Laguna Grande Bioluminescent Bay Tourist Satisfaction Project Proposal



Sponsoring Agency:

Department of Natural and Environmental Resources

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Chapter 1: Introduction

In the seventeenth century, Spaniards exploring north-eastern Puerto Rico stumbled upon a lagoon surrounded by mangrove trees near what is now Las Croabas. The glowing waters were so shocking to them that they concluded it must be the work of the devil. In an effort to end this perceived sorcery, the Spanish attempted to block the bay's access to the ocean by placing large boulders in the canal. However, this reduction in outflow from the bay actually increased the bioluminescence. The Spaniards had discovered a bioluminescent bay. While rare throughout the world, Puerto Rico is unique in that it has three active bioluminescent bays: Laguna Grande, La Parguera, and Mosquito Bay. The focus of our study, Laguna Grande, is found just outside of Las Croabas, Puerto Rico. Recently, it has grown into a popular tourist attraction [Laguna Grande, 2010].

Bio-bays are a fragile ecosystem, requiring very specific conditions in order to survive. The phosphorescence emitted from a bio-bay is due to tiny microorganisms that live in the water. Known as dinoflagellates, these tiny creatures are a species of plankton about 1/500 inches in size. Millions of dinoflagellates live in a single square meter of water. Scientists speculate that the plankton glow when they are agitated or feel threatened. As a result of their dense population, the glow they emit is highly visible. Bio-bays themselves are surrounded by mangrove swamps. These mangrove trees provide food for the plankton by releasing tannin through their roots, a chemical that is abundant in Vitamin B12 and the dinoflagellates main source of food. When the leaves fall off the trees, further nutrients are released as they decompose [Fitt et al., 2000].

A narrow channel leading from the Laguna Grande bay to the ocean controls the depth and temperature of the water [Seliger et al., 2000] within the bay. Alterations to the channel can significantly alter the lifespan and health of the plankton. If the channel is expanded it would allow too much water to enter the bay from the sea and would lower the bay's water temperature significantly, killing the plankton. Restricting the channel would likewise affect the water temperature and depth, harming the plankton. This bay, like all bio-bays, has a very low tolerance for change [Seliger et al., 2000].

Another concern for the survival of the bay is pollution from humans. Swimming in the bay has been recently banned by the local government [Dr. Lilyestrom, personal conversation, January 29, 2010,] because contaminants such as sun block or bug-spray can adversely affect the

plankton. Most tourists visit the bay in kayaks or boats, which allow people to experience the phenomena of the bioluminescence without causing excessive damage to the plankton or their habitat.

While the exploration of bio-bays is something that should be experienced by tourists, too many visitors can be harmful to the ecology. One example of a bio-bay that has lost some of its luminescence is the La Parguera Bay in south-western Puerto Rico. This bay was damaged as a result of non-regulated tourism and a general misunderstanding of the ecosystem. The channel that leads to the bay was narrow and local guides pushed for it to be widened, allowing for larger tours of the bay. However, this led to a disturbance of the ecosystem, either due to pollution or changes in water characteristics, and the bay eventually lost most of its glow [personal conversation, January 29, 2010, Dr. Lilyestrom].

The subject of our study, the Laguna Grande, is located in Las Croabas, Puerto Rico, is an example of one the most spectacular phenomena in nature. A steady flow of tourists arrive nightly to swim and kayak in the lagoon's neon blue-green glow. Several businesses surrounding the bay also cater to the tourist trade, including charter fishing companies, restaurants and resorts. Although the bay is a popular tourist destination, little is known about the tourists' experience. Basic figures such as the number of annual visitors and their overall economic value are unknown at this time.

The bio-bay itself is overseen by Puerto Rico's Department of Natural and Environmental Resources (DNER). DNER issues operating permits to kayak companies and monitors the bay's well being to ensure a healthy population of dinoflagellates. The DNER has commissioned our team to conduct a study on the tourist experience at the bio-bay. Our project will assess the impact of ecotourism on the surrounding area based on the data we collect from interviews and surveys conducted with tourists and surrounding businesses.

Chapter 2: Literature Review

Fajardo, a popular city in Puerto Rico, is located in the eastern region of the island on the coast of the Atlantic Ocean. Its local name, "La Metrópolis del Sol Naciente," is translated to "the city that guards the sun of the Caribbean" [Rivera, 2010]. Downtown Fajardo is often referred to as "Fajardo Pueblo." This small city is a center for recreational boating and is a busy boat launching port for vessels heading to Culebra, Vieques, and the American and British Virgin Islands. It is also home to Puerto del Rey, the largest Marina in the Caribbean [Rivera, 2010].

Fajardo was founded in 1760 by the Spanish governor Bravo de Rivera. Originally named Santiago de Fajardo, this port city was used by Americans to invade the island [Figueroa, 2000]. The USS Puritan was routinely sailing when the Captain of the ship noticed the Cape San Juan lighthouse, which was to be the future landing site for the U.S. Army on the island. U.S. sailors, along with some Puerto Rican volunteers, were sent ashore to raise the American flag atop the lighthouse [Figueroa, 2000]. A small, Spanish platoon noticed the Americans approaching but was ordered to stand down and take no action. The mayor of the city, Dr. Santiago Veve Calzada, recognized the small platoon had withdrawn and that his city was now defenseless against invading U.S. troops [Rivera, 2010].

The mayor assumed that the Spanish forces had abandoned his city and decided to seek protection of the city from the invading Americans. Dr. Veve Calzada befriended American Captain Frederic W. Rogers and the United States flag was raised above the city hall [Rivera, 2010]. Governor General Macias sent 200 men to recapture the city. However, when the Spanish troops arrived, the city was completely evacuated of all residents. The residents had retreated to the safety of the American protected lighthouse. The Spanish attacked at night and U.S. ships countered by bombarding the shore, forcing a Spanish retreat back to the city [Rivera, 2010]. Although the U.S. had thwarted a Spanish attack, they realized it was necessary to withdraw from the lighthouse; the only withdrawal from any position the Americans would have during the campaign in Puerto Rico [Figueroa, 2000]. As for the natives who sought refuge at the American protected lighthouse, the U.S. armed forces saw to it that all people were safely relocated to Ponce [Figueroa, 2000].

The bio-bay is one of the few bio-bays in the world and a prominent attraction near Fajardo. However, there are several other notable landmarks in this historic city. One of the more historical sites is the lighthouse previously mentioned, Las Cabezas de San Juan lighthouse. The San Juan lighthouse is one of the oldest lighthouses on the island and is the only one used for nautical purposes [Huber & Hunter, 2006]. Constructed in 1880, it is located on the northeastern part of the highest point of Cape San Juan and was officially lit on May 2, 1882 [Huber & Hunter, 2006]. Completed in 1988, Puerto del Rey Marina is the largest marina in the Caribbean, giving port to about 1,100 boats. The marina is busiest October through April, the height of the boating season [Huber & Hunter, 2006]. The aerial photo below indicates the primary landmarks in the community (see Figure 1).



Figure 1: Map of Fajardo

The Laguna Grande is located in Las Croabas, which is a district of the main city, Fajardo. Las Croabas is a quiet, picturesque town that has a population of about 1,000 people. The Laguna Grande is located away from the port of Las Cabezas and secluded on the outskirts of the town as shown above.

2.1 How the Bioluminescent Bay Works?

Dinoflagellates stem from Cilliaphora, which are 1/500 of an inch invertebrates that joined together with cryptophyte algae and became one organism. Around 20 million years ago, fossils of this species were found and currently there are 4,000 known species of dinoflagellates. However, there is speculation that there may be another 4,000 species that have yet to be discovered, increasing the total number of dinoflagellate species to about 8,000. The Latin name for the dinoflagellates is *Pyrodinium Bahamense*. Pyro, meaning "fire," describes this microorganism's ability to glow and "dino" is derived from the Latin for "whirling" to describe their swimming motion. Flagellate, or "flagella" means "legs," the dinoflagellates' main mode of swimming in the bay.

The dinoflagellates are unicellular and they are split evenly between autotrophs and heterotrophs [Dodge, 1984]. Autotrophs, or "self-feeders," are organisms that are able to make their own food, in the form of sugars, by using the energy of the sun [Autotrophs, 1998]. The types of dinoflagellates that exist in Laguna Grande are autotrophs, feeding from the sun and obtaining nutrients from the Red Mangrove trees that surround the bay. The B12 and sunlight that the dinoflagellates absorb categorize it as an autotroph.

Laguna Grande's location contributes to the sustainability of the dinoflagellates. The bay breaks up the waves from the ocean, making calm water for the plankton. Mangrove trees surrounding the bay provide a vital function to the dinoflagellates survival. As the leaves and roots of the trees decay and fall into the water, they release vitamin B12. This vitamin is one of the food sources for the plankton. The dinoflagellates move from the water's surface, where sunlight is absorbed through photosynthesis during the day, to the bottom of the bay where it absorbs the nutrients [Gasparich, 2007].

Dinoflagellates move around using tail-like structures called flagella. Flagella tend to be long structures that function much like a sharks' tail, moving left to right to propel it through the

water. The key factor for this type of movement being achievable is the existence of micro-tubes inside the flagella. When the micro-tubes are energized they cause the dyneino or "arms" to move forwards and backwards. As a result they move the anchored micro-tube doublets or "legs" allowing for only a range of motion consisting of moving up and down. The final result is a wave like pattern that moves the dinoflagellates [Shockwave, 2010]. This is shown below in Figure 2.



Images courtesy of: http://www.northland.cc.mn.us/biology/biology1111/animations/flagellum.html

Figure 2: The Flagellum of the Dinoflagellates

The release of light from the dinoflagellates is a result of having an electron excited. The excited electron jumps to a higher energy level and when it falls down to a lower energy level it emits light. There is the key difference between the bioluminescence of the dinoflagellates and the fluorescence of other creatures.

There are a number of different theories as to why the dinoflagellates emit light. One theory is emitting light when they are excited. This results from an application of force to their exterior membrane. The forces usually come from the movement of water, fish swimming through the water, the hulls of boats cutting through the water, and people swimming in the water. The light that is produced by the dinoflagellates is blue-green and its wavelength is 474-476nm [Abrahams 258]. This specific wavelength is ideal for being seen long distances through the water. Since the light is visible at long distances through the water, there is speculation that the bioluminescence is a form of communication for this species.

2.2 Ecotourism

One definition for ecotourism is the "responsible travel to natural areas that conserves the environment and improves the well-being of local people" [The International Ecotourism Society (TIES), www.ecotourism.org]. According to the International Ecotourism Society, ecotourism

involves uniting conservation, communities, and sustainable travel. In order to implement and participate in ecotourism activities the following ecotourism principles should be utilized minimize impact, build environmental and cultural awareness and respect, provide positive experiences for both visitors and hosts, provide direct financial benefits for conservation, provide financial benefits and empowerment for local people, and raise sensitivity to host countries' political, environmental, and social climate [TIES, www.ecotourism.org]. These principles are important for maintaining a natural area that does not lose its natural beauty while being explored by humans.

The Economic and Social Council (ECOSOC) serves as the central forum for discussing international economic and social issues, and for formulating policy recommendations addressed to Member States and the United Nations system [un.org, Economic and Social Council]. On July 30, 1998, the ECOSOC

"stressed that the implementation of Agenda 21 requires the full integration of sustainable development in the tourism industry in order to ensure, inter alia, that travel and tourism provide a source of income for many people; that travel and tourism contribute to the conservation, protection and restoration of the Earth's ecosystem; that international trade in travel and tourism services takes place on a sustainable basis; and that environmental protection is an integral part of tourism development" [un.org, Economic and Social Council].

Ecotourism gain global attention when ECOSOC declared 2002 as the International Year of Ecotourism. There have been many articles and journals written about ecotourism, but due to the various forms of ecotourism activities which are offered by a variety of operators, there is little consensus about the true meaning. The ECOSOC admits that there is no universal definition for ecotourism, but does mention general characteristics. The several characteristics of ecotourism from the ECOSOC are as follows:

- 1. "All nature-based forms of tourism in which the main motivation of the tourists is the observation and appreciation of nature as well as the traditional cultures prevailing in natural areas
- 2. It contains educational and interpretation features
- 3. It is generally, but not exclusively organized for small groups by specialized and small, locally owned businesses. Foreign operators of varying sizes also organize, operate and/or market ecotourism tours, generally for small groups.
- 4. It minimizes negative impacts upon the natural and socio-cultural environment
- 5. It supports the protection of natural areas by
 - generating economic benefits for host communities, organizations and authorities managing natural areas with conservation purposes,

- providing alternative employment and income opportunities for local communities,
- increasing awareness towards the conservation of natural and cultural assets, both among locals and tourists." [un.org]

A majority of the definitions of ecotourism involve the ideas within most, if not all, of the characteristics mentioned above.

Héctor Ceballos-Lascuráin is a Mexican architect, environmentalist, and ecotourism and cultural tourism expert. In the early 1980s, he coined the term ecotourism because he believed architects should be more concerned about the environment than most other professions. According to Héctor Ceballos-Lascuráin, ecotourism involves "traveling to relatively undisturbed natural areas with the specific object of studying... and enjoying the scenery... as well as existing cultural aspects found in these areas" [Héctor Ceballos-Lascuráin, www.ceballos-lascurain.com].

The Global Development Research Center (GDRC) gives the common definition of ecotourism as travel to destinations where the flora, fauna, and cultural heritage are the primary attractions [gdrc.org Definition]. The GDRC also compared several other definitions of ecotourism from the *Centre of Ecotourism, Science and the Environment, Tourism Concern,* and *Western Samoa, National Ecotourism Program.*

The Centre of Ecotourism lists several criteria on what ecotourism entails.

"It is an enlightening, participatory travel experience to environments, both natural and cultural, that ensures the sustainable use, at an appropriate level, of environmental resources and, whilst producing viable economic opportunities for the tourism industry and host communities, makes the use of these resources through conservation beneficial to all tourism role players. It is not a marketing ploy, nor is it scenic or nature-based travel. It is an approach that creates a variety of quality tourism products that are: environmentally/ecologically sustainable, economically viable, socially and psychologically acceptable. The result of which reflects: an integrated and holistic approach to product development, capacity building in host communities, a sense and uniqueness of place, commitment to the greening of the tourism industry" [gdrc.org, Center for Responsible Travel, CREST].

The National Council for Science and the Environment (NCSE) states that the trick is to preserve the natural resources while also promoting them and accommodating volumes of tourists. The NCSE also mentions how "it is important to maintain a careful balance between preservation and promotion in order to ensure the long-term health of both the eco-systems and the tourism economies" [gdrc.org, NCSE].

The most effective definition of ecotourism would involve combining the ECOSOC characteristics along with the other definitions from other respected sources: Ecotourism is a form of nature-based tourism that educates tourists with information on the surrounding environment and culture preserving and promoting the health of the ecosystem and the tourism economies.

Many ecotourism destinations are also a protected natural area. The Laguna Grande is a natural area that is protected by the DNER of Puerto Rico. The International Union for Conservation Nature and Natural Resources (IUCN) defines a protected area as "an area dedicated primarily to the protection and enjoyment of natural or cultural heritage, to maintenance of biodiversity, and/or to maintenance of ecological life-support services" [Ceballos-Lascuráin 1996; Zebich-Knos 2008]. Most people think of a protected area as a national park or reserve, but it includes other areas. An example of a protected area is Mexico's Monarch Butterfly Biosphere Reserve. While it is technically not a national park, it is an area dedicated to conservation of monarch butterflies' winter habitat [Ceballos-Lascuráin 1996; Zebich-Knos 2008]. The Laguna Grande in Las Croabas, Fajardo is protected by the Department of Natural Environmental Resources of Puerto Rico and therefore is considered a protected area.

In order for ecotourism to be successful, the tourists attending these ecological environments need to be conscientious of the environment around them. Dr. Michele Zebich-Knos, professor of political sciences and international affairs, uses the term – "responsible tourist" – to describe the preferred type of visitor for successful ecotourism. In her view, a responsible tourist is different from the average tourist, due to the fact that the responsible tourist is more interested in the local culture and resources. According to Dr. Zebich-Knos a responsible tourist would be an individual who would rent rooms in modest pensions, small, locally owned hotels to see how locals live and understand their lifestyle. They would also be sensitive to local environs and seek to learn about local conditions rather than disrupt community life. Another definition of a responsible tourist is a person who is respectful of natural and cultural environment in which they are visiting. The tourist is aware of his own influence on the local territory and contributes in an ethical manner to the local economic development [www.eveil-tourisme-responsable.org]. An example of a responsible tourist would be someone who would want to learn and visit community development projects in order to understand the lifestyle of the locals.

The Laguna Grande is considered a marine protected area containing valuable economic resources important to local and national economies [Dixon, 1993]. According to John A. Dixon, Sr. Environmental Economist, the trade-offs between protection of rich ecological resources and use of the same resources for economic gain is clearly seen in the Caribbean, where "sun and sea" tourism is an economic mainstay for a number of small countries. Puerto Rico is full of ecological resources and the three bioluminescent bays on the island are ecological treasures. The Laguna Grande gains income through the kayaking and boating industry, which needs to be regulated in order to sustain the environment. The DNER supervises the Laguna Grande and receives income through the permits, which the tourist companies need to obtain in order to operate in the bay. According to Dr. Craig Lilyestrom, the money received from these permits is based on a percentage of the income that the companies receive annually. This money is supposed to be used to improve and maintain the area (i.e. restrooms, parking, and conservation).

Ecotourism is a vital aspect to a country's economic system due to the amount of jobs it creates and foreign revenue it attracts. Therefore, government funding for the environmental issues is important in maintaining a steady economic infrastructure. In some cases, ecotourism is a secondary source of income for Caribbean countries. Ecotourism attracts international tourists, but in order to maintain tourist satisfaction, funding must be spent to sustain and improve the level of the tourist experience. In order to sustain a high-level tourist experience, the environment must be protected because that is what is attracting the tourists.

2.3 Environment and Development

There are four different scenarios that relate environment with development. According Erlet Cater (the professor of tourism studies) the four possible scenarios in which environment and development are linked are as follows: win-win, win/lose, lose/win, and lose/lose. The win-win scenario results in environmental improvement along with the enhancement of economic growth. An example of this would be decreasing the amount of gas a car consumes. This is a win-win because the car would emit less carbon dioxide and the gas costs would be less. The next scenario is a win-lose. A win-lose scenario results in an environmental improvement with a lack of development. An example of this would be the conservation of a national park. In terms of the environment this is a win because it will not be damaged, but the local population will be excluded in traditional activities that usually involve the park. A lose-win scenario has the opposite effect of a win-lose. In this scenario, the environment has a negative impact and the

while another interest is benefited. An example of this would be cutting down trees in order to build a shopping plaza. The last scenario is a lose-lose. This is where, resulting from the degradation of the very resources that attracted tourists in the first place, all interests are compromised. [Cater, 1995] An example of this would be to cut down the mangrove trees surround the bioluminescent bay so large motorboats would be able to fit. At first, the income would increase due to more people being able to view the bay. But shortly over time, the dinoflagellates would die and the bay would lose the majestic glow that initially attracted the tourists.

2.4 Sustainability and Sustainable Tourism

The concept of sustainable tourism emerged in the early 1990s from the parent concept of sustainable development, which in turn gained widespread publicity as a result of the release of the Brundtland Report in the late 1980s [World Commission on Environment and Development, 1987]. Dr. Martha Honey, Executive Director of the Center on Ecotourism and Sustainable Development, states that environmental, social and economic criteria are vital for sustainable development [ecoclub.com]. To fully understand her perspective, we will evaluate the how changes in the environment affect ecotourism.

The topic of global warming has gained particular interest in countries that benefit from ecotourism as a main contributor to the countries' economy. "Concurrent concerns about relationship between tourism and climate change as well as energy price escalations have further stimulated government, corporate, and public interest in sustainability" [Lawton, 2009]. This makes sense because as the climate changes, many of these sites will be affected and could lose tourism and income. At the same time, the increase in energy prices could steer people away from traveling and drastically cut down on tourism. Sustainability is an important aspect of government run parks and reserves. The goal is to sustain the environment as much as possible but also maximize the benefits of the environment. Dr. D.B. Weaver (Professor of Ecotourism and Sustainability incorporates an element of long-term financial viability since without this a product is unlikely to survive, and all other aspects of sustainability then become meaningless" [Weaver, 2006]. Sustainable tourism is important in protecting the morale of the locals, tourists, and companies. But most importantly, sustainable tourism is practiced to protect the site along with the tourism itself. As Dr. Zebich-Knos notes,

"Without a coordinated working relationship between community – business – government at all levels from grassroots, regional, national to international, most residents adjacent to, or in, protected areas will find it difficult to achieve the goal of deriving significant benefit from ecotourism" [Zebich-Knos, 2008].

The natural phenomena of the dinoflagellates in the water attract people to this ecotourist site at the Laguna Grande. The knowledge of ecotourism and sustainable development are significant in understanding the type of tourists that visit the Laguna Grande. Any information on the tourists' opinions or views allows for a better assessment on possible improvements to the Laguna Grande.

Chapter 3: Methodology

While the bioluminescent bay at Las Croabas is a popular tourist destination in Puerto Rico, there exists very little data about its popularity. The local government in Fajardo and the DNER have no records concerning the number of annual visitors, peak visitation times, or the economic impact of bio-bay tourism. Furthermore, government officials are unaware of tourists' satisfaction. The goal of this study is to obtain basic tourist data and to develop a sense of the tourist experience.

In order to reach this goal, our group has identified three main objectives. The first is to ascertain an estimate of the number of annual visitors to the bay and identify peak visitation periods. Obtaining an estimate of annual visitors would provide an estimate of the economic value of the bay, as well as providing a baseline load on infrastructure at the site. The second is to collect data that characterizes the tourist experience at the bio-bay, namely concerning the state of facilities and infrastructure owned and maintained by the DNER. The final objective is to present our results in a manner allowing for our sponsor to make accurate, informed decisions about tourist visitation at the bio. Such decisions would be implemented to improve the overall visitor experience to the bio-bay.

The study will be comprised of two primary phases. The first phase will consist of interviews with DNER officials and workers within the tourist industry. The interview phase will give us a broad perspective of the state of tourism at the bio bay as well as how it has changed from past years. The second phase will consist of tourist surveys distributed to visitors at the bio-bay. These surveys will give us a clear view of the tourist experience at the bay.

3.1 Interviews

To accomplish the first objective of obtaining data regarding tourism at the bay, the project team will interview the local tourism companies and kayak guides. The interviews should give a broad picture of the tourism at the bay from the perspective of the tour companies themselves. Our interviews will focus on obtaining data that tourist surveys would not provide. Such data includes estimates on the annual number of visitors to the bay as well as visitation trends throughout the year. Furthermore, the interviews seek to gain the opinions of the tourism workers. Opinions on possible improvements to the tourist experience and the current state of the infrastructure owned and maintained by the DNER are most desirable.

The type of interview that the team will employ is known as an in-depth qualitative interview [Doyle]. These interviews by nature employ flexible questioning that are altered based on the responses of the interviewee. The questions are open-ended, allowing for the subject to elaborate and give detailed answers. Interview questions can be adapted between interviews based upon information obtained from previous subjects. Since the team will interview a relatively small number of people within the tour companies themselves, and so the sample is small.

The project team will obtain interview appointments with tourist companies and guides upon arrival in San Juan. Major tourist companies will be identified through the examination of operating permits distributed by the DNER. The team intends to send both letters and emails to each of the major tourist companies operating within the bio-bay in Fajardo. The letter introduces the researchers as students and outlines the project and the value of their interviews to future of the bay. It describes the purpose of the interview, along with the confidentiality of any responses. The team will also provide contact information and will follow up the letter with an in person visit to the tour companies at the bio-bay. At this time, the team will be prepared to answer any questions about the project and interview, along with getting permission to record the interview on an audio recorder.

Since the team will be working with human subjects, care will be taken in regards to ethics. Before the interview is started, the team will obtain "informed consent" to conduct the interview with the subject [Doyle]. A short statement will be read outlining the purpose of the interview and the intended use of any data obtained in the interview. The interview subject will be reassured that the great care will be taken in order to protect their privacy. Transcripts and recordings of the interview will only be reviewed by members of the project team, and there will be no names attached to any of the transcripts or audio recordings. Subjects will be informed of their rights during the interview, which include the right to stop the interview at any time and to refuse to answer questions that may be incriminating or uncomfortable. The subject will be granted the option of reviewing a transcript of the interview upon completion.

The team will primarily target kayak guides and tour company administrators responsible for the logistics of the business such as the booking of trips. Within those two groups, participants with a higher level of experience within the industry will be sought, hopefully leading to a broader, more detailed picture of the tourist experience. The exact number of interviews to be conducted will be determined on-site in Puerto Rico after successful contact with the tourism companies.

A tentative interview design will be employed, with flexibility based on the subjects' responses. Interviews will be divided into three stages [Doyle]. The first stage consists of background questions, designed to determine their experience at the bio-bay. In addition, the first set of questions will seek information on the history and progression of tourism at the bay from their perspective. The second stage features questions on the present state of tourism at the bay. Questions in the second stage will focus on the subjects' experiences and observations. The final stage seeks to collect the subjects' own conclusions and opinions regarding tourism at the bay based on their experiences and perspective as tourism workers. In this stage of the interview, we will request the opinions of the subjects' regarding any possible improvements or changes that they think should be made. The subjects will be informed of the interview's structure before questioning begins, and will be informed of its direction during questioning. A complete script of questions for each interview will be prepared on site according to the three phase format.

The actual interview of the subject will utilize two members of the project team. One member will assume the role of questioner while the other will be responsible for the audio recording, or for taking notes if the subject opts not to have the interview recorded. During the interview, only the team member conducting the interview will speak. Only two members of the project team will be take part in the interview so as not to overwhelm the subject. The roles of questioner and recorder will be rotated among the team members for each separate interview.

Once the interviews with the tourism companies are finished, results will be analyzed. All interviews will be recorded in order to preserve a verbatim record. However, if a subject declines

to have the interview recorded, detailed notes will be taken instead. Recordings or notes will subsequently be reviewed by the project team to reduce the volume of data the team will analyze. Each interview will be summarized and stored along with an audio recording.

3.2 Surveys

The team will use the Face-to-Face method because it is most effective when surveying a population with no master list compiled. "This 'needs assessment survey' is used to solicit public opinion about community problems and possible solutions" [Punch 2003]. This survey style will also permit the team to collect information from those people who would not likely respond to mailed surveys or surveys conducted over the phone [Punch 2003]. Also, Face-to-Face allows for a higher complexity of questions. This method will be most effective because the interviewer can clarify questions for the interviewees and watch the respondents' reactions to the questions. Thus, close-ended questions with ordered choices provide the best tool for meeting the project's objectives. The survey sample audience consists of tourists returning from the bay.

For this process to be successful, several precautionary steps were taken. First, the team designed their survey in such a way as to limit the error in the results. In order to do this, the team was specific about what information they actually need from the interviewees. Accurate and understandable questions are a must in order to collect a result base with limited error. The team went through an in depth process to compile a comprehensive and suitable survey to achieve the objectives.

The first step the team took in designing their survey was to specify the research questions that will be addressed:

- How many tourists visit the bio bay per evening, maximum and on average? Approximately how many per year?
- How many companies are involved in the activities?
- Can a rough estimate of the annual economic value of the Laguna Grande bio-bay tourist industry be produced?

The team's goal was to design the survey in such a way as to address these objectives, but at the same time, keep in mind that it is crucial to make the respondent's task as easy as possible. In

other words, the team had to minimize the reason for not responding [Converse, 1986]. Working to the team's advantage is being able to conduct Face-to-Face surveys.

There are several advantages to conducting Face-to-Face surveys in comparison to surveys done over the telephone or by mail. The most beneficial aspect of Face-to-Face Surveys is that response rates are usually higher due to the fact that it can be more difficult to refuse someone Face-to-Face [Converse, 1985]. This method of survey also allows the team to have more control of the response situation as well as implementing more complex questions. When encountering respondents in person, it allows the team to clear up any questions or concerns the respondents may have while completing the survey.

Closed-ended questions state the question as directly as possible and the answer options are provided for the responder. Opposed to closed-ended questions, there are open-ended questions which allow for responders to give a variety of answers. Open-ended questions can provide for a more difficult data collection and analysis process because respondents are allowed to answer in their own words, leaving it up to the team to interpret the meaning of the responders' answers [*Designing Surveys*, 2004]. Closed-ended questions are more specific and are more apt to communicate the same frame of reference to all respondents [Converse, 1986] allowing for an easier coding system to analyze the data.

Coding is the assignment of numbers or conceptual names to the responses given to survey questions. Data coding will allow the team to estimate characteristics or to look for patterns among the collected responses [*Designing Surveys*, 2004]. The following is an example of coding:

- If the team had 824 responses, each person's response would be assigned a number between 001-824.
- Each answer to the closed-ended questions is assigned a number as well. If the team had three questions with answers A, B, and C, A would be assigned 1, B assigned 2, and C assigned 3.
- If response 001 answered A to question one, C to question two, and B to question 3, the respondent's code would become 001132.

This system will allow the team to better monitor the results of completed surveys to ensure no questions are being missed and that directions are being followed [*Designing Surveys*, 2004]. Using the coding system, the team will enter the collected information into a computer data file, an Excel Spreadsheet.

The team will use closed-ended questions, and so the task of organizing the questions is a priority. It may not be possible to include every question of interest, and each question needs to be justified and pretested [*Designing Surveys*, 2004]. It is good practice to cluster the demographic questions either at the end or beginning of the survey. *Designing Surveys* suggested placing the demographic questions at the end of the survey to deflect any thoughts that the demographic questions are not relevant to the topic. For example, if a survey is being conducted on crime rate and the first questions was "What is your highest level of education?" the responder may wonder what relevance his or her education has on his or her opinion of the crime rate [*Designing Surveys*, 2004]. After reading this example, the team decided their demographic questions would be better suited at the beginning to appease an unwritten rule of survey design, beginning with easy-to-answer questions. The demographic questions the team is implementing for tourist surveys are shown in Figure 3 and a sample survey is included in the Appendix.

1) Wh	at is your gender?
	□ Male □ Female
2) Wh	at is your age group?
	□ 13-19 □ 20-29 □ 30-39 □ 40-49 □ 50-59 □ 60+
3) Wh	at is your country of residence?

Figure 3: Demographic Questions

Beginning with easier questions to answer keeps the responder from immediately turning away. Although, some may find difficult questions intriguing, others may find harder questions too difficult and give up on the survey [*Designing Surveys*, 2004]. The team's sample base will be a majority of tourists who will possibly be on their vacation when the team asks him or her to answer a survey. The easier and more straightforward the survey questions are, the better possibility the team will receive significant feedback.

3.2.1 Case Study

Numerous research projects have involved ecotourism and utilized surveys in their research. One such project was completed in 2008 and addressed the effects of non-natural noise on the visitor park experience in Puerto Rico. The students working on this project administered several surveys at various public parks around Puerto Rico in order to gauge the effects of artificial noise, such as aircraft and automobiles, on the visitors' experience in the park [Blauvelt et al., 2008]. Their survey techniques were successful, yielding a total of 197 completed surveys from four different parks over a seven week period.

The team's success in administering their survey had rested greatly on its design. The survey was pre-tested, allowing for any potential problems with its design to be detected and fixed before the survey was distributed [Blauvelt et al., 2008]. Moreover, the survey was based upon questionnaires already in use by the National Park Service. The survey itself consisted of ten questions and had a length of five pages. The students asked background information such as gender, date of birth, whether the person was a native of Puerto Rico or a tourist, and if this had been their first visit to the park [Blauvelt et al., 2008]. After the preliminary questions, the survey presented questions regarding the tourists' experience and their awareness of noise while they were there. These questions were presented as closed ended questions, with possible answers consisting of a number one through five. This allowed for uniform responses in the surveys and an easier tabulation of results.

The survey's implementation strategies also aided in yielding a high number of completed surveys. To ensure that there would be no language problems, surveys were made in both English and Spanish and were distributed by bi-lingual students [Blauvelt et al., 2008]. This also ensured an ease in communication if study participants had any questions about the survey. The project team used a method known as the "convenience method," where they approached every visitor available to complete their survey, concentrating on adults [Blauvelt et al., 2008]. The team believed that targeting adults would yield a high number of completed surveys, since it was perceived that younger people would be more hesitant to answer survey questions.

Lastly, the project team's strategic approach in the survey's distribution contributed to a high yield. Survey distribution points were placed at the exits both to the park and to major trails

within the park. Project team members consulted park employees on the times when visitor volume was the heaviest in order to plan their surveying days accordingly [Blauvelt et al., 2008]. The project team spent approximately a week at each site distributing surveys. Participants in the survey were read a preamble in either English or Spanish, taken from Harris Miller & Hanson Inc. The preamble assured anonymity, voluntary participation and stated the purpose of the survey [Blauvelt et al., 2008]. In addition to being read to participants, a copy was provided at the start of the questionnaire.

While the project team was able to yield a high number of complete surveys, they did encounter problems along the way. Park visitation was considerably lower than they had anticipated. This caused them to adopt an aggressive distribution strategy [Blauvelt et al., 2008]. Also, the initial goal of the project was to have one hundred completed surveys per park. However, due to lower than expected park visitation rates, the team lowered their goal to thirty completed surveys per park, which they were able to meet.

3.3 Strategy

We will conduct a site analysis prior to any surveys being conducted with the tourists. Our first step will be to visit the bio-bay and take some initial observations. Some of these observations will include simple tasks such as counting how many tourists arrive at the bio-bay in one night and where tour buses are dropping off and picking up the tourists. After accomplishing this, the team will have a better idea of their strategy to approach the tourists, how to collect survey responses, as well as the frequency of how often the team will need to go to the bio-bay to survey tourists.

Our sponsor has provided us with an outline of questions that should be answered by our survey process. The list is quite extensive, and it would be unreasonable to place all provided questions on a single survey because a survey that is too long would yield a lower completion rate than a ten question survey. Therefore, the team will be using multiple surveys. Each survey will contain the same demographic questions but the remainder of the survey will vary depending on the version. Different versions will enable the team to incorporate all of the sponsor's provided questions into the study. The distribution of these surveys will be for a specified time period to be determined onsite. The total circulation time of a particular survey

version will depend on its completion rate. If the team finds that a particular survey is not returning a sufficient completion rate, then the team will reevaluate the survey's distribution.

The team's initial plan is to conduct the tourist surveys after they have experienced the bio-bay. This approach will be taken because it seems to be the most effective way to achieve the objectives previously stated. The team will approach the tourists prior to them getting back onto the tourist bus which brought them to the bay. This way the team will not be interrupting the tourists' experience at the bio-bay. This point in time seems like the most appropriate to conduct our surveys because it will be a point where the tourists are most inactive and will have free time to answer the surveys and will not be distracted by other attractions such as preparing to kayak in the bio-bay.

The team has a rough estimate of a timeline for accomplishing certain tasks. However, a more detailed timeline will be constructed when the team arrives in Puerto Rico after initial observations are taken as previously discussed. Our time line to date is represented in Figure 4.

Task	Prior To	Week						
	Arrival	1	2	3	4	5	6	7
PQP								
Initial								
Observations								
Company								
Interviews								
Tourist Surveys								
Data Analysis								
Final Proposal								
Final								
Presentation								

Figure 4: Project Timeline

3.4 Summary

The team will be conducting Face-to-Face interviews with tourists companies surrounding the bio-bay area as well as conducting Face-to-Face surveys with tourists visiting the bio-bay. By using these two methods, the team will be able to present data to the DNER about the state of tourism at the bio-bay, including not only the overall satisfaction of the

tourists' experience at the bay, but also the satisfaction of the tour companies. The team's recommendations to the DNER will provide for a thorough explanation of whether or not tourist companies feel government funds are being properly distributed to maintain the local infrastructure.

Chapter 4: Conclusion

Laguna Grande is a magnificent natural occurrence and tourism has grown significantly in this area. The specific type of tourism is known as ecotourism. Ecotourism is, in short, tourism associated with some form of natural landmark, such as a park or in this case a bay. Our goal is to survey the tourists and tourist companies at the bay to see if there is any way that we could improve the overall tourist experience.

In order to achieve a successful survey collection database, we have decided on a Faceto-Face strategy. This would allow us to get the most accurate and in-depth results. We will interview the tourists via a written survey. There will be multiple versions of the written survey, each with a different set of questions, apart from the general demographic question. In this way, each individual tourist would not have to answer more than ten questions, which would in-turn give us a higher response rate. The tourist companies will be interviewed in a verbal context, rather than the written type distributed to the tourists. This is because the tourist companies will have a greater insight into the industry and we will be able to get more overall information from them.

The data that we obtain will be entered into a spreadsheet, compiled, and the results will be calculated. Upon having all of our data calculated we will present our findings to the DNER. With the information that we will have provided them, they will be able to take appropriate actions to the bio-bay and increase overall tourist satisfaction.

In conclusion, based on the data collected from interviews with tourists and surrounding businesses, this project will help determine how to give the visiting tourists a more enjoyable experience at the Laguna Grande bio bay.

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Appendix



Laguna Grande Bioluminescent Bay Tourist Satisfaction

Please take a moment to help us improve your experience at the Laguna Grande Bio-Bay. When you're done, please return the questionnaire to us. The confidentiality statement is shown at bottom of page. Thank you!

General Questions

1) What is your gender? Male Female 2) What is your age group?

3) What is your country of residence? ____

Site Specific Questions

1) How did you learn of the bay? 🗆 Website 🔲 Article (News/Magazine) 🗋 Friend 🔲 Travel Agency Other, please specify: _

2) Did you arrive with a 🗌 tourist company or 🗌 private transportation? If you selected 'tourist company' please specify which one _

3) Do you feel that the signage is adequate to make your way to the launch point? \Box Yes \Box No

4) Did you receive sufficient training before kayaking?
Yes
No

5) Did you find the kayak tour was too physically challenging? \Box Yes \Box No

6) Is this your 🗌 first visit or 🗋 repeat visit to the bay? If this is your repeat visit, which number is this?___

7) How would you rate your overall experience? Please rate from 1 to 5, '1' being not satisfied at all, and '5' being extremely satisfied. 2 3 4

8) Do you have additional concerns that you would like to mention? \Box Yes, please elaborate below \Box No

Thank you

Confidentiality Statement: The data that is collected through this survey will be kept private to the extent allowed by law. Data will be kept under a code number and all individual firm and facility information will be kept in a secured, limited access location. Results will only be presented in an aggregated form. Respondent identities will not be revealed in any publication or presentation of the results of this survey. There are no foreseeable risks by participating in this study.

Participation in the survey is voluntary. Respondents do not have to pay to participate nor will they be paid.

If you have any questions about your rights in participating in this research study, you may contact Worcester Polytechnic Institute (pr-bio@wpi.edu)