



# WPI

## Implementing a Recycling Program & Educational Campaign in Piñones, Puerto Rico

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# ABSTRACT

The goal of this project, initiated by the non-profit LimPiaR, was to develop an implementation plan and an educational program for recycling in Piñones, Puerto Rico. Before our project, Piñones struggled with a poor waste management infrastructure resulting in an inability to recycle plastics which often accumulated as litter on the beaches. Through research, documentation, interviews, and surveys, our team created and improved upon workshop materials to educate about how to recycle as well as posters that promote recycling and keeping beaches clean. The project resulted in an educational poster campaign, interactive workshops with local restaurants, the installation of a recycling container, and a recycling program for community members and 7 businesses with potential for expansion.

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# EXECUTIVE SUMMARY

Piñones is a beachside community of 2,300 residents located on the northeast coast of Puerto Rico and is a popular domestic and international tourist destination known for its famous food kiosks. However, these tourists and restaurants serve as a large generator of the litter that Piñones suffers with. This waste build-up combined with limited access to waste management services has caused extreme pollution in the surrounding ecosystems. Our team partnered with LimPiaR, a non-profit environmental organization, to develop and implement a recycling program for local restaurants in Piñones. After discussing with LimPiaR and community leaders, we learned that many communities had never been exposed to recycling which made educating the public a major focal point of this program. This project will provide the opportunity to recycle to Piñones residents and restaurants as well as attempt to solve the deep-rooted infrastructural problems.

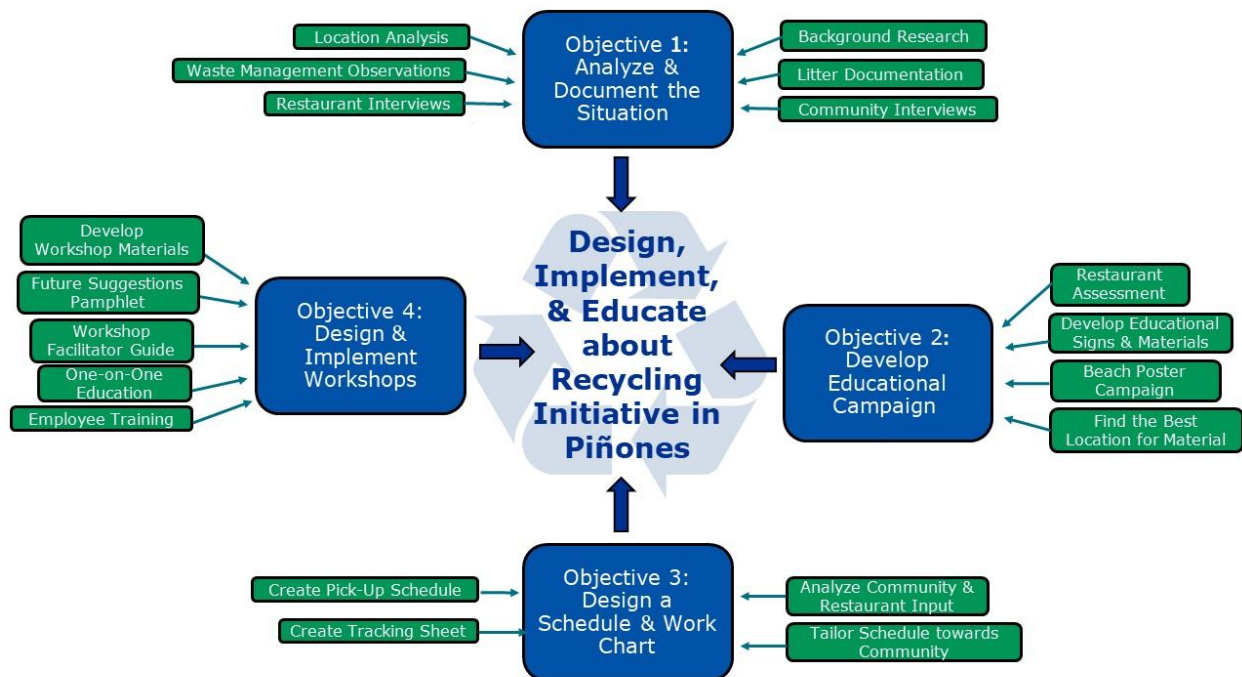


Figure 1: Methodology Flow Chart

**Goal and Objectives:** The overall goal of this project was to implement a recycling program in Piñones and create an educational campaign to raise awareness among community members, tourists, and restaurants. See the specific objectives below and see Figure 1 for a summary of the objectives..

**Objective 1:** The first objective was to improve our understanding of key components to the project, such as current waste production and management, and deep-rooted structural and societal issues. This goal was largely accomplished through numerous interviews and extensive documentation.

**Objective 2:** The second objective was to create an educational poster campaign to promote recycling and composting, and beach messaging. This process involved making multiple different posters that fit the requests of our liaisons, then using their input and feedback to narrow down to the most effective posters and adjust them to better accomplish their purpose. (Figure 2)





Figure 2: Our Team & Our Poster

**Objective 3:** The third objective was to develop a schedule and procedure for both recycling and composting. We created multiple schedules for LimPiaR, based on the business' availability, to reference and help the program run smoothly.

**Objective 4:** The fourth objective was to design and conduct training workshops. To prepare for the workshops, the restaurant owners were interviewed, providing poster feedback, informing us where the posters and recycling bin would go, and telling us when they are available for the workshop. Then, an instructional workshop plan was created that would be used to teach the restaurants and community about how to recycle correctly with LimPiaR. Workshops were completed with two restaurants (Figure 3)



Figure 3: Implementation of the Workshop at Nuevo Acuario

## FINDINGS

This section will relay what our team learned as a group during our time in Puerto Rico to the reader and will include a section for each objective and those objectives' corresponding findings broken up into more concise subcategories.






### Limitations of the Waste Management Infrastructure in Piñones:

- **Current Waste Management Practices in Piñones:** The poor waste management system, inconsistent trash pickup, and inability to recycle are highlighted in Piñones due to governmental neglect as an effect of socioeconomic discrimination and systemic racism.
- **Recycling Educational Level of the Community:** Our sponsors explained that the community has little to no experience or education about recycling, many also were unaware of the universal recycling symbol and what it means.
- **Composting in the Community:** Compared to recycling, composting is a much more difficult and involved process. In addition, there was no infrastructure to support the program, combined with the limited resources of LimPiaR made it unrealistic to complete at this time.

## Creation and Implementation of Educational Materials Using Community Input & Interviews:

- **Poster Creation:** To tailor these posters towards the community, our team had community leaders, local business owners, and residents provide constructive feedback to offer suggestions on the poster designs. These comments and suggestions were then implemented into the final poster designs.
- **Poster Printing & Implementation:** For the posters to be the most effective, we learned quickly that they must be able to withstand the elements and stay posted up for large amounts of time. Therefore, our team knew that we needed to create posters with long-term durability, this led us to laminate every poster. We developed a series of posters, 4 of which are currently in use, which focus on recycling, keeping the beach clean, and protecting the local ecosystems. See a summary of the printed posters below in Table 1.
- **Other Educational Materials:** One of the big problems that we learned from the restaurant interviews is that they believe their staff may accidentally throw the trash into the recycling bin when the restaurant is busy. Therefore, our team decided that it would be best to use special recycling cans where the top of the container only has a small hole that will only fit cans, water, and other small recyclable items. In addition to creating recycling lid stickers, our team designed recycling stickers to raise money and spread awareness about LimPiaR.

Table 1: Summary of Printed Posters

Poster Name	Poster Display	Main Goal	Location in Piñones	Location in Report
Recycling Display (Simple)		Display the most common recyclable materials	Restaurants	Appendix 5
Recycling Guide (Steps)		Describe the steps when identifying recyclable materials	Restaurants	Appendix 4
Guide to Leaving a Clean Footprint		Remind visitors about the “rules” of the beach to reduce beach litter	Restaurants & Beach	Appendix 6
Piñones Ecosystem		To teach and raise awareness about local wildlife and ecosystems	Restaurants & Beach	Appendix 8
Environmentally-Minded Restaurants		To promote to the public the restaurants that are recycling	Beach	Appendix 7

### **Scheduling and Organizational Logistics of the Program:**

- **General Scheduling Logistics:** For the recycling and composting programs to run smoothly, the participants must be aware of when and where they will be able to participate, including both the restaurants and the residents. To ensure this understanding, a schedule has been created which details the times at which different events will happen, such as the recycling pickup for restaurants or when the recycling container is available to the residents.

### **Research Culminates into Interactive Educational Training:**

- **IFCO Interviews:** To prepare the most effective and efficient workshops, our team interviewed IFCO, the recycling company, to learn more about the different processes. The information from these interviews allowed us to create effective workshops focusing on highlighting the main products that will be recycled rather than the detailed recycling process.
- **Designing Workshops:** Our team developed 30-minute workshops that consisted of both lecture-based information, as well as hands-on activities to teach the restaurants what they can recycle. These workshops will take place over two separate days. The first meeting will include the preparation and placement of the recycling containers, as well as a short explanation on how to properly recycle. The second will consist of going through the recycling that the restaurants collected over the previous week and providing constructive feedback on how they did and how they can improve the process.

## **RECOMMENDATIONS**

While implementing the recycling program, potential issues became apparent as well as ideas for additional waste management programs for LimPiaR to adopt. For this to occur, LimPiaR must follow an action plan of specified steps to keep the recycling program operating and implement new projects.

From our experience designing and implementing the posters, we recommend that LimPiaR performs the following actions:

- **Monitor the posters:** Replace any damaged or missing posters
- **Consult graphic designer for future change:** This will increase brand recognition

Based on our interview findings and observations, we recommend that LimPiaR keeps the following things in mind when expanding the recycling program:

- **Expanding the project in a controlled manner:** Moving slowly will result in all participants being well educated on the process
- **Master plastic type 1 & 2 before expanding to include 4:** Plastic 4 is much harder to identify and consultation with IFCO should occur before expansion
- **Document heavily:** Details are essential for grant applications and scheduling updates

Based on our findings from the TAIS interviews and our extensive research, we recommend that LimPiaR keeps the following things in mind when implementing the composting program:

- **Understand the infrastructure and resources needed to maintain the program:** The composting process is complex, so development should be approached carefully
- **Learn, trust, and rely on the experts when implementing the program:** LimPiaR should refer and defer to Tais for composting information as much as possible
- **Implement the program at the right time:** Wait until the recycling program is running smoothly to avoid overwhelming participants or the LimPiaR team

Based on our findings from our time in Puerto Rico and our extensive research, we recommend that LimPiaR keeps the following things in mind when they are ready to expand to other projects:

- **Tackling the glass bottle issues:** Investing in a glass pulverizer would allow reuse and recycling of the overabundant glass bottles
- **Creating a restaurant certification program:** Creating a guide for restaurants to follow including suggestions like limiting disposable plastic use would reduce waste significantly
- **Eliminating single-use plastics:** Elimination of single-use plastics in restaurants could lead to a local movement to stop using plastic

# INTRODUCTION

Piñones is a small, tight-knit, beachside community of 2,300 residents located on the northeast coast of Puerto Rico. They are known for their picturesque beaches, food kiosks, and traditional Afro-Caribbean culture. This unique blend of delicious food and stunning beaches makes Piñones a major tourist destination for both domestic and international travelers. As the community attracts more tourists, it has struggled with littering and waste management in the area. Unfortunately, the same restaurants that make Piñones such a desirable travel destination also serve as a source for much of the waste and litter. The combination of poor waste management infrastructure, waste generation by the local restaurant industry, and a lack of community education about recycling accelerate the growing waste problem. To prevent further buildup of this litter, the community must adopt cleaner practices, like recycling.

Every year, the world's oceans are exposed to over 8 million tons of litter, which adds to the estimated 5.25 trillion pieces of plastic already there (Parker, 2021). While this is a serious global concern, it often impacts small islands significantly more than the rest of the world. Furthermore, small communities on these islands often have no opportunity to recycle. This situation causes all the community's waste to end up in landfills, where the potential value from the recycling of the items is lost. Puerto Rico's lack of an effective waste removal infrastructure only adds to the obstacles they face with litter. Nearly all the waste in Puerto Rico winds up in landfills that are almost at capacity ("Puerto Rico Landfills," 2019) and will soon pose a significant issue when there is no space left to put the waste. These two factors - litter build-up and unsustainable waste removal practices, directly affect all areas and people. These threats are impossible to avoid for the island communities, small business owners, and tourists, however, there are people and organizations actively working to address this problem.

One way that organizations and communities are responding to this issue is by implementing local recycling infrastructure. Recyclable items have the potential to provide value to the community. Recycled plastics can be upcycled to produce new plastic items such as, plastic lumber, picnic tables, and even playground equipment. The concept of recycling is slowly gaining momentum in small communities as they start to recognize the value in the practice. A village in Palestine, Al Jalameh, Jenin is one of the first communities to implement a recycling plan in its community. The project was led by community leaders eager for change and the local joint service, JSC (Council for Solid Waste Management in the Governorate of Ramallah and Al Bireh). Most areas of Palestine practiced open dumping and burning of solid waste, which is considered a primitive form of landfilling and is dangerous to the nearby communities and the environment. To avoid this harmful practice, the community began recycling cartons, plastic bottles, glass, and metals. Al Jalameh can be used as inspiration for Piñones and proves that the switch to a more sustainable waste management system in a small community is possible if proper education and infrastructure are available.

LimPiaR is a Piñones-based non-profit organization that has the goals and resources to provide these services to the community (Claypoole, 2018). Their goal is to create a program that encourages local restaurants and community members to recycle their plastic waste. LimPiaR has partnered with IFCO, Puerto Rico's second-biggest recycling company, to establish a recycling program for the local restaurants and residents. In addition to their recycling efforts, LimPiaR organizes beach cleanups and educational campaigns to raise environmental awareness. Larger scale beach cleanups are run by the Scuba Dogs Society and the Ocean Conservancy, which has over 10,000 volunteers a year that help monitor and clean the beaches of Puerto Rico (Scuba Dogs Society, 2019). Over eighteen beach cleanups between 2015-2017, Scuba Dogs removed over 10 metric tons of plastic debris from the San Juan Bay Estuary in Piñones, and their efforts can be used as inspiration for similar clean-up projects (Stegemann, 2015).

Despite these organizations' efforts, Piñones still struggles with waste and litter. The local restaurant industry provides the tourists with single-use plastics like, bottles, and cans, which are often not properly disposed of. While occasional beach cleanups result in short-term success, the community does not have

the resources needed to prevent long-term waste buildup. Fortunately, because of the efforts made by some restaurant owners, community leaders, and organizations, like LimPiaR, there are already plans to try and reduce the amount of waste generated in Piñones. However, the main issue is not with implementing these plans, but with the education of the local community and restaurant owners. By educating the community about the benefits of recycling, they can learn strategies to significantly lower their waste impact on landfills. While the Piñones community must apply a recycling plan to lessen their impact on the growth of landfills, it is essential to first educate the community about the new opportunities to recycle.

This project will address these issues by educating the community on the intricacies of recycling, while also implementing a community-wide effort to recycle plastics and aluminum. To begin, the team will study the current waste production and management process, structure, and problems in Piñones. Once the situation is better understood, our team will work with LimPiaR to create educational posters and to post in the restaurants and along the beach to promote recycling, environmental awareness, and ecological responsibility. Next, the team will design a schedule and procedure for recycling pickups. We are also going to design and participate in running workshops with restaurants to help educate and describe proper recycling techniques. Lastly, the team will create a foundation for improvements, as well as an action plan for future projects that could be implemented by LimPiaR.

# CHAPTER 1: AN OVERVIEW OF WASTE MANAGEMENT IN PIÑONES & KEY STAKEHOLDERS

This chapter will help the reader understand what our team plans to do and why we will be doing that. The background will begin with a breakdown of the project sponsor and location. It will then flow into the current waste management infrastructure at the project location and end with a breakdown of recycling techniques.

## 1.1 Sponsor & Project Location

This chapter breaks down a description of the project location and sponsors. In addition, it also gives a brief description of the key stakeholders of the project while also analyzing the tourist demographics of Puerto Rico which will help our team effectively tailor our deliverables.

### 1.1.1 Project Location - Piñones

Piñones is a small town of 2,300 people known for its traditional Puerto Rican food and beautiful beaches. This close-knit community is located just outside of San Juan in Loíza, along Route 187. This two-lane road is usually bustling with traffic and many of the restaurants and food kiosks are located there, where tourists can try delicious local specialties like shrimp arepa, empanadilla, alcapurria, and bacalaíto. These restaurants reflect Piñones' Afro-Caribbean culture through their traditional meals and music. Many residents consider Piñones to be the “soul of the island.”

The families living in Piñones have been there for generations, making it an extremely close-knit community. Religion is also a major part of the residents' lives, where the churches and priests act as a reliable and trustworthy source of information.

Another major part of Piñones is its beaches. Beaches in Piñones are not government-run so there are no buoys, lifeguards, showers, concession stands, or parking areas. Because of this, the beaches are wild ecosystems and residents worry that they are being abused by tourists that consistently leave their litter behind. While this is a main source of the litter, community leaders believe that the root cause of waste is produced by restaurants.

### 1.1.2 – Project Sponsor - LimPiaR

LimPiaR is a non-profit organization based in Piñones that began its beach cleaning efforts in February 2018 (Claypoole, 2018). The organization is led by its founder, Jami Claypoole, and director of community outreach, Auraluz Guzmán. Claypoole founded the project after she visited Piñones and was saddened by the enormous amount of garbage she saw. She saw beaches and walking paths teeming with trash and these images were etched into her mind, inspiring her to create LimPiaR and continue pursuing these efforts (Claypoole, 2018).

LimPiaR's mission is to achieve a cleaner and greener Puerto Rico for everyone while also providing educational information to raise environmental awareness. Currently, LimPiaR addresses these goals by hosting coastal beach cleanups, organized by Claypoole and an army of passionate volunteers, and conducting a series of educational efforts (Claypoole, 2018).

LimPiaR promotes discussion to increase involvement and engagement in both the public and private sectors and because of this, the organization continues to grow and operate on donations from individuals and businesses. LimPiaR incentivizes these donations by publicizing supporting businesses and partnering with them through social media and promotional materials. Some businesses that support LimPiaR are BDO PR, Rev Systems and Polytechnic University, and Metro MSP (Claypoole, 2018).

### 1.1.3 Stakeholder Analysis

This project has several stakeholders, including LimPiaR, that are invested in the implementation of recycling and composting initiatives and cleaning the litter on the beaches.

The main stakeholder is the restaurant sector in Piñones, specifically Sun City, Nuevo Acuario, Nana's Place, La Casa del Indio, Mi Casita Seafood, and the Waterfront. These restaurants are participating in the recycling pilot program and the implemented changes will directly impact their operations.

In addition to these restaurants, LimPiaR identified 25 families in the Piñones community to participate in the program. These families are also stakeholders as the recycling process will change their everyday lives. The families will take the same actions as the restaurants, just on a smaller scale weekly recycling events they can bring their recyclables to, rather than having a vehicle go to their house to pick it up.

IFCO is the second-largest recycling company in Puerto Rico and another stakeholder. They have provided a recycling container to Piñones and are providing pro-bono pick-up for the community, and they will make a profit off the recycling from Piñones.

Other stakeholders include the Department of Natural Resources, the San Juan Estuary Program, and other environmental protection and conservation programs because of the project's environmental impact.

Tourists, other cultural groups, and the general public will also be impacted by the improvements to the area and the potential economic impact on the restaurants.

### 1.1.4 – The Importance of Tourism in Puerto Rico

Tourism is one of the biggest industries in the Puerto Rican economy. Between 2014 and 2019, Puerto Rico amassed over 2.2 million visitors in five of those six years with a peak of 2.6 million visitors in 2016 (López, 2021). Because of this, tourist revenue is a vital part of the economy and in 2019 alone, Puerto Rico recorded a tourism revenue of over 3.6 billion dollars (López, 2021). Due to the diverse backgrounds of the tourists and residents, our team will have to take this into account when working in Piñones.

## 1.2 Current Waste Management in Puerto Rico & Piñones

This section is designed to inform the reader about current waste management and reduction techniques in Puerto Rico, and specifically Piñones as well as the waste removal challenges that Puerto Rico faces. The end of the section highlights litter removal strategies. Our team defines waste as anything that needs to be disposed of in a landfill and litter as waste that is left on the beach, streets, or the ground.

### 1.2.1 – Waste Management in Puerto Rico

Waste management in small, tourist-heavy islands is an issue across the world and Puerto Rico is no exception. Over 2 million people visit Puerto Rico every year, and while essential for their economy, these tourists play a major role in the production of the 4,000,000 tons of solid waste that is generated each year (“Solid Waste Management in Puerto Rico,” 2010).

Puerto Rico lacks an incineration facility, which causes waste to end up in one of two places, landfills, or recycling locations. However, only about 10% of waste in Puerto Rico is recycled and the remaining 90% ends up in landfills. There are currently 29 operating landfill sites in Puerto Rico and nearly all of them are either over capacity or are expected to reach capacity in the next few years. It was estimated in 2019 that within the next 2-4 years all the landfill sites in Puerto Rico will be full, resulting in nowhere for the yearly 4,000,000 tons of new waste to go (“Puerto Rico Landfills,” 2019).

Puerto Rico also has its unique challenges to overcome regarding waste management. The island's topography produces a natural sloping gradient which results in an unusually large amount of runoff, which debilitates their waste management efforts by depositing harmful pollutants, trash, and chemicals into water sources (EPA, n.d. b). Hurricane Maria, with its widespread devastation, severely weakened



Puerto Rico's waste management efforts. The hurricane was estimated to have created 6.2 million cubic yards of waste and solid debris for the island to handle ("Solid Waste Management in Puerto Rico," 2010). The locations of the landfill sites are also an infrastructural flaw, with full landfills in the areas that generate the most waste and empty ones where little waste is generated ("Puerto Rico Landfills," 2019).

### 1.2.2 Recycling Management Infrastructure in Puerto Rico

As 90% of all waste in Puerto Rico gets landfilled, there are multiple waste control companies tasked with transporting the waste from each location to the corresponding landfill. While some of this waste can be recycled, there is not enough infrastructure to implement a nationwide recycling program. However, there are still some recycling companies on the island. The two largest are Conwaste and IFCO.

The largest of the two, Conwaste, was founded in 1993 in San Juan, Puerto Rico (Conwaste, 2021). This company provides a large range of services such as Biomedical Waste Collection, Solid Waste Collection, and Recycling Programs (Conwaste, 2021). Although Conwaste markets themselves as a recycling program, they still create and maintain landfills on the island and because it is cheaper to just dump the material at landfills, most of the community does not believe that their recycled materials are actually recycled. The reputation of being a recycling company with landfills has tarnished the public's opinion of Conwaste recycling efforts across Puerto Rico, causing people to pursue other companies instead.

The smaller of the two companies, IFCO, has provided recycling services for more than 45 years (Refsnes, 2015). Unlike Conwaste, IFCO only handles the collection, processing, and marketing of over 24 recyclable materials like plastic 1, 2, and 4 (Refsnes, 2015). They currently operate five recycling plants, and they continue to grow. IFCO has a much better reputation among Puerto Ricans as they do not operate any landfills and LimPiaR plans to work with them to bring recycling to the Piñones' community and restaurants.

### 1.2.3 Waste Management in Piñones

Though waste management is a widespread issue across Puerto Rico, this concern is highlighted in smaller, tourist-heavy communities such as Piñones. Smaller communities face the problem that tourists either do not understand the impact they have on the local environment, or they simply do not care enough to change their ways. This is evident looking at the tourist-heavy beaches compared to the areas where the residents live. Inside the local community, there is not the same amount of litter as on the main roads and the beaches. This leaves the community feeling abused and taken advantage of.

It is estimated that only 10% of the waste found in Piñones is produced by the residents, while the remaining 90% is a direct result of tourists and businesses. Tourists visit and take advantage of everything Piñones has to offer, then leave their trash behind for the community to deal with. The lack of waste management infrastructure in Piñones also makes it difficult to dispose of public trash cans because of intermittent at best removal services.

Piñones is active in its fight against these challenges with litter and waste. LimPiaR conducts coastal cleanups to preserve the beaches and protect the wildlife, which has resulted in positive, but short-term results. Other organizations like LimPiaR are also trying to help Piñones by focusing on addressing irresponsible waste production and lack of personal responsibility from tourists, businesses, and community members.

Piñones is an extremely resilient community and has been continuously brainstorming new and creative ideas to slow and prevent waste build-up. These ideas are focused on educating businesses, visitors, and residents on the harm that pollution has on the environment.

### 1.2.4 Beach Litter Control in Piñones

As previously stated, beach litter is a massive issue in Piñones. Community leaders believe that a big part of the issue revolves around two main culprits: the tourists and the current culture. Tourists are known for going to the beach for the day and leaving behind their trash and other beach essentials. This is problematic for the community as it leaves its beaches littered with single-use plastic, food, and other harmful items. Because Piñones is not a government-run beach, the area lacks infrastructure for consistent municipal trash pickups and is not consistently picked up by residents. In the United States, tourists are made aware of their need for personal responsibility through the “Leave No Trace” campaign.

The “Leave No Trace” campaign is implemented in all United States National Parks and used on beaches throughout the world (NPS, 2018). It has two key principles, the first of which is to plan and prepare (NPS, 2018). Tourists should know what to expect when visiting the location and they must be aware that nothing can be left behind. This can include educational signs and posters. The second principle is to educate visitors on proper waste disposal strategies (NPS, 2018). Everything brought to the location must also be removed by who brought it. In addition, symbols on properly marked garbage cans can help tourists dispose of trash in the proper location (Gorman, 2020). The successful implementation of this culture should lead to reduced beach litter that will continue to decrease over time (Gorman, 2020).

### 1.2.5 Beach Litter Control Initiatives

One major international event addressing beach and ocean litter is the International Coastal Cleanup, organized by the Ocean Conservancy, a nonprofit focused on the ecological conservation and protection of the ocean. Over 153 nations participate in this event and since its inception in 1986, over 220 million pounds of trash have been collected along coastlines and waterways (“International Coastal Cleanup,” 2017). The Ocean Conservancy also partners with local organizations around the globe to host smaller scale beach cleanups.

The Scuba Dogs Society is the local coordinator of the International Coastal Cleanup in Puerto Rico. They work closely with the Ocean Conservancy to organize and run beach cleanups throughout the year. In 2020, Scuba Dogs and their volunteers removed 15,433 pounds of trash from coastal regions during the International Coastal Cleanup (Scuba Dogs Society, 2020). They are given funding by the National Oceanic and Atmospheric Administration (NOAA), which provides funding for other cleanup and environmental initiatives as well. One of the NOAA funded projects through the Marine Debris Program was a 2015-2017 debris removal series in Piñones, where 10 metric tons of plastic waste and debris were removed from 500 acres over 18 removal events (Stegemann, 2015).

## 1.3 Recycling

This chapter focuses on the background information our team needed to successfully implement an effective recycling program in Piñones, which has never had recycling before. This chapter explores what the recycling requirements are and the important information stakeholders need to know about recycling to implement the program.

### 1.3.1 Analysis of Recyclable Plastic Types

Plastic products are often labeled with a number from 1 to 7, displayed within a triangle of arrows. A display of the 7 plastic-type symbols can be found in Figure 4. This number is used to signify what material the plastic is made of, allowing for easy plastic-type identification and a more streamlined recycling process.



Figure 4: Example of Plastic Symbols  
(Torres, n.d.)

Plastic 1, polyethylene terephthalate (PET or PETE), is used in a variety of common products like water bottles, soda bottles, cooking oil containers, and soap dispensers. This plastic is widely recyclable and is likely going to comprise the highest volume of recycled plastic in Piñones due to the large number of plastic beverage bottles that are used (Seaman 2012).

Plastic 2, high-density polyethylene (HDPE), is similar to plastic 1 in that it is also used in a range of products and is widely recyclable, but some forms are not commonly recycled. Some recyclable products include shampoo bottles, yogurt tubs, and milk jugs. The forms that are not commonly recycled are bags, such as cereal box liners and some shopping bags. Only the solid container form will be accepted in Piñones, as the bag forms often lack an identifying symbol and are contaminated. This is going to be the second most recycled plastic type in the restaurant's kitchens and in households (Seaman, 2012).

### 1.3.2 IFCO Recycling Requirements for Plastic

IFCO is providing a large 22' x 9' x 7' recycling container and pro-bono pickup services. They will profit from recycling, compacting, and exporting the collected plastics to other companies. However, not all types of plastic are profitable, and the plastics must be prepared before they can be recycled. Plastics 3, 5, 6, and 7 either hold too little value or are too difficult to recycle, making them not profitable to process. Because of this, IFCO only accepts clean plastics 1, 2, and 4. Plastics that are contaminated and not easily cleaned, like cooking oil containers, should be rinsed out as contamination can cause issues in the recycling process. Lastly, the plastic containers can be crushed, even if by hand, to significantly lower the volume of the products, allowing for more plastic to be recycled in each container.

### 1.3.3 IFCO Recycling Requirements for Aluminum

IFCO also accepts aluminum products, but as with plastic, there are limitations as to what can be recycled. The primary limitation is that they are only accepting aluminum beverage cans. These cans generally have a very high concentration of aluminum, while other "aluminum" products are made of mixed alloys, which IFCO will not accept. Assuming that the cans are empty, nothing else needs to be done to recycle them, outside of crushing them so that less space is taken up, but this is not necessary.

### 1.3.4 Non-Recyclable Items

While other items outside of plastic and aluminum can be easily recycled in other parts of the world, this is not true in Puerto Rico. An example of this is glass. Unlike plastic and aluminum, glass is bulky and heavy in comparison, which makes it undesirable to export and makes recycling glass much more difficult. The best way to manage glass waste is through a glass pulverizer, which turns all glass materials into fine particles to be used for other applications, like road improvements, filling potholes, or paving new roads. Another option is to repurpose the glass for more creative purposes, such as artwork. Whether using pulverized glass or entire glass bottles, artists can create pieces of artwork from previous waste.

## 1.4 Future Initiatives & Implementation Techniques

This section provides LimPiaR and our team with some simple initiatives that can be suggested and implemented at the end of the project. These initiatives also focus on decreasing the overall restaurant waste production and will help accomplish our current goal of reducing Piñones' impact in landfills. This

section will also help LimPiaR develop implementation strategies for future initiatives in the participating restaurants. Although investing money into becoming a more sustainable restaurant is daunting, some organizations will aid with the transition which will result in many positive outcomes.

### 1.4.1 Non Recyclable or Non Compostable Waste Reduction Techniques

To get the benefits of waste reduction, restaurants must commit to the process and effort required to overcome future challenges. Jack Bandy, president of the restaurant consultancy Goliath Consulting Group, describes this relationship stating, “Cost savings are gained through better inventory controls, purchasing the right item for the application, fresher/better quality products served to guests and safer products too, since it is served well before it expires.” (Hall 2019) Bundy understands the key concepts that restaurants must commit to, but the most important key is to fully invest in waste reduction.

There are many easy and affordable ways for a restaurant to reduce waste. All the following strategies will save the restaurant money in both the short- and long-term (Hall 2019).

1. Count out specific napkins and condiments for every order, if done correctly, this will result in a 50% decrease in usage and, in return, direct savings and landfill impact
2. Only provide water to the guests when the water is requested
3. Clean out food containers extremely well, this can save about 5% of the product every time
4. Use clear garbage bags to see what is being wasted and what is being overused
5. Add a cooking oil filtration system, this can reduce waste up to 75% and some restaurants see up to \$15,000 annually in savings
6. Evaluate portion sizes of meals, diners leave an average of 17% of their food uneaten
7. Save food for extra uses, use food scraps for meat stocks, vegetable stocks

These seven rules will result in savings for any restaurant, especially in annually decreasing their overhead. This decrease in overhead varies based on how consistently these rules are followed.

### 1.4.2 Benefits of Sustainable Food Management & Food Waste

Restaurants that conduct sustainable practices will minimize their overhead and receive tax benefits. Sustainable management of food is a systematic approach focused on reducing unused or wasted food. Wasted food is not just wasted food, but also wasted natural resources that were used for its sale, manufacture, and delivery. For this reason, restaurants should try to limit food waste and only use the required amount of food (EPA, 2021).

In addition to limiting costs, there are many other strategies to save money in association with limiting food waste. With less waste, restaurants will pay less for trash pickup and some haulers will lower fees if food waste is separated from the trash. This separated food waste can then be composted instead of delivered to the landfill. In general, restaurants that waste less, spend less. Lastly, reducing food waste will also reduce energy and labor costs by eliminating the costs of extra storage, preparation, and cooking.

Sustainable restaurants are also conserving natural resources. By decreasing their landfill contribution, these restaurants reduce the methane produced by landfills (EPA, 2021). When food is put into a landfill, it is difficult for the nutrients in the food to return to the soil causing the food to rot and produce methane gas. This methane gas damages the ozone layer in the atmosphere which has long-term environmental impacts. There are also many hidden impacts associated with wasted food. The water, gasoline, energy, labor, pesticide, and fertilizer needed to produce the food all have their own environmental impact and when food is wasted, that impact is worthless (EPA, 2021). These larger environmental impacts are why a restaurant needs to practice sustainable techniques and limit its ecological footprint.

### 1.4.3 Using Subsidizing Organizations for Ecological Products

At the onset, switching from plastic to ecologically friendly items can be expensive. However, some companies will help subsidize the cost of purchasing these items to incentivize restaurants to use greener products.

Plastic Free Restaurants (PFR) is a non-profit organization with the mission to eliminate single-use plastics and Styrofoam in restaurants by providing subsidies to make up for the cost difference between plastic and its reusable alternatives. Essentially, this organization will pay restaurants to stop using single-use plastic. PFR will pay 100% of the cost difference between a single-use plastic item and a reusable (glass, wood, steel) alternative and 50% of the cost difference for reusable plastic items. Specific manufacturers and companies that partner with PFR also offer special discounts to restaurants that are purchasing green food ware and utensils (Plastic Free Restaurants, n.d.).

Although daunting at first, there are ways that restaurants can handle the extra expenses of going plastic-free that will lead to economic and social benefits in the long run.

### 1.4.4 Customer Loyalty Initiatives

Eco-friendly restaurants create a more loyal and active customer base. The study, “Can sustainable restaurant practices enhance customer loyalty? The roles of value theory and environmental concerns” (Kim & Hall 2020), analyzed the effects of the value theory when a restaurant is and markets itself as sustainable. Customer perception is created based on hedonic values, emotional or affective features, utilitarian values, and functional or economic benefits and these perceived values appear to be critical factors in the consumer’s attitude, satisfaction, and behavioral intentions.

Consumers who possess high levels of environmental concern regard the eco-friendliness of a restaurant as important, which proves that ecologically minded customers are already more likely to eat at a sustainable restaurant (Kim & Hall 2020). Results from the study show that sustainable restaurant practices have positive and significant effects on consumers' utilitarian values on waste reduction. Therefore, in restaurants that undertake food sustainability practices, consumers perceive more usefulness and enjoyment during dining, and they believe that they are participating in waste reduction practices, which leads to customer loyalty.

# CHAPTER 2: METHODOLOGY

The overall goal of this project was to implement a recycling program in Piñones and create an educational campaign to raise awareness amongst community members, tourists, and restaurants.

To achieve these goals, we developed the following research objectives (see Figure 5):

1. Analyze and document the current waste production and management process, structure, and challenges, both commercially and residentially, in Piñones
2. Create an educational poster campaign to promote recycling and composting and beach messaging
3. Develop a schedule and procedure for recycling and composting
4. Design and lead training workshops

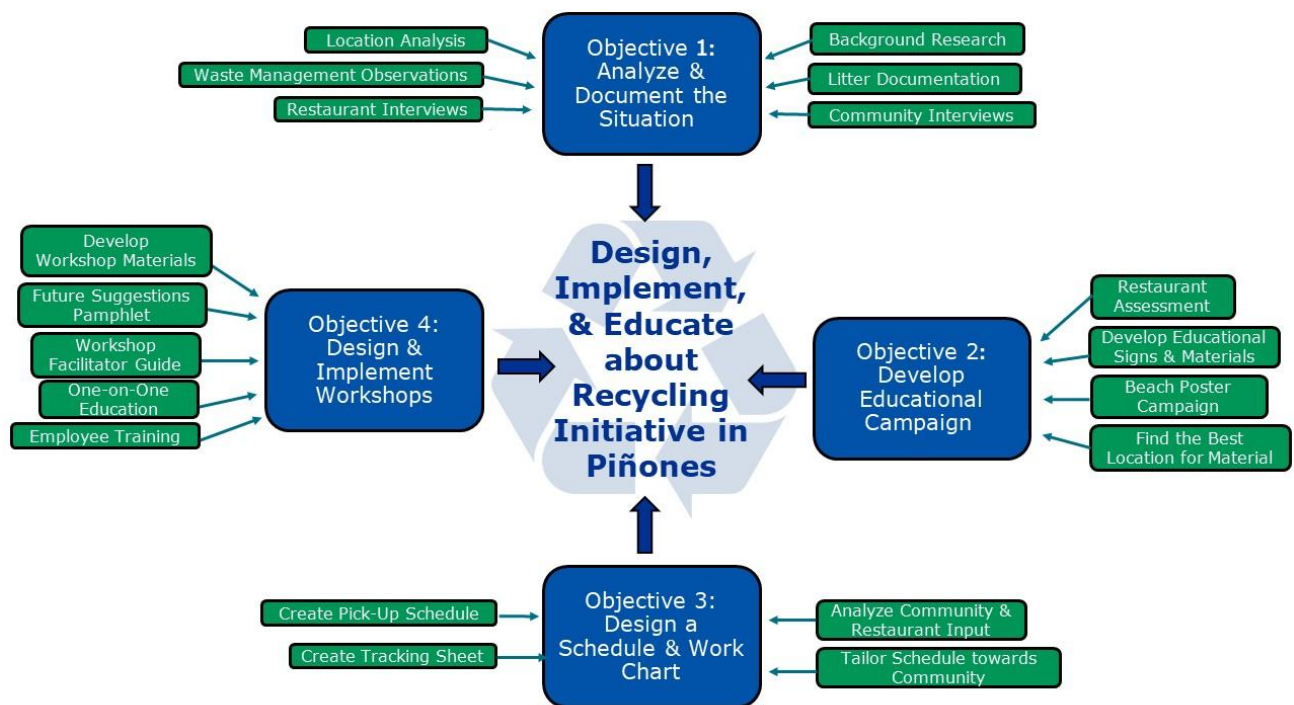


Figure 5: Methodology Flow Chart

This methodology chart provides a visual description of our project objectives and our anticipated steps to achieve these objectives. This diagram can be seen in Figure 5. It is important to note that the blue boxes are the objectives and the green boxes are the things that need to be done to “complete” the objective. First, we analyzed the community of Piñones, the specific restaurants, and the waste management circumstances and gained important contextual information about the situation. Once we have the necessary baseline knowledge about the community and situation, we began to develop educational and awareness posters, schedules, and other useful materials that we provided to our sponsor, LimPiaR. Once we had these materials created, we focused on educating the community through displaying the posters, running workshops, and running community-wide events. We hope the execution of these objectives will reduce the amount of landfilled waste currently generated in Piñones, decrease the amount of litter on the beach, and lead to a more ecologically-minded community.

## 2.1 Objective 1: Analyzing and Documenting the Current Waste Infrastructure

This objective included improving our understanding of key components of our project, such as current waste production and management, and related structural and societal issues. Understanding this context prepared us to complete the rest of our project's objectives more effectively. To achieve these objectives, we used the following techniques.

### 2.1.1 Background Research

To understand the key issues related to waste in Piñones, we started by conducting extensive background research in the following areas:

- Current recycling and composting practices
- What items can and cannot be recycled
- What items can and cannot be composted
- What materials are being used most by members of the community and the local restaurants
- The current knowledge level of recycling and composting of community members
- Financial and environmental benefits and drawbacks of recycling and composting

Once we completed our research, we had the necessary knowledge and contextual information to confidently move forward and conduct fieldwork in Piñones.

### 2.1.2 Documentation

Extensive documentation also played a role in our understanding of the issues and factors at play in the Piñones community. This documentation consisted of photographic and observational evidence that ensured a complete and accurate portrayal of the current circumstances. All observations were ethically conducted and properly recorded.

### 2.1.3 Restaurant Interviews

Before our arrival, LimPiaR had established contact with 4 restaurants: Sun City, Nuevo Acuario, Nana's Place, and La Casa del Indio. While onsite, LimPiaR and our team reached out to more local restaurants and after initial interviews, 2 more, the Waterfront and Mi Casita Seafood joined the program. These 6 restaurants were our "early adopters" for the program. These interviews were important as they allowed our team to develop a relationship with the restaurant owners. To remain consistent in our messaging and to minimize the language barrier, all visits and interviews were conducted with our liaisons. See Appendix 1 for questions examples and Appendix 2 for our consent statements. See Appendix 11 for all interviews.

In the initial interview with the restaurants, we asked the owners the following questions:

#### General Questions

1. What do you hope to get out of this process?
2. What are your main concerns with participating in this program?
3. What do you think would be the best training material for your restaurant?
4. What input or feedback do you have for our educational materials and posters?
5. What times and dates would be ideal for a training workshop?

#### Recycling Questions

1. Where would you put your bins for recycling materials?
2. What would be the best days for recycling pick-up?
3. When do you mean prep?
4. Who would you expect to be putting waste into a recycling container?
5. Which days are you busiest?

6. What days do you generate the most recyclable items?
7. What kinds of plastic do you use the most?
8. What single-use plastic items would you be willing to stop using first?

The responses to these questions gave us important logistical information for ourselves and our sponsors for the operation of the recycling program. We compiled a table of the provided responses for the pick-up and workshop dates to provide to LimPiaR that helped create the schedule for the program. All of these responses were gathered from interviews with restaurant owners, like in Figure 6.



Figure 6: Restaurant Interview with Sun City

### 2.1.4 Community Interviews

In addition to restaurants, community involvement was another important aspect of our project. As this was the first residential plastic recycling and composting program in Piñones, it was important to obtain the necessary information on potential logistics and interest from the local community. LimPiaR had identified 25 families in one neighborhood in Piñones that were going to participate in the program. We interviewed one lifelong Piñones resident and local community leader, and asked the following questions:

1. What are some of the main challenges you anticipate us facing?
2. What does the community currently understand about recycling and composting?
3. What educational materials do you think are most important for us to provide?
4. What do you think is the best way to encourage participation in the program?
5. What days would work best for recycling pick-up for community members and yourself?
6. How has the community mentality towards the environment changed over time?
7. What marketing techniques would you recommend that would resonate with the community?

We also interviewed another community member and discussed youth involvement and outreach. We asked him the following questions:

1. What is the mentality that the younger generation has towards the environment?
2. How has the generational gap impacted the youth in Piñones?
3. How do we connect with your community?
4. What techniques and strategies would you recommend increasing community involvement in our programs and events?
5. What marketing techniques do you think would resonate most within the community?
6. What do you think are the main difficulties preventing environmental improvement in Piñones?
7. What input and feedback do you have for our poster designs?



These responses were used to gather a deeper understanding of the community, its values, and its mentalities. We took all of this input into account when designing our posters, additional educational materials, workshops, and other events to make our designs resonate with the community and encourage participation in the program to increase environmental awareness amongst community members. An example of our team conducting a community interview can be seen in Figure 7.



Figure 7: Community Interviews

## 2.2 Objective 2: Create an Educational Poster Campaign to Promote Recycling

LimPiaR requested that we develop a promotional and educational campaign focused on how to recycle and compost and its benefits for the restaurants and community members. To accomplish this, we designed several signs to post throughout the beaches, restaurants, and residential neighborhoods. These signs aimed to educate about the logistics of recycling and composting and their importance to preserving the ecosystems of Piñones.

### 2.2.1 Poster Design & Printing

Posters were tailored to their specific location and the individuals that will be interacting with them. These posters were created using Canva, an online design software. We chose to use Canva because it produced more professional-looking posters as compared to other design software and it allowed us to easily collaborate with our liaisons on the documents.

The posters were printed and laminated at Office Max. This was the simplest and most efficient method of printing posters that were going to be posted at restaurants. The dimensions of these posters were 18 x 24 inches to make them visually accessible and noticeable to restaurant patrons and employees. The lamination made them weather-proof and will last for a longer period.

Another way the posters were printed was through the Department of Natural and Environmental Resources (DRNA). These could print on a plastic cardboard material which was ideal for the posters going on the beach. This printing strategy made the posters more durable and likely to withstand the elements that occur at the beach.

### 2.2.2 Common Poster Themes

Our team connected all of the posters with key similarities including logos, symbols, colors, and slogans. We added LimPiaR's logo to each poster and had a recurring color scheme of orange, blue, and green (Figures 8 & 9). We decided on this color scheme as the colors are bright and will capture passerby's attention and they reflect the colors in the LimPiaR logo. In addition, all of the posters also had one of the following messages:

1. Deja una Huella Limpia (Leave a Clean Footprint)
2. Para Salvar los Océanos... (In Order to Save the Oceans...)
3. Guía de... (Guide to...)
4. Recicle (Recycling)
5. Compostaje (Composting)
6. Cuidar los Ecosistemas (Care for the Ecosystems)

We added these consistencies to increase LimPiaR's brand recognition and provide uniformity to the program's promotion and messaging.

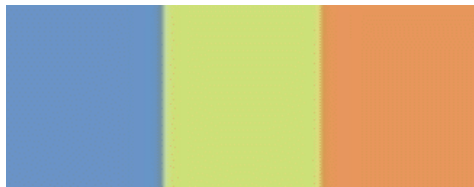


Figure 8: Poster Color Palette



Figure 9: LimPiaR's Logo  
(Source: LimPiaR)

### 2.2.3 Recycling Posters

We created a set of recycling posters detailing the most relevant information for the process. For these posters, we focused on relaying image-based messages identifying what can and cannot be recycled and composted to catch people's attention and to overcome any language barriers. We designed the posters so that they would have both English and Spanish translations, premier local animals, and focus on image-based designs. We learned that Piñones is home to many native Puerto Rican endangered species that residents feel a connection with and adding these animals to our poster would make them resonate more with the community. Therefore, we felt that we should include these animals in our designs. Some of the animals that were mentioned were blue crabs, parrots, pelicans, manatees, sea turtles, and local game fish. We also developed posters describing the process of recycling that provided an in-depth description of how to recycle in addition to the images. As these posters were only going to be provided to restaurant employees and residential community members, the text was only in Spanish. Any poster that was located in a public area was translated into both languages.

### 2.2.4 Other Educational Outreach Ideas

We developed a series of stickers that could be used as further environmental awareness outreach for LimPiaR. These stickers were designed on Canva and had a variety of imagery, mostly focused on the local wildlife including blue crabs, manatees, pelicans, and turtles. These symbols were accompanied by the LimPiaR logo and contained the following slogans:

1. Deja una Huella Limpia (Leave a Clean Footprint)
2. Reduce, Reusa, Recicla (Reduce, Reuse, Recycle)
3. Cuida los Océanos (Care for the Oceans)

We recommended selling these as either regular stickers for computers or water bottles or as bumper stickers for cars.

### 2.2.5 Reducing Beach Litter

Trash and litter can be seen throughout the beaches in Piñones and is an eyesore for the residents. An example of this can be seen in Figure 12. Our team tried to combat this by creating recycling and composting educational signs and a series of posters to be posted at the beach and surrounding areas. These posters were focused on the message of “Deja una Huella Limpia,” which is LimPiaR’s version of “Leave No Trace,” translating more directly to “leave a clean footprint.” This exemplified LimPiaR’s main goal of preventing waste buildup in the first place.

We highlighted the native ecosystems and wildlife in the posters to make the message resonate with the community and be culturally relevant, as well as cause feelings of guilt and empathy for the animals that could potentially be harmed by the waste being left behind. The purpose of these posters was to make beachgoers aware of the steps that they need to take to help keep the beaches clean and convince them that it is worth the inconvenience of dealing with their own trash to keep the environment clean. These signs remind tourists to leave with everything they came with and that these beaches are homes to many people and animals, not landfills. The posters are designed to imply that the suggestions are expected of everyone who visits and respects the area, as well as remind the public that to keep the beaches clean for long periods, everyone must be invested in the idea. These ideas create a social environment that causes increased pressure on beachgoers to follow the instructions on the signs. Ideally, this will create a beach culture where, rather than just reaching out to those who take the time to read the signs and consider it, people are judged more harshly for littering, which would have a much stronger impact. An example of beach litter can be seen in Figure 10.



Figure 10: Beach Litter at La Pocita Beach

### 2.2.6 Implementation of the Signs at Specific Locations

To determine where to post these signs we held a secondary meeting with the restaurant owners to review the poster designs and suggest possible locations for displaying the posters. The posters were placed inside the restaurants in highly visible locations, maximizing exposure while also making sure the posters will not be damaged or taken down. See Figures 11 and 12 for examples. The posters and beach messaging posters were placed in high traffic areas such as the entrance, exit, bathroom, and bar to increase exposure. The recycling educational posters were placed next to the bins as a reminder for the employees.

To determine locations around the beach to hang our posters, we scouted the area along the beach and the surrounding areas. The most important factors that we considered were the ability of the posters to withstand the element and receive authorization to hang them. The specific locations were chosen based on observed high traffic areas and existing poster locations.

We chose to not post any signs in residential neighborhoods because the residential recycling program had not been rolled out yet. Furthermore, we are going to post signs at the recycling bin itself and at the

composting site, both of which are located in the community, and will be freely viewable for those who may want to participate.



Figure 11: Poster Location at the Entrance of Sun City



Figure 12: Poster Location at Sun City

### 2.2.7 Design of Stickers for Recycling Bin Lids

The restaurants will be provided with recycling bins which they will use to store their recycling material separately from their other waste. Additionally, some of these bins may be available to the customers, and to minimize the amount of non-recyclable material that makes it into the bin, two strategies are being used.

Firstly, bins for the recycling bins are being used which have a small opening that is slightly larger than the aluminum cans and water/soda bottles which are expected to make up the majority of the recycling. This will hopefully cause people to second guess what they're putting into the bin, allowing the second strategy to have a more significant impact. The second strategy is to create informational stickers which will be placed on the lid of the bin, encircling the hole in the center, and stating on the sticker that it is a

recycling bin. An example of these designs can be seen in Figure 13. The white circle in the middle is where the bin’s hole would be so that the recyclable item can be placed inside the bin.



Figure 13: Display of Stickers for Lid of Recycling Can

The artistic aspect of the lids combined with the relatively small opening should draw attention to the words on the sticker, causing whoever is going to use the bin to realize that only plastic 1, plastic 2, and aluminum should be placed in, reducing the amount of non-recyclable material that is placed in the bin.

In addition to stickers that are displayed on top of the container, our team designed stickers that can be used as educational or during fundraising events which can be seen in Figure 14.



Figure 14: Display of the Stickers

## 2.2.8 Beach Cleanup

Our team identified locations to place beach messaging posters during a beach cleanup on Friday, November 19. An image from this beach clean-up can be seen in Figure 15. After setting up and beginning the beach cleanup, the team made sure to identify locations with higher amounts of trash, places that would be more visible, and places where many people set up and moved through as regular beachgoers arrived. 11 locations were identified around the area where the beach cleanup took place. Unfortunately, because the area is a public space, hanging up posters requires permission from the Departamento de Recursos Naturales y Ambientales (DRNA). LimPiaR has reached out to them, but has not yet or gained permission to hang the posters, but when they do they should be able to print and hang the posters in those locations.



Figure 15: Beach Clean Up Conducted on November 19, 2021

## 2.3 Objective 3: Develop a Schedule and Procedure for Recycling and Composting

This objective breaks down the logistics of the recycling and composting program. We created multiple schedules for LimPiaR to reference to help the program run smoothly. The development of these schedules is important to allow for proper pick-up of the recyclable materials and to keep all restaurants, the community, and LimPiaR on the same page.

### 2.3.1 Composting Informational Interview

We interviewed TAIS liaisons to get insight into the logistics and details of developing a composting site and running a community-based composting program. Some of the questions discussed were:

1. What should we do to prepare before implementing the composting system?
2. What are the most important criteria we need to be aware of?
3. What are the important logistics of the composting site itself?
4. What are the differences between running a restaurant vs a community composting program?
5. What information do we need to keep track of?
6. How important is extensive training?
7. What will be the cost of these services?
8. What are the steps in this process? Both big picture and on the individual level?

These responses to these questions helped us identify the needs and requirements and we then provided LimPiaR with our recommendations for the composting program.

### 2.3.2 Recycling Informational Interview

We interviewed an IFCO liaison to get insight on the logistics and details of implementing our recycling program at restaurants and throughout the community. Some of the questions discussed were:

1. What needs to be done to the plastics to not cause any problems?
2. Can the small rings that caps are attached to remain on the bottle or do those have to be removed?
3. Will you swap the container or empty it? If swap, will it be swapped when it is picked up, or will another be dropped off later?
4. When can you come to empty it? How often/what days?
5. What is the cleaning process for aluminum cans?
6. When cleaning plastic containers with oil in them does soap need to be used?
7. What are the consequences of the wrong plastic or there being food waste?

These responses to these questions helped us identify the needs and requirements and we then provided LimPiaR with our recommendations for the recycling program.

### 2.3.3 Scheduling for Recycling and Composting

To organize this process, we created a work schedule for LimPiaR to reference, including information like when and where pickups occurred and how much material was collected. The collected data will help LimPiaR apply for more grants to help expand their organization and outreach. The information found in the worksheet was collected based on the responses from the initial interviews with the restaurants and community leaders. In addition to the master schedule created for LimPiaR, we created individual tracking sheets for each of the restaurants and for community members, that indicate important dates and deadlines so that they can track when their pick-ups as well. These monthly work schedules were created in Microsoft Excel and the template was provided to LimPiaR. Our team provided a document to LimPiaR that will help them maintain their work schedules and their progress. This document is called “Work Chart FAQs” and aims to mitigate any potential issues LimPiaR may have when working on the Excel Sheet, the complete guide can be found in the supplemental material section.

## 2.4 Objective 4: Design and Conduct Training Workshops

Due to the lack of knowledge about recycling in the community, holding workshops to make sure the recycling program participants knew what and how to recycle was vital for the program to succeed. While our team will not be present for the beginning of the program, we helped LimPiaR create a comprehensive plan for the workshop to get the project off to a smooth start.

### 2.4.1 Preparation Meeting for Training with Restaurants

We held a secondary interview with the restaurants to get final feedback about the posters before printing and to discuss some final logistics before hosting workshops with them. The discussion points for this meeting included:

1. Poster feedback and input
2. Poster sizes and quantities
3. Ideal locations for posters
4. Recycle bin availability
5. Placement of recycling bins
6. Workshop dates and times

The responses from these meetings allowed us to get more understanding of where the restaurants were in terms of preparation, print the correct number of posters, buy recycling bins, and schedule workshops. In Figure 16, our team is conducting interviews at Nuevo Acuario (left) and La Casa del Indio (right). See appendix 11 for all interviews.



Figure 16: Initial Restaurant Interviews

### 2.4.2 Orientation Workshop for Recycling in Restaurants

The restaurant workshops will be in the restaurants on the days that fit their schedule. We are going to schedule another meeting for 7-10 days after our original introduction meeting to check in and analyze

how the recycling initiatives are working. We are going to review each piece of plastic that they put in the kitchen recycling container and let them know if it is recyclable and if it is prepared correctly. If not, we will explain why and help walk through the restaurant employee on how to prepare it properly. Not only are the restaurants going to need to be trained on kitchen recycling, but also going through the customer recycling and identifying and preparing the items from there as well. During this workshop, we will show the restaurants what can and cannot be recycled. IFCO does not require the plastic to have removed caps or labels. Only plastics that contain oils, soaps, and cleaning chemicals must be thoroughly rinsed out with water. During this workshop, our team will be sure to tell the restaurant that if they have any questions about the plastic or the cleaning standard of the item that they should not recycle the item. This item would then just be thrown out in the normal trash. The goal of this workshop is to explain to the restaurant team the limitations of the recycling program and to answer any questions about the pickup or schedule. This process can occur however often the restaurant deems fit, but it will need to occur at least once a week before pickup by LimPiaR. An example of our team conducting one of these workshops can be seen in Figure 17.



Figure 17: Workshop Conduction at Nuevo Acuario

### 2.4.3 Training Workshops for Recycling in the Community

Similarly, recycling will also require proper training and understanding from the residential participants. IFCO, the recycling company, provided a large container to collect all recyclable items and will haul it away and replace it once filled. IFCO currently only collects plastics types 1 & 2 and aluminum cans. These items did not need to be separated by LimPiaR because IFCO has a sorting system on site. The only criterion needed for recycling is that plastics that contained oils, soaps, and cleaning chemicals must be thoroughly rinsed out with water. Based on the workshops with the restaurants, our team wrote a workshop guide that outlined the necessary information that community members would need to know to participate in the recycling program. This document was provided to LimPiaR.

### 2.4.4 General Workshop, Clean Up & Brigade Notes

During each workshop, our group and LimPiaR were there to clarify which materials are recyclable and provide alternatives as to what to do with the items that are not viable for either process. Community members and the restaurant owners were encouraged to create a list of what they put in their recycling, so we can see if any waste materials could compromise the overall recyclability of the collection. One of our sponsors lives in the same neighborhood that the community center is located in. They will be leading all of the community workshops and will be present for all recycling occasions. Because large containers are often used as dump locations, especially in areas where people are not given access to functional waste disposal, the recycling container must be locked unless someone is there to make sure everything that goes in is recyclable. Our liaison will have the key to the recycling bin and will have to open the bin every recycling pick-up date. They will be an extremely helpful asset to this cause, serving as the voice in the



community, encouraging people to visit the center, and helping us overcome any potential language or cultural barriers that may arise.

#### 2.4.5 Future Recommendations & Supplemental Documentation

LimPiaR has expressed great interest in both an expansion of the recycling program and the beginning of a composting program. For this to occur, our team must leave behind the proper instructions for LimPiaR to succeed. Therefore, we developed plans and strategies LimPiaR could use for the start and continuation of both programs to maximize the odds that they will be successful.

We provided LimPiaR with important supplemental documents that will keep the recycling and composting operational and will hopefully lead to its expansion to other restaurants in the reef in the future. We also noted challenges faced during our experiences running the workshops and training programs so that LimPiaR can reference them in the future and potentially run similar, improved workshops for new participants and restaurants. This will work as one of the foundational documents for how the recycling and composting program will be implemented and expanded in the future in Piñones. If these programs are run successfully and smoothly, LimPiaR will be able to help other communities by providing the documents and instructions to implement a recycling and composting plan. The document that highlights the actions needed to run the workshops is in the “Recycling Orientation Facilitator Guide” and this document is in the supplemental material.

Our team also developed a plan of action for LimPiaR for their short- and long-term future. This document highlights possible avenues of expansion for the recycling program as well as an action plan for the composting program and future initiatives. This document is located in the supplemental material and is called “Plan of Action for Future Projects”.

## CHAPTER 3: OUTCOMES & FINDINGS

The goal of this chapter is to relay what we learned during our time in Puerto Rico to the reader. The chapter is organized similarly to the methodology and will include a section for each of the objectives.

### 3.1 Waste Management Infrastructure in Piñones

There are no main deliverables from this section, just our findings based on our research and interviews.

#### 3.1.1 Current Waste Management Practices in Piñones

Each of our liaisons provided important unique background information to understanding waste management in Piñones. They explained that as one of the poorest communities in Puerto Rico, Piñones does not have regular trash pick-up, which is the main contributor to litter. In addition to a lack of services, many Puerto Ricans do not recycle because they do not trust the system. The island's largest waste management company, Conwaste, claims that they recycle, but they also own the majority of Puerto Rican landfills, and it is understood across the island that they dump recycling in landfills to cut costs.

Due to governmental neglect as an effect of socioeconomic discrimination and systemic racism, Piñones has suffered from a lack of services resulting in extreme difficulty disposing of trash, and the inability to recycle. In addition to inconsistent pickups, many of the waste management companies will not accept larger items, leading community members to dispose of these large items in overgrown, abandoned lots. In one plot of land behind the community center, we found abandoned bicycles, chain link fences, carpets, tires, and microwaves, along with a large variety of other random items. This lot had been unkept for years, which resulted in hundreds of pounds of trash build-up which, according to our liaisons, is not an uncommon occurrence.

They also explained to us that the geography of Puerto Rico makes recycling much more difficult. There are no recycling plants on the island which means that all recyclable materials must be exported to foreign countries to be recycled. This limits the materials that can be recycled and the number of companies that are willing to offer these services. We discovered that the main example of this is glass, and while it cannot be recycled there are opportunities for upcycling, but these are not widely available and often expensive.

Our liaisons also described the impact of poor waste management and littering on the community and environment. One example was that Laguna de Torrecilla, one of the main lagoons in Piñones, used to be bioluminescent, but because of pollution has ceased to be so. They also described how the local wildlife is impacted by plastic pollution, boating accidents, and global warming and how that damages the ecosystem as a whole.

#### 3.1.2 Recycling Educational Level of the Community

Our liaisons explained that the community has little to no experience with recycling. Before this program, there were no opportunities for businesses or community members to recycle plastic or aluminum. Even if community members wanted to recycle, there was no infrastructure to allow them to do so. This long-term lack of exposure has resulted in very few educational materials available to the community. This is reflected in the fact that the liaisons made us aware that many community members weren't even aware of what the recycling symbol looks like. Because there is no recycling program in place, there was no circumstance in which community members would need to learn that information. We took these educational limitations into account when designing our posters and workshops to create a useful and understandable program.

#### 3.1.3 Composting in the Community

Originally, our team was tasked to create both a recycling and composting program in Piñones. We learned that like recycling, there is no current composting initiative and limited knowledge amongst

community members about composting and its benefits. In addition, there was no infrastructure to support the program, and the complexity of creating a composting site made it infeasible for us to accomplish, but we were able to assist LimPiaR in the early stages.

After visiting the proposed composting site and interviewing TAIS, the composting company, we quickly learned that creating a composting program was unrealistic and would require more time than our seven weeks. There were more obstacles to developing the site than LimPiaR initially anticipated. They had designated an area in an overgrown lot behind the community center to be the site of a 10x15 foot composting site. Upon arrival at this area, we found it overgrown with vegetation upwards of 6 feet tall and full of trash. Our sponsors hired community members to cut the vegetation to ground level and weed whack the area. Afterward, our team participated in a brigade to remove the trash from the area. We disposed of hundreds of pounds of trash including chain-linked fences, rugs, ovens, and tires. A display of the trash that our team uncovered can be seen in Figure 19. Even with all of the community help, the site still needed at least 2 more brigades to be prepared. In Figure 18, our composting brigade can be seen.



Figure 18: Composting Brigade with the Climate Group & our Liaisons



Figure 19: Trash Collection from the Composting Brigade

Even after the site is prepared, there is additional infrastructure that needs to be implemented before composting can occur. The most important logistics we needed to consider were the environmental impacts of the site. TAIS explained to us that preventing contamination needs to be a priority, which requires minimizing runoff. The composting site is adjacent to a drainage channel that flows directly into the mangroves, and runoff from the compost can damage the lagoon ecosystem and wildlife. TAIS recommended building a concrete base underneath the site to prevent harmful runoff and protect the surroundings. These limitations forced LimPiaR to delay the timeline for implementing the composting program and therefore pushed it outside of the scope of our seven-week timeframe. See Appendix 3 for more information regarding composting.

### 3.1.3 Beach Clean Up

Our team managed and ran a beach clean-up on November 19, 2021, with 30 participants. Our team can be seen in Figure 22 and the participants can be seen in Figure 21. During the beach clean-up, we found an abundance of microplastics like straws, water bottles and beer bottle caps, and broken pieces of larger plastics. However, along the side of the road and across the street we found many of the larger items. These items included tires, aluminum cans, plastic containers, and beer bottles. Collectively, we picked up over 15 bags of trash which are seen in Figure 20. Our team used this beach clean-up to analyze potential areas of expansion for LimPiaR, pinpoint areas of high garbage, and make the beaches a little bit cleaner!



Figure 20: Display of Collected Garbage at the Beach Clean Up



Figure 21: Beach Clean-Up Team



Figure 22: Our Team at the Beach Clean Up






## 3. 2 Educational Campaign

The deliverables of this section are our educational posters, stickers, and stickers for the lid of the recycling container.

### 3.2.1 Educational Posters

Our team met with the owners of all 6 restaurants that are participating in the program: La Casa del Indio, Mi Casita Seafood, Nuevo Acuario, Nana’s Place, Sun City, and the Waterfront, as well as local leaders and residents, to discuss our poster designs and receive their feedback. Based on our findings through the interviews, our team designed 20 posters of varying design and messaging to provide to LimPiaR. The table below summarizes the goals and locations of the posters that were approved by LimPiaR to be hung. All other poster designs are located in the supplemental material document.

Table 2: Summary of the goals and locations of the posters that were approved by LimPiaR to print.

Poster Name	Poster Display	Main Goal	Location in Piñones	Location in Report
Recycling Display (Simple)		Display the most common recyclable materials	Restaurants	Appendix 5
Recycling Guide (Steps)		Describe the steps when identifying recyclable materials	Restaurants	Appendix 4
Guide to Leaving a Clean Footprint		Remind visitors about the “rules” of the beach to reduce beach litter	Restaurants & Beach	Appendix 6
Piñones Ecosystem		To teach and raise awareness about local wildlife and ecosystems	Restaurants & Beach	Appendix 8
Environmentally-Minded Restaurants		To promote to the public the restaurants that are participating in the recycling program	Beach	Appendix 7

The following educational posters focused solely on recycling. These posters were displayed at the restaurants to educateSteps, remind employees about the steps of recycling.

The “Simple Recycling Guide” was created to quickly display examples of the materials that are recyclable to be referenced by restaurant employees. The poster categorizes items into the three types of recyclable material (plastic 1 & 2 and aluminum) and shows all of the items going into the same bin. This exemplifies that the different types of recyclables do not need to be put into separate bins.

The “Guide to Recycling – Steps”, seen in Table 2, provides the necessary steps restaurant employees need to take to recycle an item. We learned in our interviews that the vast majority of restaurant employees are native Spanish speakers and therefore this poster is solely in Spanish. The steps are simple and easy to follow, and the images show how to find the number of the plastic, which is step 1.

In addition to the educational recycling posters, we also created educational posters for the composting program that will be implemented in the future. The “Composting” poster, seen in Table 2, displays both food waste and Borikashi, the two necessary inputs, going into the TAIS composter, which is representative of the composting process as described to us by TAIS.

The following three posters are related to the beach and serve the purpose of informing beachgoers about the environment on how to limit their impact on the ecosystem. These posters create our beach messaging campaign that focuses on reducing beach litter through a “leaving a clean footprint” initiative.

The “Guide to Leaving a Clean Footprint”, in Table 2, was designed to educate the public about bringing their trash home with them to prevent beach litter. This was our equivalent of a “Leave No Trace” campaign. This poster will be posted publicly, so the messages are written in both Spanish and English. We observed that the beaches were not well maintained and covered in trash, so we hoped that by raising awareness and providing education, people would be deterred from doing so.

The “Piñones Ecosystems” poster, seen in Table 2, was designed to educate the public about the ecosystems in Piñones. By raising awareness, we hoped to encourage people to respect the environment and protect its beauty. The animals were suggested by our sponsors and community members during interviews. Table 2, was designed to promote the restaurants that are participating in LimPiaR’s recycling program. This poster serves to educate beachgoers about the restaurants that are actively trying to limit their landfill waste generation and make Piñones cleaner, and influence beachgoers to go to these businesses.

### 3.2.2 Poster Implementation

In addition to the restaurants, we developed plans for the beach messaging posters to be hung at specific locations along La Pocita de Piñones, one of the main beaches. A diagram of the beach and general poster locations can be seen in Figure 23. We found that it would be best to hang up the posters in the palm tree line and on the existing garbage areas because these structures give the posters a little more protection from the elements while also being in areas of high foot traffic. In addition, we also recommended hanging posters along the road where cars park to maximize exposure and because high amounts of litter were found along the road. The locations identified for poster placements are seen in Figure 23 below.



Figure 23: Map Showing Desired Locations for Beach Posters on the La Pocita de Piñones

### 3.2.3 Recycling Bin Education

In addition to the posters, our team also designed sticker designs for the recycling program. During our interviews with the restaurants and IFCO, it was brought to our attention that one of the biggest challenges with recycling would be preventing contamination and ensuring that only recycling gets put in the recycling bin. To combat this, we found that we needed to buy recycling containers with special tops that have a small hole that will only fit cans, water bottles, and other small recyclable items. An example of a lid like this can be seen in Figure 24. Because of this unique design, our team found that we could add extra educational material to the lid. Therefore, we designed stickers that can be fit around the hole or on the lid to educate the users about the bin.



Figure 24: Recycling Bin Lid

## 3.3 Scheduling and Organizational Logistics of the Program

The deliverables of this section are multiple Work Charts that are designed for different people in the recycling program and a Work Chart FAQs document.

During our interviews with the 6 participating restaurants, we asked them when the best time would be for their recycling to be picked up. They all said either Monday or Tuesday because they are busiest on the weekends (Sun City, Restaurant Interview, 4 November 2021) (Nuevo Acuario, Restaurant Interview, 4 November 2021) (Nana's Place, Restaurant Interview, 2 November 2021) (La Casa Del Indio, Restaurant Interview, 2 November 2021) (Mi Casita, Restaurant Interview, 12 November 2021) (The Waterfront, Restaurant Interview, 12 November 2021). Based on these suggestions, we recommended that weekly pick-ups occur on Tuesdays. However, this schedule is subject to change once in operation. For example, one restaurant owner mentioned that the busiest time of the week may change depending on the season therefore the recycling pick-up day will need to change as well (Sun City, Restaurant Interview, 4 November 2021). A second pick-up day may also need to be implemented if the restaurants collect more recyclable material than they can store. An example of the restaurant work chart can be seen in Figure 25.

In a similar fashion to the restaurants, we spoke to community leaders to create a recycling schedule for the community. Based on their responses, we decided that Thursday will be when the recycling bin gets unlocked for community members to drop off their recycling. As with the restaurant, this day is subject to change based on the availability of the community leaders.

This work chart (Figure 26) consists of a master tracking sheet for LimPiaR and a schedule with their logo for each restaurant that is participating in the program. The days where pick-up is occurring were highlighted to stand out. This document was provided to LimPiaR. An example of both the master chart and the restaurant-specific chart is below. Larger images of each work chart can be seen on Appendix 9 and 10.

2022 ENERO  
AÑO DEL CALENDARIO MES CALENDARIO

LUNES PRIMER DÍA DE LA SEMANA



LUNES	MARTES	MIERCOLES	JUEVES	VIERNES	SABADO	DOMINGO
01	02	03	04	05	06	07
08	09	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Figure 25: Example of Restaurant-Specific Work Chart

2022 ENERO  
AÑO DEL CALENDARIO MES CALENDARIO

LUNES PRIMER DÍA DE LA SEMANA



LUNES	MARTES	MIERCOLES	JUEVES	VIERNES	SABADO	DOMINGO
01	02	03	04	05	06	07
08	09	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Figure 26: Example of Master Work Chart

These schedules are subject to change and the document was provided to LimPiaR so edits can be made. We created a frequently asked questions document for the work charts which details how to execute some of the technical tasks that are required when updating this document. We added step-by-step instructions and pictures to minimize any confusion that may occur. A picture of the FAQ document is in Figure 27.



Figure 27: Title Page of Work Chart FAQs

### 3.4 Research Culminates into Interactive Educational Training

The deliverables from this section is a Workshop Facilitator Guide.

#### 3.4.1 IFCO and TAIS Interviews

To develop an understanding of the information we needed to share in our workshops, we held interviews with TAIS, the composting company, and IFCO, the recycling company.



When we first arrived in Piñones, LimPiaR had been told by IFCO that the labels and caps of all items that were going to be recycled had to be removed. However, after speaking to an IFCO representative, we learned that the only criterion was that the container needs to be clean (IFCO Interview, 5 November 2021). This made the recycling process much simpler and more feasible for us to roll out in restaurants. Our original workshop plans had multiple steps and explanations, but after that conversation, it became much simpler to only have to describe the types of plastic that can be recycled. Although it is the only criterion, the cleanliness of the recycled items is essential. We were told that if a recycled item is contaminated with food waste, it will contaminate the entire batch and then none of the material can be recycled and will be landfilled (IFCO Interview, 5 November 2021). This is also important for the large recycling container. If any contamination occurs in the large container, then the entire container gets landfilled. IFCO consistently stated their concern with an open container. They have dealt with situations where the entire container gets landfilled because people have thrown in dead pets or couches. To prevent this from occurring in Piñones they recommended that LimPiaR keeps the container locked except for the brief period when recyclables are collected. This information was used to tailor the workshops to the community, restaurants, and the stakeholders in the project.

During the TAIS interview, our team learned a lot about the composting process and how complex it is. LimPiaR's initial goal was to involve both the community and restaurants in a composting program, however, after speaking with TAIS, we quickly realized that it would be nearly impossible to do this on such a large scale. With the limited space and size of the proposed composting site, they said they did not recommend LimPiaR start composting at every restaurant (TAIS Interview, 1 November 2021). They recommended developing the site and starting the program with a few residents and possibly one restaurant. Also, there is significant training and monitoring that would need to be done by LimPiaR, which is time-consuming and costly. We agreed with TAIS and recommended that they start the program with only a few community members to allow for ample time to work out all the logistics of its operation.

### 3.4.2 Designing Workshops

Our team planned and finalized workshops early in our time in Piñones, however, the infrastructure was not in place for us to hold them. Primarily, IFCO suggested laying a concrete foundation for the 22x9x7-foot container to sit on to prevent damage to the area when it gets replaced. This foundation was not set until our final week in Puerto Rico and delayed implementing this program in restaurants. Additionally, the recycling bins LimPiaR is going to provide to the restaurants were not scheduled to arrive until after our seven weeks. However, the restaurants must be trained before participating in the program, so our team created workshops that would help LimPiaR train restaurant employees and implement the recycling program.

Because of this, we created a document that contains all of our plans on how to run the workshops to provide to LimPiaR. This guide contains all of the material and information the liaisons need to conduct an efficient and informative workshop. An image of the title page of the workshop guide is in Figure 28.

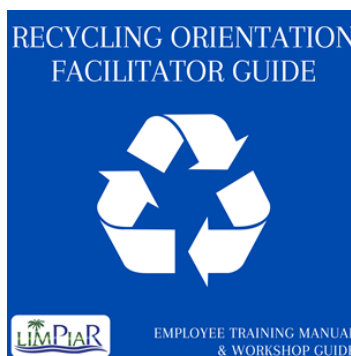


Figure 28: Title Page of Recycling Facilitator Guide





Figure 31: Poster Location at Sun City



Figure 32: Poster Location at Nuevo Acuario

### 3.5 Documentation Contributing to LimPiaR's Future Success

The deliverables from this section are the Plan of Action for Future projects, a recommendation document for LimPiaR.

Before our departure, we created a document for LimPiaR describing some future endeavors that they can implement. The plan includes suggestions, areas of improvement, and recommendations that we observed and researched. These suggestions include not only expanding on current projects, but also new sustainability practices that they can implement in the future. Some of these plans include expanding the recycling program, the roadmap to composting, investing in a glass pulverizer, and other marketing and fundraising opportunities. The title page of the document is in Figure 33.



Figure 33: Title Page of Action Plan

# RECOMMENDATIONS

During our time in Piñones, we observed and researched possible recommendations for LimPiaR to aid in the expansion of their programs. These recommendations relate to the educational poster campaign, recycling and composting programs, and future initiatives. A document titled “Plan of Action for Future Projects” outlining these recommendations can be found in the supplemental document section.

From our experience designing and implementing the posters, we recommend that LimPiaR performs the following actions:

- *Monitor the posters.* The posters may be stolen, vandalized, or otherwise severely damaged, which would necessitate a replacement poster.
- *Consult graphic designers for future change.* If more posters will be developed or the current ones will be changed, input from a professional graphic could increase the effectiveness of the posters

Based on our interview findings and observations, we recommend that LimPiaR keeps the following things in mind when expanding the recycling program:

- *Mindfulness of the complexity of the program.* It is best to start the program with limited participants to iron out any common errors and to finalize the logistics of the program before expanding.
- *Expanding the project in a controlled manner.* Our team suggests that once the community is involved with the recycling program, it is best to start with small groups of people to ensure the effectiveness of the workshops and the educational level of the community.
- *Master Plastics one & two before moving on to four.* Plastic four is much harder to identify and may lead to problems with IFCO if implemented in a rushed manner.

Based on our findings from the TAIS interviews and our extensive research, we recommend that LimPiaR keeps the following things in mind when implementing the composting program:

- *Understanding the infrastructure and resources needed to maintain the program.* In our initial meeting with TAIS, our team found that the process is extremely complex and will lead to many obstacles such as installing environmentally friendly composting plots, maintaining the amount of dead brush needed for the composting pile, and acquiring the proper material at a cheap price to start the program. Be mindful of the obstacles and plan to conquer them.
- *Learn, trust, and rely on the experts when implementing the program.* Our team suggests that LimPiaR should rely on educational material, composting expertise, and general knowledge about implementing a composting program from Tais.
- *Implement the program at the right time.* Our team recommends waiting to implement the composting program until the recycling program is running smoothly and there are no complaints. Do not stretch your team too thin across multiple massive projects.

Based on our findings from our time in Puerto Rico and our extensive research, we recommend that LimPiaR keeps the following things in mind when they are ready to expand:

- *Tackling the glass bottle issues.* Based on our team’s observations, glass is a big issue on the island, and investing in a glass pulverizer is the first step to slowing this growing issue.
- *Creating a restaurant certification program.* With the launch of the recycling program, committed and motivated restaurants can expand on recycling to include other environmentally friendly initiatives.
- *Eliminating single-use plastics.* Elimination of single-use plastics can begin with restaurants buying recyclable or reusable silverware and can lead to a local movement to stop using plastics.

# CONCLUSION

The overall goal of this project was to implement a recycling program in Piñones and create an educational campaign to raise awareness amongst community members, tourists, and restaurants. Although a common practice in wealthy nations, recycling programs are often not available in poor communities because of limited services and resources; however, it is these communities that suffer the most from poor waste management and litter. This program will provide that opportunity to Piñones.

We addressed our goal to educate the community about and implement a community-wide recycling program through the following strategies:

- Researching and observing the current waste management, production, structure, and issues
- Developing educational and promotional posters for the program
- Designing a schedule and procedure for LimPiaR to follow
- Designing and leading workshops in restaurants
- Creating a plan for future recommendations and project ideas

Throughout our time in Puerto Rico, our team developed educational material, posters, and design workshops to ensure the success of the program. We developed a poster campaign that consisted of 4 designs that focused on recycling, keeping the beach clean, and protecting the local ecosystems. These posters were printed and hung at the participating restaurants to educate both employees and their customers. To train the restaurants in the necessary steps involved in participating in the recycling program, we held workshops with the managers of 2 restaurants: Nuevo Acuario and Sun City. These two restaurants were provided with one copy of each of the posters and their individualized work chart. Based on our research and observations we developed a training manual that was provided to LimPiaR to host future workshops with the other participating restaurants. All in all, the project resulted in an educational poster campaign, interactive workshops with local restaurants, the installation of a 22x7x9 ft recycling container, & an overall recycling program for Piñones community members & 7 businesses with potential for expansion.

These methods and procedures can be used by LimPiaR and other environmental organizations in the future to roll out similar programs involving composting and glass upcycling. With the implementation of the recycling program, Piñones and LimPiaR have both made a massive stride towards a cleaner, more sustainable, and exciting future.

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# APPENDICES

## Appendix 1: Stakeholder Interview Questions

### 1.1 Overview

Interviewing local community members, tourists and restaurant workers played a pivotal role in our team's understanding of the issues at play in Piñones. This information was obtained through informal and sit-down interviews.

### 1.2 Sponsors: LimPiaR

The liaisons were our go-to resource while in Piñones. They helped us understand the context of the situation and serve as translators when speaking to restaurants. Our team actively asked for input throughout the project. Because of these things, our team needs to be able to actively ask questions about the project and task at hand. By asking the liaison specific questions about the goals of our project, we can confidently understand our task at hand and how to proceed to accomplish this task.

1. What is the current status of waste in Piñones/Incentive Techniques for Restaurants?
2. What do you believe has been the biggest impact that restaurant litter has had on the Piñones community?
3. What sector of the restaurant business do you believe is the most problematic? (Where is the best insertion point for us?)
4. Are tourists the big waste problem or restaurants?
5. How many restaurants do you plan on accepting and adhering to our advice on waste reduction?
6. What is the reality of waste management in Piñones?
7. What is your end vision for the restaurant waste project?
8. Where do you see our team fitting in on this vision?

### 1.3 Community Leadership

Piñones is a small tight-knit community along the northeast coast of Puerto Rico. This community relies on its leaders to make decisions in the community to better the overall area. These leaders may include churches, restaurant owners, business owners, respected elders, and other official leaders. These leaders may be more open to voicing their opinions on the current litter and waste in Piñones than others.

1. How long have you lived in Piñones?
2. What is your role in the community?
3. Where do you see the biggest issues in terms of waste in Piñones?
4. How would you adjust the current waste and littering problem at Piñones?
5. Would you back and promote a restaurant that is currently making changes to become more sustainable?

### 1.4 Community Members

Piñones is the home to more than 10,000 community members. These members all possess different opinions, ideas, and voices. Each opinion is important as it will expose our team to different ideas and perspectives. Daily interaction among the community members will help us understand the day-to-day life of the community and some things that they see every day. Most of these questions will be asked at the beaches or in the town square.

1. How long have you lived in Piñones?
2. What are the biggest changes you have seen in Piñones due to waste?



3. What things do you think are the biggest problems you see with the current waste management in Piñones?
4. Do you think tourists contribute a large fraction of the waste Piñones and the beaches?

## 1.5 Restaurant Owners and Employees

Our project revolves around reducing waste in restaurants and creating more sustainable plans for these restaurants as well. Therefore, we will ask many questions that revolve around their current waste management techniques. The restaurant owners will be able to provide us with specific data and costs of their current food and waste management. This will help us assess their current issues and to identify their fundamental issues. The employees will help us assess their current day-to-day practices with waste. This will help our team understand the locations in the process where we can implement our current thoughts. The following questions will be asked in informal sit-down interviews with the owners and employees.

1. What do you feel are the greatest issues when it comes to restaurant waste?
2. What are your opinions on switching to greener practices?
3. What are some of the strategies that your restaurant already uses to limit your ecological impact?
4. What do you think are the biggest concerns in terms of the ecological impact of your restaurant?
5. What would be your biggest concerns and worries about converting your restaurant to using more eco-friendly practices?
6. How do you feel your business practices have been impacted by the litter surrounding areas

## Appendix 2: Informed Consent Script

### 2.1 Sample Verbal Consent

Hello, my name is \_\_\_\_\_. I am a student at Worcester Polytechnic Institute in Massachusetts, and we are here working in collaboration with LimPiaR, a local nonprofit organization dedicated to battling litter in Puerto Rico, to collect information on (beach litter/restaurant waste management). Would you be willing to take 5 minutes to answer a few questions?

### 2.2 Complete Verbal Preamble

Hello, we are a group of students from Worcester Polytechnic Institute in Massachusetts. We are interviewing restaurant owners and employees to learn more about their waste management practices and their willingness to implement eco-friendly strategies. We are working in collaboration with LimPiaR, a local nonprofit organization dedicated to battling litter in Puerto Rico, to reduce the amount of plastic produced by restaurants to hopefully decrease the amount of litter that is found in the surrounding areas and on the beach.

Your participation in this interview is completely voluntary and you may withdraw your consent at any time. Please remember that all of your answers will remain anonymous if desired. If you decide to remain anonymous all names and identifying information will not appear in any of our reports or publications.

As mentioned, this is a collaborative effort with LimPiaR, and your participation is greatly appreciated. If interested, we can send you a copy of our results after the study.

### 2.3 Written Consent

We are a group of students at Worcester Polytechnic Institute in Worcester, Massachusetts. We are conducting a research project on behalf of LimPiaR, a local nonprofit organization dedicated to battling litter in Puerto Rico, to reduce the amount of plastic waste produced by restaurants and therefore decrease the amount of litter that is created on the beaches and surrounding areas. As part of this project, we are conducting a series of interviews with key individuals, and we are asking you to participate because we

believe you have unique and useful knowledge of these issues that will be valuable to our understanding and completion of this project.

Before we begin, we would like to thank you for taking the time to participate in the interview which will take about 30 minutes. Your participation is entirely voluntary. You may refuse to discuss any question or withdraw your consent to this interview at any time. With your permission, we would like to record this interview for future reference. All tapes, notes, and subsequent transcripts will remain confidential, and your name will not be used in any subsequent report or publication without your permission.

If you consent to be interviewed at this time, we ask that you indicate your agreement with your signature below.

## Appendix 3: Composting Information for Future Recommendations

### 3.1 Potential Stakeholder Analysis

TAIS is a major stakeholder in our project, as they are a composting company that will be supplying all the composting materials to the participating restaurants and households. TAIS will also be picking up the full containers from restaurants, which will be paying them for their services.

### 3.2 Composting

Similar to the recycling section, this section is designed to give the reader a brief overview of composting and the composting technique our team will be using. This section also gives the reader a quick overview of why composting is so beneficial to the community.

#### 3.2.1 Composting Basics

Composting is the “natural process of recycling organic matter, such as leaves and food scraps, into a valuable fertilizer” (Hu, 2020). About 40% of the waste generated in Puerto Rico is food waste, and by creating and implementing a composting program, not only will the overall waste generated decrease, but it will also create a valuable commodity for the community (Fajardo, 2020).

#### 3.2.2 TAIS Composting Method

TAIS, Titro Agro-Industrial Services, is a Puerto Rican corporation whose mission is to provide composting opportunities and the creation of sustainable agriculture. Their composting method uses an additive including anaerobic microorganisms that leads to the fermentation of food scraps before it decays (J. Pacheco Gale, Interview, November 1, 2021). The putrefaction of food scraps leads attracts animals and undesirable odors, which is avoided through the fermentation process.

#### 3.2.3 What can be Composted in the TAIS Method?

The additive that TAIS uses is called Borikashi, which is used to ferment food scraps and increase the amount of food that can be composted. In many composting methods, only specific organic materials like vegetables, shells, coffee grounds, and fruits can be composted. Traditionally, meat, bones, eggs, and dairy products would be put in the normal garbage. However, the use of Borikashi in the TAIS method ferments all of the food scraps and quickens the composting process which allows for those typically non-compostable materials to be used. The only limitation to the process is that there should be as little liquid as possible and compostable materials should be in small pieces. All objects should be cut into the size of a quarter and drained to help maximize the effectiveness of the Borikashi (J. Pacheco Gale, Interview, November 1, 2021).

#### 3.2.4 TAIS Composting Pre-Compost

The collection of compostable materials in restaurants and households is what TAIS refers to as “pre-compost.” This pre-compost consists of the mixture of the fermented food scraps and Borikashi.

The steps that are involved in composting are the same for both restaurants and community members and are listed below:

1. Line the bin with a compostable liner
2. Place all food scraps in the bin throughout the day
3. Add a scoop of Borikashi to start the fermentation process
4. Compact the bin using the presser to remove any oxygen to allow for an anaerobic process
5. Repeat daily
6. Bring to the compost pile when full, rinse bucket & repeat

Steps three and four are pivotal in the effectiveness and success of the pre-composting stage. If Borikashi is never added, the food will rot instead of ferment. In addition, if the Borikashi and the bin are not properly prepared, the fermenting process will fail as well. Borikashi only works when removed from the presence of oxygen, which means that if the bin is not properly compacted the Borikashi will not be able to ferment. This will result in unpleasant odors and the bucket will fill up much faster.

### 3.2.5 TAIS Composting Pile

Once community members and restaurants have filled their composting buckets, they need to empty their pre-compost at a composting site. TAIS provides removal services for a fee, but also provides consultation on community composting spaces. They recommend either trench or static pile composting strategies. Trench composting is one of the lowest-maintenance composting systems. It requires digging a hole or trench every time there is an addition, covering it with leaves or wood chips, and then recovering the pile with dirt and leaving it untouched for a month (“Trench Compost,” n.d.). This strategy prevents already existing compost from having to be turned over and disrupted, which will speed up the process. In static pile composting, organic waste is mixed into a large pile layered with leaves and wood chips to aerate and facilitate composting process.

Composting requires 2 sources: a carbon source and a nitrogen source, which are known as feedstock. The carbon source is known as the “brown” source and consists of dried leaves, twigs, or wood chips. The nitrogen source is known as the “green” source and consists of all organic food waste (food scraps) (Hu, 2020). For the process to work, there needs to be equal weight nitrogen and carbon source. Ideally, the feedstock will be collected once a month (every 4 weeks), but it can also be collected biweekly depending on the need based on organic waste production.

### 3.2.6 Benefits & Future Uses of Composting

Minimizing food waste is one key to a successful restaurant because it can save thousands of dollars if done correctly. Composting is one way to accomplish this. There have been studies that prove this concept. One study found that for every \$1 that is invested in food waste reduction, restaurants can benefit \$7 in savings from decreasing overhead and minimizing food waste (Waste360, 2019).

This report, “The Business Case for Reducing Food Loss and Waste: Restaurants”, was completed by Champions123, an international coalition dedicated to achieving sustainable development, in partnership with Walmart Foundation; Ministry of Agriculture, Nature, and Food Quality of the Kingdom of the Netherlands; Richard Swannell of Waste and Resources Action Programme (WRAP); and Austin Clowes and Craig Hanson of World Resources. This report includes an evaluation of financial cost and benefit data for 114 restaurants across 12 countries. The restaurants included in this study ranged in size from small cafés with annual food sales of \$400,000 to multimillion-dollar restaurants with annual sales of \$17.3 million (Waste360, 2019). Nearly every location received a positive return on investment when they invested in reducing their food and waste use. Within just one year, the restaurants had reduced food waste from their kitchens by 26% on average and more than 75% had recouped their investment (Waste360, 2019).

The monetary investments made by the restaurants were not large. Every site was able to keep its total investment below \$20,000 (Waste360, 2019). Restaurants made changes to their system to constantly measure and monitor the amount of food wasted, training staff in new food handling and storage procedures, and redesigning their menu to better fit their new plans. These increased savings that can be accessed by reducing food waste show that while the cost of change was low, the benefits were high for all businesses assessed (Waste360, 2019).

When composting is done correctly, the finished byproduct has a plethora of uses. Compost is teeming with nutrients and is most commonly used as great nutrient-boosted plant food, which will be the most observable use of compost in Piñones, through the development of an urban garden (Cowan 2019). Compost can be used to “feed” or give nutrients to fruit trees, container plants, flowers, and grass. In addition, compost can be used to grow healthier herbs and vegetables. It can also be used as mulch and the primary soil source in flower beds. (EPA, n.d. a). Byproducts of this program include water conservation, improved soil health, lessen erosion, and decreased methane emissions from landfills.

# GUÍA DE RECICLAJE

1. Busca el número 1 o 2 en los envases de plástico

2. Identifica las latas de aluminio de bebidas

3. Enjuaga los envases si están sucios

4. Depositálos en el contenedor de reciclaje



Appendix 5: Recycling Guide Display



## Appendix 6: Guide to Leaving a Clean Footprint

**GUÍA PARA DEJAR UNA HUELLA LIMPIA**  
Guide to Leaving a Clean Footprint

**TENGA EN CUENTA LOS ECOSISTEMAS Y VIDA SILVESTRE A SU ALREDEDOR.**  
Be mindful of the ecosystems, and wildlife around you.

**EVITE USAR PLÁSTICOS DE UN SOLO USO. TRAIGA UTENSILIOS Y VASOS REUSABLES.**  
Avoid using single-use plastics. Bring reusable utensils and cups.

**TRAIGA UNA BOLSA DE BASURA Y LLÉVESELA TODA DE VUELTA A CASA.**  
Bring a garbage bag and take it all back home.

**DISFRUTE DE LA PLAYA Y DÉJELA MÁS LIMPIA DE LO QUE LA ENCONTRÓ.**  
Enjoy the beach and leave it cleaner than you found it.

**LIMPIAR**

## Appendix 7: Environmentally Minded Restaurants

**¡SE AMBIENTALMENTE RESPONSABLE, COMO ESTOS RESTAURANTES!**  
**BE ENVIRONMENTALLY RESPONSIBLE, LIKE THESE RESTAURANTS!**

**LA CASA DEL INDIO**  
F248 + GJX, Cangrejo Arriba, Carolina, Puerto Rico, Loíza 00983

**NUEVO ACUARIO**  
Carretera 187, Punta Cangrejo (Piñones), 00772

**SUN CITY**  
Calle Finca Piñones, Carolina, Loíza 00772

**NANA'S PLACE**  
Carretera PR-187 frente Negocio El Farol, Piñones, 00983

**THE WATERFRONT**  
Carretera 187, O.C. Playa km.5, Loíza, 00772

**MI CASITA SEAFOOD**  
Km 5, PR-187, Carolina, 00983

The bottom of the graphic features a row of logos for the featured restaurants and the organizing organization. From left to right: La Casa del Indio (a Native American head in a circle), Sun City (a sun and palm trees), WaterFront (a blue wave), LIMPIAR (a palm tree and the word 'LIMPIAR' in large letters), Nana's Place (a chef's hat), Fresh Seafood Acuario (a fish in a circle), and Mi Casita Seafood (a crab).



## Appendix 8: Piñones Ecosystem

# Ayúdanos a Cuidar los Ecosistemas de Piñones



Help us Take Care of the Piñones Ecosystems



**Mangle Rojo**  
Red Mangrove



**Pelicano Pardo**  
Brown Pelican



**Lagartijo Crestado**  
Puerto Rican Crested Anole



**Garza Azul**  
Little Blue Heron



**Tinglar**  
Leatherback Sea Turtle



**Manatí Antillano**  
Manatee



**Juey Azul**  
Blue Crab



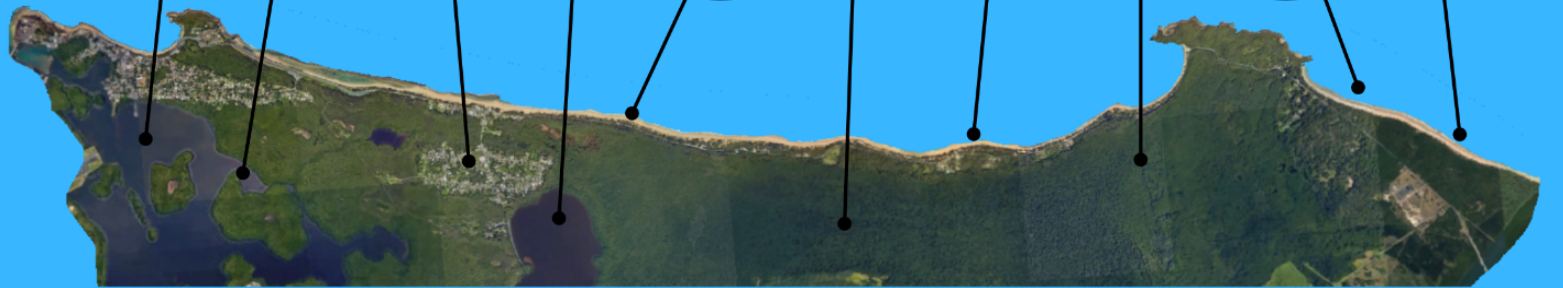
**Arrecifes de Coral**  
Coral Reefs



**Dunas de Arena**  
Sand Dunes



**Robalo**  
Common Snook



## Appendix 9: LimPiaR Work chart

2022

ENERO

AÑO DEL CALENDARIO

MES CALENDARIO

LUNES

PRIMER DIA DE LA SEMANA



LUNES	MARTES	MIÉRCOLES	JUEVES	VIERNES	SÁBADO	DOMINGO
27	28	29	30	31	01	02
03	04 RECOGIDO DE DESPERDICIOS DE RESTAURANTE VOLUMEN: _____	05	06 RECOGIDO DE DESPERDICIOS COMUNITARIA VOLUMEN: _____	07	08	09
10	11 RECOGIDO DE DESPERDICIOS DE RESTAURANTE VOLUMEN: _____	12	13 RECOGIDO DE DESPERDICIOS COMUNITARIA VOLUMEN: _____	14	15	16
17	18 RECOGIDO DE DESPERDICIOS DE RESTAURANTE VOLUMEN: _____	19	20 RECOGIDO DE DESPERDICIOS COMUNITARIA VOLUMEN: _____	21	22	23
24	25 RECOGIDO DE DESPERDICIOS DE RESTAURANTE VOLUMEN: _____	26	27 RECOGIDO DE DESPERDICIOS COMUNITARIA VOLUMEN: _____	28	29	30
31	01	02	03	04	05	06

## Appendix 10: Restaurant-Specific Work Chart (Sun City)

2021

DECIEMBRE

AÑO DEL CALENDARIO

MES CALENDARIO

LUNES

PRIMER DIA DE LA SEMANA



LUNES	MARTES	MIÉRCOLES	JUEVES	VIERNES	SÁBADO	DOMINGO
29	30	01	02	03	04	05
06	07 SUN CITY RECOGIDO DE DESPERDICIOS VOLUMEN: _____	08	09	10	11	12
13	14 SUN CITY RECOGIDO DE DESPERDICIOS VOLUMEN: _____	15	16	17	18	19
20	21 SUN CITY RECOGIDO DE DESPERDICIOS VOLUMEN: _____	22	23	24	25	26
27	28 SUN CITY RECOGIDO DE DESPERDICIOS VOLUMEN: _____	29	30	31	01	02

## Appendix 11: People Interviewed

<b>Affiliation</b>	<b>Name</b>	<b>Date</b>
LimPiaR	Auraluz Guzmán	Sep 17th, 2021
LimPiaR	Jami Claypoole	Sep 17th, 2021
LimPiaR	Nuria Escalera	Sep 17th, 2021
COPI	Maricruz Rivera Clemente	Oct 25th, 2021
Piñones Community	Shawn Halliburton	Nov 15th, 2021
IFCO	Billy Tous	Nov 5th, 2021
TAIS	Jose Miguel Pacheco Gale	Nov 1st, 2021
TAIS	Oscar Meléndez Colon	Nov 1st, 2021
Restaurant	Nana's Place	Nov 4th, 2021
Restaurant	La Casa del Indio	Nov 4th, 2021
Restaurant	Nuevo Acuario	Nov 5th, 2021
Restaurant	Sun City Rooftop	Nov 5th, 2021
Restaurant	Mi Casita Seafood	Nov 12th, 2021
Restaurant	The Waterfront	Nov 12th, 2021