en plena vigencia el día 1 de marzo del año 2017. El establecimiento que no cumpla con esta medida, una vez iniciada su aplicación efectiva, será sancionado por las autoridades.

Este Acuerdo empezará a regir a partir de su sanción.

COMUNIQUESE, PUBLIQUESE Y CUMPLASE.

Dado en el Salón de Sesiones del Honorable Concejo Municipal, a los veintitrés (23) días del mes de enero del año dos mil diecisiete (2017).

Norberto Valencia
NORBERTO VALENCIA
PRESIDENTE

Gennifer Wright
GENYFER WRIGHT
SECRETARIA



SANCIONADO: Acuerdo número 004 del 23 de enero de 2017, hoy cinco (05) de Abril de dos mil diecisiete (2017).

H.J. Downer
H.J. DOWNER
Alcalde del Distrito de Bocas del Toro

Nicolás González R.
NICOLÁS GONZÁLEZ R.
Secretario General



LA SUSCRITA SECRETARIA DEL CONCEJO MUNICIPAL DE BOCAS DEL TORO GENYFER WRIGHT CERTIFICA QUE ESTE DOCUMENTO ES FIEL COPIA DE SU ORIGINAL QUE REPOSA EN ESTE DESPACHO.

Gennifer Wright
GENYFER WRIGHT
Ced. 1-730-67
SECRETARIA DEL CONCEJO MUNICIPAL DE BOCAS DEL TORO



Number 022: Plastic Bags Proposal

CONSEJO MUNICIPAL DE BOCAS DEL TORO

ACUERDO No. 022

Del 18 de Julio de 2018

POR MEDIO DEL CUAL SE MODIFICA EL ACUERDO No.004 DEL 23 DE ENERO DE 2017, POR MEDIO DEL CUAL SE REGLAMENTA EL USO DE PLÁSTICOS, BOLSAS, FOAM (STYROPHOAM), Y OTROS DERIVADOS DEL PLÁSTICO EN EL DISTRITO DE BOCAS DEL TORO.

EL HONORABLE CONCEJO MUNICIPAL DE BOCAS DEL TORO,
EN USO DE SUS FACULTADES LEGALES Y

CONSIDERANDO

- 1- Que el manejo de los residuos sólidos es uno de los problemas más acuciantes en relación con el desarrollo del turismo en el Distrito de Bocas del Toro, así como en la salud de la población y del ambiente que la rodea.
- 2- Que el volumen de los residuos sólidos producidos en nuestro Distrito crece continuamente, en forma exponencial, y no parece haber un límite para este crecimiento.
- 3- Que existe una dificultad manifiesta en contar con áreas para la disposición de los mencionados residuos, debido a la falta de terrenos adecuados, y aunque los hubiera el crecimiento del volumen de los residuos haría que, en un futuro cercano, la generación exceda la capacidad de disposición.
- 4- Que entre los componentes más importantes de los residuos producidos se cuentan los productos derivados de los plásticos y el foam (styrophoam), cuya característica principal es que demoran más de 200 años en ser degradados por la naturaleza.
- 5- Que se hace urgente y necesario reducir el uso de productos manufacturados con los mencionados materiales para disminuir la producción de residuos sólidos.
- 6- Que para paliar el efecto de los residuos sólidos se ha iniciado la campaña denominada "CERO BASURA EN BOCAS" conducida el Consejo Municipal la Alcaldía del Distrito de Bocas del Toro, ONGS, las Juntas Comunales del Distrito, así como la coalición público-privada, destinadas a mejorar la situación de esta importante amenaza a la salud, el ambiente y el turismo de nuestro Distrito.

Por lo anterior

ACUERDA:

ARTICULO 1.

Este acuerdo será conocido como Acuerdo para la Reglamentación del uso de los plásticos de un solo uso y foam en los todos los establecimientos de Expendio de Comidas, Bebidas, así en todos los locales comerciales no importa su denominación, que presten servicio comercial en el Distrito de Bocas del Toro.

ARTICULO 2.

ARTICULO 6. La prohibición detallada en el Artículo 3, ya se encuentra en plena vigencia desde el día 1 de marzo del año 2017. La prohibición detallada en el Artículo 4, entrará en vigencia a partir del 1 de septiembre de 2018. El establecimiento que no cumpla con esta medida, una vez iniciada su aplicación efectiva, será sancionado por las autoridades.

ARTICULO 7. Todos los locales comerciales, personas naturales y/o jurídicas, dedicadas al comercio en cualquiera de sus manifestaciones, tiene la obligación de reemplazar las bolsas plásticas por otras ambientalmente menos dañinas, las que serán entregadas a los clientes para envolver o transportar los productos distribuidos, esta disposición al igual a todas las anteriormente señaladas son de obligatorio cumplimiento.

No podrá el comerciante sobre la base de la prohibición de utilizar bolsas plásticas, exonerarse de la responsabilidad de entregar debidamente envuelto los productos distribuidos.

ARTICULO 8.

El Municipio de Bocas del Toro, a través del Departamento correspondiente, será el encargado de vigilar el cumplimiento de estas medidas, así como de aplicar las sanciones debidas.

COMUNIQUESE, PUBLIQUESE Y CUMPLASE.

Dado en el Salón de Sesiones del Honorable Concejo Municipal, a los dieciocho (18) días del mes de julio del año dos mil dieciocho (2018).

DEMETRIO MOLINA
Presidente



GENYFER WRIGHT
Secretaria

SANCIONADO : Acuerdo número 022 del 18 de Julio de 2018, hoy 14 de Agosto de 2018

H.A. Licdo. MARTIN DOWNER
Alcalde del Distrito de Bocas del Toro



NICOLAS GONZALEZ R.
Secretario General

Para los fines de este Acuerdo, los siguientes términos tendrán los significados que a continuación se expresan:

- a Establecimientos de Expendio de Comidas y Bebidas** son aquellos comercios que se dedican a servir en su propio local o para llevar, comidas y bebidas para el consumo humano. Se incluyen en esta definición, como mínimo, los restaurantes, panaderías, cafeterías, bares, carritos, camiones y vendedores ambulantes.
- b Establecimiento Comercial** Espacio físico, local o tienda en que se transmiten bienes y servicios con el objetivo de obtener beneficios. Es un conjunto de establecimientos situados en uno o en diversos edificios de un mismo espacio comercial, en el cual se llevan a cabo diferentes actividades comerciales.
- c Consumidor** Toda persona, natural o jurídica, que compra o recibe productos, mercancías u otros materiales en un establecimiento comercial.
- d Bolsas de Papel:** bolsas de papel, preferiblemente de un material reciclado post-consumo que un establecimiento provee a un consumidor en su punto de venta.
- e Bolsas Plásticas Desechables o de un Solo Uso** Tipo de empaque flexible hecho de plástico que se utiliza para contener y transportar artículos, provisto por un establecimiento a un consumidor en un punto de venta y que no está diseñado para ser reutilizado. En esta definición se incluyen las llamadas bolsas plásticas "biodegradables", "oxi-degradables" y "reciclables" de un solo uso. Esta definición no incluye los empaques que vengan, de origen, incorporados al producto.
- f Bolsas Reusables** Tipo de empaque hecho de tela o de cualquier otro material que no sea nocivo a la salud o al ambiente, y que cumple con los siguientes requisitos: cuenta con mangos o agarraderas para ser cargado, específicamente diseñada y manufacturada para ser utilizada en múltiples ocasiones, es susceptible de lavarse en máquina y está hecha de un material que puede ser lavado y desinfectado.
- g Bandejas de Foam (Styrofoam) o de Plástico de un Solo Uso:** tipo de empaque que se utiliza para contener y transportar alimentos y bebidas en el local o hacia el exterior de un Establecimiento de Expendio de Comidas y Bebidas.

ARTICULO 3.

Se prohíbe la utilización de cubiertos, bolsas, vasos, carrizos y platos plásticos de un solo uso o de foam (styrophoam), en todos los establecimientos de expendio de comidas y bebidas del Distrito de Bocas del Toro, cuando los alimentos y/o bebidas son para consumo en el propio local, **así como en todo local comercial dedicado al comercio de cualquier tipo no importa su denominación o actividad comercial.**

ARTICULO 4.

Se prohíbe, además, la entrega o venta de carrizos y revolvedores plásticos, de bandejas de foam o de plástico de un solo uso y de bolsas plásticas de un solo uso, tanto para los alimentos y/o bebidas a ser consumidos en el local como para llevar.

ARTICULO 5.

Los restaurantes no deberán aceptar que los clientes introduzcan en el local, para su uso, cualquiera de los items prohibidos en los artículos 3 y 4 de este acuerdo.

Methodology Charts

Key for Substrate Locations

	Beachside Substrate	Roadside Substrate
Playa Bluff	BS	BR
Bocas del Toro	TS	TR
Boca del Drago	DS	DR

Uncollected Solid Waste Accumulation Method Chart

BS/DS/TS BR/DR/TR	# of sample	Production Location	Corporation
Location on Isla Colón			
Quadrant Length & Width			
GPS Coordinates			
Plastic Bottles			
Aluminum			
Wrappers			
Roof Tile			
Other			
Textiles			
Unidentified Plastic			
Food Waste			
Rubber			
Wood			
Paper/Cardboard			
Glass			
Metal			
Total weight:	Notes:		

Interview Introduction, Guide, and Questions

Types of Interview Utilized: Semi-Structured

Interviewees: Angel Gonzalez-Diaz

Interview Introduction and Guide

May I ask permission to record this interview? My name is Andy Rhodes and I am a student with the school of international training studying the environment. Señor Gonzalez, your participation is voluntary and during the interview you have the right not to answer any questions or to discontinue participation at any time without penalty. Your name will be kept anonymous unless you would like your name to be used in my study. Would you like to remain anonymous or would you like me to use your name in my results. My finalized study will be complete on December 4th and I will send you a copy of it. The purpose of my study is to assess the abundance of solid waste accumulation on Isla Colón in Bocas del Toro. I will also be researching the history of solid waste on the island and mitigation methods that are being utilized on the island. Thank you so much for the opportunity to interview you, this will be very helpful for my project.

¿Puedo pedir permiso para grabar esta entrevista? Mi nombre es Andy Rhodes y soy estudiante de la escuela de formación internacional estudiando el medio ambiente. Señor Gonzalez, usted participación es voluntario y durante la entrevista usted tiene el derecho de no contestar ninguna pregunta o de suspender la participación en cualquier momento sin penalidad. Su nombre será mantenido anónimo a menos que usted quisiera que su nombre fuera utilizado en mi estudio. ¿Usted quisiera permanecer anónimo? Mi estudio estará completo el cuatro de diciembre y le enviaré una copia. El propósito de mi estudio es evaluar la abundancia de la acumulación de desechos sólidos en Isla Colón en Bocas del Toro. También, voy a investigar la historia de los desechos sólidos en la isla y los métodos de mitigación que se están utilizando en la isla. Muchas gracias por la oportunidad de entrevistarle, esto será muy practico para mi proyecto. Gracias por todo.

Interview Questions

- a. Where did you grow up and for how long have you been living there?
 - i. When did you move to Isla Colon?
- b. ¿Dónde creciste y por cuánto tiempo estuviste viviendo allí?
 - i. ¿Cuánto llevas vivir en Isla Colón?
 - ii. 35 years in Panama....24 years in Bocas.
- c. Do you have any prominent memories about litter on the island?
¿Qué es una memoria prominente que usted tiene sobre basura en Isla Colón?
When did you become interested in mitigating solid waste on the island?
- d. ¿Cuándo se interesó en mitigar los desechos sólidos?
- e. Do you remember how Cero Basura began?

- f. ¿Usted recuerda como la organización Cero Basura comenzó?
 - i. When did you begin working with Cero Basura?
 - ii. Cuando usted comenzó trabajar con Cero Basura?
 - iii. What are the main goals of Cero Basura?
 - iv. Cuales los objetivos principales de Cero Basura?
 - 1. What mitigation methods have you used in order to accomplish these goals?
 - 2. ¿Cuales métodos de mitigación usted ha usado para lograr los objetivos?
 - a. Have there been better mitigation methods than others?
 - b. Ha habido mejores métodos de mitigación que otros?
 - i. Why?
 - ii. ¿Por que?
 - iii. What do you believe is the best mitigation method?
 - iii-iv. ¿Que usted crea es una mejor método de mitigación?
- g. Okay so now, I would like to ask you some questions on the history of solid waste on the island.
- h. Pues, ahora, me gustaría hacerle algunas preguntas sobre la historia de solidos desechos en la isla.
 - i. How has solid waste been managed on the island?
 - ii. ¿Cómo se han manejado los desechos solidos en la isla?
 - iii. What was the first event that made the community on the island have a desire to change how solid waste was being managed?
 - 1. When was this and who invoked it?
 - iv. ¿Cuál fue el primer evento que hizo que la comunidad de la isla tuviera el deseo de cambiar cómo se gestionaban los desechos sólidos?
 - 1. ¿Cuándo fue esto y quién lo invocó?
 - v. What happened with the initiative for a landfill on the mainland?
 - vi. ¿Que paso con la iniciativa de un vertedero en la continente?
 - vii. Have there been other events, protests, or laws that have been implemented about solid waste management?
 - viii. ¿Ha habido otros eventos, protestas, o leyes que hayan sido implementadas sobre la gestión de desechos solidos?
 - 1. When was that event?
 - 2. ¿Cuándo fue?
 - 3. Who initiated them?
 - 4. ¿Quien lo inicio?
 - 5. Who is involved in the mitigation strategy, is it only a few people, or is it the whole community?
 - 6. ¿Quien esta involucrado en la estrategia de mitigación, es solo unas pocas personas, o es toda la comunidad?

7. How has the community reacted to these new mitigation strategies?
 8. ¿Como ha reaccionado la comunidad a estas nuevas estrategias de mitigación?
 9. Have you seen improvement?
 10. ¿Usted ha visto mejoras?
- ix. What do you believe has been the main reason for improvement of solid waste on the island?
 - x. ¿Cual usted cree que ha sido la razón principal de la mejora de los desechos solidos en la isla?
 1. ¿Que método de mitigación?
 - xi. What do you believe is the next step in making Isla Colón a trash free island?
 - xii. ¿Cuál cree usted que es el siguiente paso para hacer de Isla Colón una isla libre de basura?
 1. Do you have anything planned for the coming months or years?
 2. ¿Usted tiene algo planeado para los próximos meses o años?
 3. What is your hope for the future for the island?
 4. Cual es su esperanza para el futuro de la isla?
 - xiii. Anything else you would like to add?
 - xiv. ¿Algo mas que anadir?

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