ARTICLE

Reducing the Impact of Plastic Pollution in a Rural Coastal Area: Focus on the Hospitality Industry & Tourism of the Central Nicoya Peninsula, Costa Rica

Andrew McGovern[1] Madeleine Beange[2] Eliecer Vargas[3]

[1]International Sustainable Tourism, University of North Texas & Centro Agronómico Tropical de Investigación y Enseñanza (CATIE), 30501, Turrialba, Costa Rica, amcgover@gmail.com
[2]Turtle-Trax, San Francisco de Coyote, Nandayure, Costa Rica
[3]Escuela de Posgrado, División de Educación (DE), CATIE

Plastic pollution has become a major plague upon the world's oceans and coasts (Fauziah & Nurul, 2015; Jambeck *et al*., 2015), affecting the marine species all throughout the food chain (Vegter *et al*., 2014), possibly even impacting human health (Rochman *et al*., 2013), and the tourist economy (Balance, Ryan, & Turpie, 2000). In the Central Nicoya peninsula of Costa Rica, a local sea turtle research voluntourism operator Turtle-Trax S.A. and the marine conservation organization CREMA (Center for the Rescue of Endangered Marine Animals) believe that plastic pollution in the area is a serious and growing problem. The staff noted that many of the hospitality businesses (restaurants and mini markets - minisupers) in the area are using single-use plastic products (i.e. drinking straws, plastic bags, take-away containers, etc.). There may be an especially acute problem in the San Francisco Coyote area in part because there may be poor waste management, with the Turtle-Trax staff noting that garbage is traditionally burned, buried, or dumped in the river; a common problem in rural Costa Rica which has been researched in other communities (Meletis, 2007).

The remote, rural central Nicoya Peninsula, specifically the small district of Bejuco (population ~3,313)(INEC, 2011) in the Guanacaste province of Costa Rica is an important habitat for several marine turtle species including the endangered Green Sea Turtle (*Chelonia mydas*), the critically endangered Hawksbill (*Eretmochelys imbricata*), Leatherback (*Dermochelys coriacea*) turtles, and the vulnerable Olive Ridley (*Lepidochelys olivacea*) (Beange, Clift, & Arauz, 2015), as well as several other animal species. The area contains several designated protected areas, including two marine protected areas, the Camoronal MPA and the

Caletas-Arío MPA. The potential for negative impacts from plastic pollution is high in this area; with marine turtles being highly susceptible to danger (Vegter *et al*., 2014), especially the Olive Ridley turtles which nest in great numbers in the area. The fact that the local beaches are important nesting sites for marine turtles adds another dimension of risk from plastic pollution as the plastic altered thermal properties of the sediment can affect the turtle population's sex ratio (Carson *et al*., 2011) and lead to difficulty laying eggs in the first place (Plot & Georges, 2010). Plastic pollution in the area could do harm to the economy, which includes traditional sun and surf tourism, "turtle tourism" (Meletis, 2007), as well as cause potential human health and economic impacts from the contamination of local seafood (Vegter *et al*., 2014). The area is a popular beach destination for Costa Rican nationals who may be driven away by the prevalence of plastic pollution on the beaches (Ballance *et al*., 2000). Previous research in the study area has indicated that the prevailing ocean currents pull micro-plastic pollution away from the area while concentrating macro-pollution on the beach leading to an unsightly problem (Roos Lundström & Mårtensson, 2015). The grave risk to the area from this pollution necessitates investigation into the "problem products", sources of pollution, and incentives to use these "problem products" in the area (Cummings, 1992).

However, identifying the problem is only the first step in any process to change environmental behavior (Stern, 2000). The issue of improving the environmental friendliness of the local businesses may be difficult because the area is very rural, and characterized by small businesses which "generally … do not have the resources to provide a detailed description of their environmental situation and the relevant flows into the environment" (Laner & Rechberger, 2009). Past studies regarding the reduction of plastic in the hospitality industry have been completed but were undertaken in developed countries (Su *et al*., 2015). Thus, we must understand the decisions to use these products from the context of the small business owner in rural Costa Rica, not from the perspective of the ecologist or marine biologist (Stern, 2000). Plastic pollution in the Coyote area is a critical problem which needs further study.

Literature Review

Impacts of plastic pollution

With plastic pollution becoming an increasingly recognized problem worldwide, its impacts are becoming clearer (Vegter *et al*., 2014). Plastic, although it has only existed for about 100 years (Derraik, 2002), is one of the most pervasive and persistent impacts that humanity has inflicted on our planet; its ubiquity is a function of its low cost of manufacturing and its incredible durability (Vegter *et al*., 2014; Su *et al*., 2015). However, this low cost is a function of the ignored externality this plastic imposes upon the rest of society, the true costs are rarely ever accounted for; especially in the developing world (Gupta & Somanathan, 2011). About half of all plastic is used for single use items like packaging, drinking straws, disposable kitchenware, bags, etc. which are used

and disposed of (Hopewell, Dvorak, & Kosior, 2009). In 2010 there was up to 12,700,000 tons of plastic entering the ocean (with the amount only increasing over time) (Jambeck *et al*., 2015), mostly from land based sources (~80%), and a high percentage of that plastic being single-use plastic items (Slavin, Grage, & Campbell, 2012; IEEP, 2016; Ocean Conservancy, 2016). These single use items "create the foundation of the marine debris problem" (Sheavly & Register, 2007). Much of the past research has focused solely on plastic bag use and pollution (Weinstein, 2009; Gupta & Somanathan, 2011), leading to bans and taxes in nations, states, and municipalities around the world (including a law under review in the Costa Rican Legislature) (IEEP, 2016). However, this focus on plastic bags has left a gap in our knowledge and action on many other single use plastic items which are considered "high risk" due to their disposable nature (Vegter *et al*., 2014). This has been singled out in several studies as one of the first changes that need to be made with regards to plastic use (Cummings, 1992; Su *et al*., 2015).

Plastic pollution is a threat to marine wildlife with risks of ingestion, entanglement, and even habitat level changes (Rochman *et* al., 2013; Vegter *et al*., 2014; Ocean Conservancy, 2016). Sea turtles are especially vulnerable to plastic pollution (Vegter *et al*., 2014); they suffer from entanglement and ingestion, with estimates of more than half of all individual turtles having ingested plastic (Ocean Conservancy, 2016). The plastic can cause internal injuries, increase buoyancy, occlude the digestive tract of the turtles, and give a false sense of fullness leading to starvation, among other issues (Nelms *et al*., 2014; Eagle, Hayman, & Low, 2016). The ingestion of plastic can even lead to difficulty reproducing, as sea turtles, like many animals have a cloaca which is used for waste expulsion and reproduction; the occlusion of the cloaca has been witnessed in turtles trying to nest (Plot & Georges, 2010). Another possibly greater risk in the long run for turtle populations of all species is the fact that plastic debris in the sand of turtle nesting beaches can change the thermal properties of the nests such that the sex ratio of the hatchlings is skewed in favor of males (Carson, Colbert, Kaylor, & McDermid, 2011). This is a serious issue for turtle populations worldwide. Other risks to turtle reproduction from plastic pollution on nesting beaches includes the risks of nesting females becoming discouraged by plastic on the beach and not nesting, nesting females becoming entangled on the beach, hatchlings not being able to dig out of litter filled nests, and the litter slowing down the hatchlings journey to the sea and making them more vulnerable to predators (Nelms *et al*., 2014). Time consuming beach cleaning can help to reduce these risks but the only long term solution is prevention of the plastic pollution in the first place (Carson *et al*., 2011).

Another, perhaps more insidious problem becoming associated with plastic pollution is its ability to infiltrate the marine food chain (Rochman *et al*., 2013; Fauziah & Nurul, 2015). When plastics in the ocean are acted upon by mechanical and photochemical processes they simply break into smaller and smaller pieces, eventually becoming microscopic

(Reissier, Shaw, Wilcox, Hardesty, Proietti, Thums, & Pattiaratchi, 2013; Vegter *et al*., 2014). Most plastics contain ingredients known to be hazardous to humans and other life (Reissier *et al*., 2013; Vegter *et al*., 2014), even more troubling there is increasing evidence that these plastic particles attract and adsorb hazardous chemical pollutants from the ocean (Reissier *et al*., 2013; Vegter *et al*., 2014). These microscopic particles are then ingested by plankton and small fish, which are then eaten by larger marine life increasing the risk of bio-magnification of the hazardous chemicals in the plastic and the adsorbed pollutants on the plastic (Reissier *et al*., 2013; Vegter *et al*., 2014; Fauziah & Nurul, 2015). This is a major concern for those people who depend on seafood as a major source of protein in their diets as there is evidence that the chemicals in the plastic as well as the adsorbed pollutants can be damaging to human health (Rochman *et al*., 2013; Reissier *et al*., 2013; Fauziah & Nurul, 2015). The cryptic nature of the marine world relative to terrestrial environmental issues means that the general public may be less aware of the current level of damage, summed up well by Ray (1988): *"The last fallen mahogany would lie perceptibly on the landscape, and the last black rhino would be obvious in its loneliness, but a marine species may disappear beneath the waves unobserved and the sea would seem to roll on the same as always".*

Hospitality industry and plastic pollution

The hospitality industry is a major source of the single use plastics (straws, lids, take-away packaging, food packaging, etc.) which often escape the waste stream and contribute to the problem of plastic pollution (Cummings, 1992; Meletis, 2007; Sheavly & Register, 2007), with one survey of street litter finding 68% was food and beverage related (Scott, 2011). There are concerns about the potential for improving the industry's record on the issue of solid waste management, primarily the cost associated with substitute products/behaviors (Pirani & Arafat, 2014; Su *et al*., 2015). However, the industry is also affected by this waste, Williams and Ponsford (2009) note that a pristine natural environment will increasingly give a destination a competitive advantage in the future, providing an incentive to better manage waste. The level of pollution on a beach is a major part of the decision making process that people go through when choosing a beach to visit (Slavin *et al*. 2012). This is a serious problem for those destinations with a high reliance on beach tourism (McIlgorm, Campbell, & Rule, 2008), with some studies showing the potential loss of up to 52% of tourism revenue due to lower levels of beach cleanliness (Ballance, Ryan, & Turpie, 2000). The risk of contamination of seafood products is also a very real risk for restaurants serving seafood to their customers (Rochman *et al*., 2013). This should be another reason for restaurants near the coast to stop polluting, because they are adding to the contamination of the locally caught seafood they serve (Rochman *et al*., 2013; Reissier *et al*., 2013; Fauziah & Nurul, 2015). Another concern for the hospitality and tourism industry is the fact that plastic pollution is a common cause of engine breakdowns in small boats, with costly repairs possibly driving

up the costs for seafood and marine tourism (Sheavly & Register, 2007). Also, a major economic concern for the industry is the potential loss of turtle tourism in a rural community (Meletis & Harrison, 2010).

There are several reasons why a business would want to reduce its use of plastic. Plastic, being primarily manufactured from petroleum products is subject to price volatility as oil prices swing decreasing the certainty of businesses' budget (UNEP, 2014). There needs to be strong consideration to economics in any plan to reduce the environmental impact of plastic pollution, Ray and Grassle (1991) note that 'no effort to conserve biological diversity is realistic outside the economics and public policies that drive the modern world''. In fact, past studies of plastic use in hospitality businesses have shown that one of the primary concerns when attempting to reduce the use of plastic is the higher costs associated with this change (Su *et al*., 2015). This corresponds with the idea that people make environmental decisions based in large part on the context of those decisions (cost, ease of implementation, etc.), with their attitudes and beliefs having smaller and smaller influence as contextual forces grow (Stern, 2000; Kollmuss & Agyeman, 2002). Any program that ignores this context and only takes values/attitudes into account is doomed to fail.

However, this singular focus on cost by businesses is not by rule, Andrews (1998) notes that businesses can and occasionally do adopt environmental practices that drive up costs. Sometimes businesses, like individuals, will continue a practice or the use of a product simply out of habit and a lack of knowledge of another way (Andrews, 1998; Stern, 2000; Kollmuss & Agyeman, 2002). Michaelis (2003) notes that even small firms have the ability to make important contributions to the social and cultural change which is required to achieve sustainable consumption, something which is important to note since tourism industry is dominated by small and middle enterprises (SMEs) (Williams & Ponsford, 2009). SMEs also have great potential to contribute to environmental degradation (Laner & Rechberger, 2009), especially in the remote and fragile areas where "ecotourism" is popular. Often these SMEs do not understand the environmental impact that their business operations are creating and do not have the resources (financial, education, time) to accurately measure these impacts (Laner & Rechberger, 2009). However, these small businesses by their nature (not beholden to outside investors) can better act their conscience rather than the pure profit motive that large corporations are often beholden to (Andrews, 2000). With regards to business it is clear that profit motive is important, but may not be the only factor in the use of plastic products.

Behavior and cultural element of plastic pollution

Stern's (2000) coherent theory of environmentally significant behavior offers a framework to build upon when attempting to make behavior changes. With several causal variables: attitudinal, based on an individual's values and beliefs; personal capabilities, based on the ability of the individual to change, including financial and educational

resources; contextual factors of the cost/benefits of change, social norms, laws, support, etc.; and habit and routine (Stern, 2000). These variables impact the different types of environmentally significant behaviors: environmental activism, willingness to publicly fight for environmental change; private-sphere environmentalism, purchasing behaviors, changes in lifestyle, waste disposal behaviors, etc.; and other, encompassing changes in organizational behavior (Stern, 2000). To persuade individuals/businesses to change their behavior one must understand the behavior from their perspective and the context the behaviors are part of, and set realistic goals for change (Stern, 2000). It is important to set realistic goals, use participatory decision making, and not overstep the bounds of intervention the actors are comfortable with to increase buy in from the participants (Stern, 2000). Constant monitoring and adjustment are an essential part of any program (Stern, 2000).

Even when new technology or ideas are introduced which have the potential to reduce pollution there is an important need to change behaviors and the cultural element of plastic pollution (Sheavly & Register, 2007). Stern's (2000) theory of environmentally significant behavior proposes that people's behavior is influenced by both their attitudes and their context. Social and cultural norms have a great impact on the way people interact with litter, people are more likely to littler if there is already litter present because it signals that a place is unclean and that littering is the norm (Gupta & Somanathan, 2011; Slavin *et al*., 2012). This may indicate that cultural and educational programs can have a large impact on the level of pollution in a community by helping people to understand the externalities of plastic use (Gupta & Somanathan, 2011).

Vegter et al. (2014) identified the need to better understand the psychological reasons behind plastic use. Behavior is related both to attitudes and to context, to try to affect change in behavior the whole picture of the target must be understood (Stern, 2000). Past studies have found that a lack of environmental awareness in developing countries about plastic pollution and its impacts may be a major limitation in the adoption of more environmentally friendly behavior (Gupta & Somanathan, 2011). Educational programs have also shown to be effective at a low cost compared to technological or legal interventions, making them especially useful in for smaller organizations and poorer areas (Gupta & Somanathan, 2011). There is evidence that women are more concerned with litter than men, possibly highlighting a need to better educate men on the issue (Gupta & Somanathan, 2011; Slavin *et al*., 2012). Past studies have found people's levels of active littering to be low (although this could be different across cultures) (Slavin *et al*., 2012) which would seem to indicate that much of the litter has escaped the waste stream accidentally and thus reduction of potential litter via prevention is likely to be more important than other actions like recycling or reuse.

The technique of "demarketing" is to use marketing strategies to reduce the demand for a product or reduce a behavior (Eagle *et al*., 2016). People's attitudes are most strongly tied to their

natural experiences as children (Kollmuss & Agyeman, 2002), something that should be taken into account in any study and which may benefit those who are working on small local problems in a community. Past studies have found that much of the plastic pollution on shorelines is from local sources, much of it deposited directly on the beach (Thiel, Hinojosa, Miranda, Pantoja, Rivadeneira, & Vasquez, 2013), meaning that local campaigns have to chance to be effective in alleviating the problem of plastic pollution. However, it must be remembered that more education about the issue to a single individual may do nothing to change their environmental behavior if the context of that behavior remains unchanged (Stern, 2000; Kollmuss & Agyeman, 2002), and thus a multipronged approach must be made to affect lasting change.

Gaps in research

There are several gaps in our knowledge about plastic pollution, and yet understanding what we can do to prevent the creation of plastic pollution is critically important (Vegter *et al*., 2014). No waste stream can be perfectly contained, trash will always escape, especially in developing areas (Ocean Conservancy, 2015), and thus the less plastic produced and used, the less potential for pollution (Jambeck *et al*., 2015). Cleaning up plastic pollution is difficult, time consuming, and expensive, and so it is far more efficient to prevent the creation of waste than to try to deal with the pollution (Carson *et al*., 2011; Vegter *et al*., 2014).

Several studies have confirmed the primacy of waste minimization as a recommendation for the hospitality industry (Cummings, 1992; Su *et al*., 2015). This is why the reduction, reuse, recycling and recovery strategy (4Rs) of managing plastic waste has become standard, meaning the desired actions are in descending order reduce, reuse, recycle, and recover (energy) (Hopewell *et al*., 2009). Unfortunately, the options of recovery and recycling, especially on a community level, require a dedicated and complex waste management system (Cummings, 1992; Meletis, 2007), and in Latin American it is estimated that 32% of all plastic waste is not collected (UNEP, 2014). Waste management deficiencies in developing countries are some of the main causes of plastic pollution worldwide (Ocean Conservancy, 2015). It is often buried or burned, leading to the easy escape of plastic waste and the creation of hazardous emissions (Cummings, 1992).

To reduce the use of plastic, we must understand why single use plastics are so prevalent and where along the disposal chain the plastic is entering the environment to allow for a more targeted approach to mitigate the problem (Vegter *et al*., 2014). Many studies of plastic use focus on the incentives to reduce consumer use of plastics (Weinstein, 2009; Sharp, Hoj, & Wheeler, 2010), but the realization that prevention of plastic from entering the market is critical, shows that investigation of the supplier side of the relationship is needed because of the greater potential reductions it can achieve (Su *et al*., 2015). High levels of plastic use are often assumed to be due to its low cost and durability (Vegter *et al*., 2014). However, other causes for its use cannot be discounted such as ingrained cultural

practices, lack of education, limited access to alternatives in remote areas, etc. (Slavin *et al*., 2012; Vegter *et al*., 2014). The reasons behind human behavior are often complex (Stern, 2000) and there is little existing research on these incentives and the underlying psychology behind the decisions to use these products, with researchers pointing to it as an area of need in research (Vegter *et al*., 2014). One of the key areas that experts on the issue have identified for study is the investigation of the problem in developing countries and small rural communities, and how to build their capacity to reduce and deal with plastic waste (Vegter *et al*., 2014). An important priority for research is understanding how these communities can be convinced to use alternative products and/or change their behavior (Vegter *et al*., 2014).

Research Objectives

Plastic pollution is a worldwide recognized problem (Jambeck *et al*., 2015) with specific implications for the central Nicoya Peninsula due to its rural nature and importance as marine turtle habitat (Meletis, 2007; Carson, *et al*., 2011; Vegter *et al*., 2014). The staff of the scientific research tourism organization Turtle-Trax has identified plastic use in the local hospitality industry as a concern for the region, something that aligns with past research on plastic pollution (Ocean Conservancy, 2016). Past reviews (Laner & Rechberger, 2009; Vegter *et al*., 2014) of the issue of plastic pollution and small business environmental management point to several areas of needed study which this proposed research will help to achieve. Adding the resources of multiple academic research institutions (UNT and CATIE) and those of a local NGO (CREMA/Turtle-Trax) to work with the local small businesses on a full investigation to better understand the potential sources of plastic pollution in the region, the "problem products". The incentives behind their use will allow for Turtle-Trax to implement a program to reduce the problem in the region and ideally serve as a template for similar communities. Based on the literature review about plastic pollution and its impacts and the information provided by the Turtle-Trax staff the researcher decided upon several questions to be investigated in this study:

- Does the Coyote area have a problem with the prevalence of single-use plastic products in the hospitality industry and why?
- Is the current waste management regime sufficient to handle the waste being produced?
- What can be done to reduce the impact of plastic pollution in the Coyote area of the Nicoya Peninsula?

This study conducted research pertaining, to and created recommendations to reduce the impact of single-use plastic pollution in the San Francisco de Coyote area. Working in conjunction with Turtle-Trax S.A. our contribution is to help reduce the plastic pollution entering the ecologically important waters off the coast of the central Nicoya Peninsula.

Methodology

Area of Study

The study area is the area around the community of San Francisco de

Coyote on the Nicoya Peninsula in Costa Rica. The area is in the Bejuco District of the Canton of Nandayure in Guanacaste Province. The area is very rural and isolated, the whole Bejuco district has only ~3300 residents (INEC, 2011). The study looked at the hospitality businesses in the Coyote area, including those in San Francisco, Playa Coyote, and nearby Costa de Oro/Javilla/San Miguel. This area was chosen because Turtle-Trax is headquartered in San Francisco de Coyote, the study was limited to this small geographic area due to limited time and resources. The field portion of the study was conducted over several days/weeks long visits to the area from January – April 2017.

Methods and procedures

The methodology is based in part on Stern's (2000) Coherent Theory of Environmentally Significant Behavior, as well as other past research. With so much of the plastic waste pollution found on beaches being of the type that originates in the hospitality industry (Ocean Conservancy, 2016,) and the industry being such an important part of the Costa Rican economy (WTTC, 2015), especially in the coastal zones most vulnerable to plastic pollution (Jambeck *et al*., 2015), the researchers decided to focus on the local hospitality industry. With our target behavior identified, the researcher must analyze the behavior to understand the actors and actions associated with the behavior (Stern, 2000). This was accomplished by compiling an inventory of the hospitality businesses in the area in question to get a full understanding of the source of the potential problem. An additional benefit in a small rural community like this, is that the limited amount of businesses in the area means that the proprietors of these few businesses likely come in contact with a large proportion of the population. This gives them potentially powerful insight into the consumptive practices of the community; this creates an opportunity for a study done with limited time and resources. With an inventory of the local businesses complete, further investigation took place via structured in-person interviews with the business owners/managers; past studies of solid waste pollution in Costa Rica have used this less technical approach (as opposed to more technical methods like waste audits) to capture the cultural dimension of pollution (Meletis, 2007). The next step was to investigate what single –use plastic products (straws, cutlery, small bags, take-away containers, etc.) are being used in the local businesses, as these have consistently been identified as "problem products" seriously contributing to plastic pollution in the literature (Cummings, 1992; WIDNR, 2008; UNEP, 2014; Vegter, 2014; PSI, 2015a; 2015b; Ocean Conservancy, 2016; PPC, 2016).

Although it may seem like a simple issue, we must understand the behavior from the perspective of the actors (Stern, 2000). Therefore, the next step was to interview the proprietors of these establishments to understand why they are using these single use plastic products, what are the barriers to change (Eagle *et al*., 2016)? The interview questions were based on past research about plastic/resource use in businesses and environmental behavior. Is it because economic incentives? Lack of knowledge about, or access to, alternative products?

Are they considering the negative externalities created by their use of these products (Gupta & Somanathan, 2011); do they understand the impacts the pollution can have (Vegter, *et al.*, 2014), including damage to the tourism industry (Balance, Ryan, & Turbie, 2000)? Is there a lack of education about their impact? What are the owners' general opinions about plastic pollution? This give a better idea of what incentives may be able to convince these businesses to enact a change in behavior. Will community pressure to reduce plastic use be enough to overcome economic incentives to continue using it? Based on what the Turtle-Trax staff reported about waste management in the area, and past research about pollution issues in rural Costa Rica (Meletis, 2007) the interviews will include questions about the current waste management regime, one of the key components in reducing the impact of plastic on the environment (Ocean Conservancy, 2015). This will give a more complete picture of the potential problems regarding plastic pollution in the area.

Based on the interviews about the problem products, the current waste management issues, and the business incentives for change a final report was compiled about what is likely to be causing the problem of plastic pollution in the area. This information will be used to research the best (realistic) solutions for reducing the impact of single-use plastic products (economics, access to products, education, etc.) (WIDNR, 2008; UNEP, 2014; Vegter, 2014; PSI, 2015a; 2015b; Ocean Conservancy, 2016; PPC, 2016) or their impacts. These recommendations take into account the rural, developing nature of the community and the businesses limited access to finances, education, alternative products, etc. (Stern, 2000; Kollmuss & Agyeman, 2002). These recommendations focused on how Turtle-Trax and the community can to try to implement a program to make concrete progress on reducing the amount of plastic used in the San Francisco de Coyote Area.

Findings

In total 12 businesses (11 owners/managers) were surveyed in San Francisco de Coyote, Playa Coyote, and Costa de Oro/Javilla (a small beach community north of Playa Coyote) to assess their use of single-use plastic products and their opinions and understanding regarding the impact of plastic on the area. The businesses consisted of 2 mini-supermarkets (one with a drink counter), 1 bar, 4 bar/restaurants, 1 café, 1 hotel bar/restaurant, and 3 restaurants. Eleven of the businesses were owned by 10 people, the hotel restaurant manager was interviewed. Of these 11 owner/managers 6 were from the local area, 3 were from Europe but now live in the area, and 2 were from another region of Costa Rica but live in the area. The owners of the businesses were generally from their mid forties to their mid fifties, with the youngest owner being 37, and the oldest 61. The businesses vary in time open/under current management from 4 months to approximately 30 years.

Common Plastic Products and why they are used:

All of the businesses use some single-use plastic products, and although

Figure 1: Common single-use plastic items used by owners/managers interviewed

Common Single-Use Plastic Items
Drinking Straws
Cutlery Service Bags
Take-Away Containers
Plastic Bags
Plastic Drink Bottles
Single Serving Condiment Packets

Figure 2: Top reasons for single-use plastic use given by owners/managers

Top Reasons for Single-Use Plastic vs Alternative
Customer Desire
Convenience
Availability
Habit
Cost
Hygiene

the exact ones vary, there are several commonly used items across the surveyed businesses and many reasons for their use. The most common items were plastic drinking straws, Styrofoam take-away containers, cutlery bags, condiment packets, plastic drink bottles, and plastic bags. With regards to these items the businesses had many reasons for using each. The owners were also asked about the price and quantity of these products. Most of the businesses noted that the demand was very unreliable other than the fact that tourism season was the busiest time of the year. The most common products used by the businesses are listed in Figure 1, with the most common reasons for use in Figure 2.

One of the products the researcher and Turtle-Trax had hoped to reduce the use of was plastic drinking straws, used by every surveyed business but one of the minisuper markets. When asked, why are straws so prevalent? The answer was nearly universal, "the customers want them". The restaurant owners all noted that the customers, especially the Costa Rican ones, often wanted a straw with each drink, although one owner told the researcher that foreigners often do not want a straw.

The restaurants in Coyote and in many places in Costa Rica often serve the cutlery to the customer in a small plastic bag, this is another item that the Turtle-Trax staff noted as a problem product (in that it seemingly serves little purpose and is very quickly disposed of). Nearly all of the restaurants surveyed use these small plastic bags. When asked why, many responded that it had to do with regulations from Costa Rica's ministry of health, which they said required the cutlery to be either wrapped in paper (like a napkin) or in a plastic bag when given to the customer. Several of the restaurants noted that when it is busy, it is easier and faster to use the bags. Others professed to using the bags out of custom.

Plastic bags were another very common item, being used by both mini-supers and several of the restaurants for

takeaway food. The reasoning was similar to the straws, in that at the mini-supers the owners claim that the customers want the plastic bags. Staff at Turtle-Trax noted that people use these plastic bags for other things around their homes, possibly indicating why they want them so badly. The owners of the minisupers said that the people just want more and more bags, and they can't stop people; with one owner reporting that some customers come in up to eight times a day and want a new plastic bag for each small item they purchase.

Take-away containers for food were common among the restaurants, with only two not offering them. The containers were generally polystyrene foam; with the owners telling the researcher that there is no other option available for take-away containers in the area.

Other items common to the businesses were plastic drink bottles at all of the businesses used because of availability; as well as the single serving condiment packets used by many of the restaurants, which one owner reported as believed to be more hygienic that large bottles, although more expensive.

Investigation of Alternative Products/Behaviors:

The use of plastic products in Coyote was generally understood to be a problem by the business owners, but the level of investigation of alternative products or behaviors was quite low. The main reasons given to the researcher for lack use/investigation of alternative products/behaviors were lack of availability, expense, or just not thinking about it. In other cases, the owners have tried alternative products/behaviors with varying levels of success. However, all business owners reported that if there were an alternative product for a similar price, they would be willing to try using the alternative.

Several of the businesses had investigated and even tried different alternatives to plastic drinking straws, more than any other item. Some had investigated the possibility of bamboo straws, but one owner believed they violated the health code; and one local man manufactures bamboo straws, however they are far more expensive than plastic straws and the man was not thought reliable by many of the owners. One business has used paper straws in the past but found they did not work well in the climate, although another business is switching to paper straws soon. Another business recently ordered stainless steel reusable straws and believes that their use of them may inspire others to switch products to keep up. Finally, one owner noted (in conjunction with the main reason for using the straws) that the business could stop using straws altogether, but the customers want them so they will not.

The small cutlery service bag was an item where some businesses were using an alternative product/behavior by wrapping the cutlery in a napkin, which the owners said was the preferred method. However, some of the restaurants only used the napkin technique over the plastic bag when they had time to do the wrapping. Other restaurants served the cutlery in napkins at all times. None of the owners mentioned investigating a bag made of other materials.

In the case of the take-away containers for the restaurants there was some investigation of alternatives. One owner found take-away containers made of paper products, however they are only available in a small size, making them useful for sending home leftovers but not large enough for a full meal ordered to go. Other businesses told the researcher that they give to-go food in a reusable Tupperware container and collect a deposit which is given to the customer upon the return of the container; with another only selling take away food to those customers who bring their own reusable container. An owner noted that she would like to charge more for takeaway but the customers would not like it. Pizza boxes are available in cardboard in the area.

The minisupers both talked about the possibility of alternatives to plastic bags. Both offer cardboard boxes to their customers to carry their groceries home, but that they are not wanted by the customers. One owner once purchased 15 reusable bags and gave them to members of the community, but only 2 of them ever used them, the rest returned and wanted plastic bags. Paper bags are more expensive, but the customers don't want the paper bags anyway, they like the plastic bags. Both owners brought up a law that is currently in review in the Costa Rican legislature which would force them to charge for the plastic bags, they both want the law to pass so they can then charge their customers and have an excuse. When asked if they would consider charging their customers without the law and one owner quickly responded "no", because their customers would think they are cheap.

Many of the businesses do use glass bottles for some soft drinks, but they are not available for all drinks; one owner was able to reduce plastic bottle use to just water, which he was not able to find in another type of container.

***Amount of Products in Use and Cost*:**

The business owners in general did not have a precise understanding of how much of these products they were using, with several noting that the demand in the area is very unpredictable and varies greatly. The minisupers both noted that they give out several kilograms a week in plastic bags ("a lot"). The restaurants noted using hundreds of straws a week. However, most of the businesses did not appear to have a detailed accounting of their product inventory and use. However, all agreed that the busiest time was from December to Holy Week, with the weeks of Christmas and Holy Week being the busiest times due to increased tourism.

Plastic products are simply cheaper that the alternatives on a per unit basis, this was acknowledged by several of the owners. However, the costs add up, with both of the Minisupers noting that they spend a great deal on the plastic bags that they then give away for free. These costs also ignore the externalities imposed on society by this plastic; health impacts from burning and consumption, increased volume of trash, environmental impacts (to marine life). The apparent lack of detailed accounting in the business may also be obscuring the long-term continuous costs of these single-use products relative to reusable alternatives. Several owners denied that cost was a

major factor in plastic use, stating that availability was a more pressing issue.

Waste Disposal Methods and Waste Management in the Area:

A major issue in the area is the poor quality of waste management. There is highly irregular waste collection provided by the municipality of Nandayure, with the business owners giving responses varying from once every two weeks, to once a month, to occasionally months without pickup. One of the business owners reported bringing their trash to nearby Jicaral or Nicoya to dispose of it because the pickup in Coyote was so unreliable. Many of the businesses noted that they separated their garbage and recycled some of it, cans, glass, plastic bottles; most responded that they sent their recycling to the nearby town of Corozalito, upon further investigation there is not a recycling center at Corozalito, however when meeting with the head of the nearby Punta Islita's waste management plant the researcher was informed that the recycler is in the nearby town of Las Parcelas. The businesses report that a truck comes perhaps once a month (inconsistently) to collect the recyclables. Although when asked about the capacity for plastic bottle recycling one of the owners reported; "No, nothing, you burn it or just throw it on the ground, but nothing else.", indicating that some in the community do not recycle. Almost all of the businesses noted that in the community most trash (including their own) is burned, either because it is unrecyclable (anything with food residue) and/or because it would simply pile up too much in between pickups; a common response regarding the burning of trash from several interviewees was "there is no other option". The burning is evident throughout the area with small piles of ash (and incompletely burned trash) abundant in the area.

Others will simply leave their trash in piles in town or at the bus stations. One of the biggest complaints from the business owners was of the large trash pile at the entrance to the Costa de Oro beach. The owner of a restaurant in Costa de Oro noted that the people staying in houses in the area will simply leave all of their trash in a pile which due to irregular collection will be torn apart and dispersed by animals. Some in the community will simply throw their trash into the rivers on the side of the road. The owners of one business in Coyote central noted that people will leave trash in front of the store, assuming that they will deal with it or that the municipality will come and collect it but they do not. At the beach in Playa Coyote there is an area for collection of trash but written on the side it reads "trash from houses prohibited". Some business owners, as well as other residents interviewed in nearby Corozalito, noted that while at some of the beaches there are separate bins for different types of trash, the municipal truck will dump them into the same bin together, discouraging them from separating their trash.

Based on the interviews with business owners and personal observation of the waste collection and pollution the area, the researcher met with the officials at the municipality. Douglas Arauz, the official at the municipality in charge of trash collection told the researcher that the municipality understands that the collection needs to be more regular but a

lack of resources has been a problem. The municipality currently has an order out to buy a new truck for trash collection, which will enable them to have once a week pickup throughout the municipality. They hope to have this new truck within the next month or two (Summer 2017). However, one of the problems the municipality faces is that the truck has a limited capacity and must turn around when full; this is an issue because according to a waste analysis the municipality performed in the town of Carmona the waste is composed of 64% organic waste which is filling the truck and limiting their ability to collect everyone's trash. He also has submitted a proposal to purchase large trash receptacles for the beach areas, these bins would have separate areas from general trash, cans, glass, plastic, and paper and a filtration system for the liquid residue. This is similar to what residents of the area have reported they were told by the mayor of the municipality; that there would be more regular collection in the next few months, but they are highly skeptical.

In the general area there is one town that has a proper waste management regime; the town of Islita, home to the luxury resort Hotel Punta Islita, has a privately funded waste management plant. The hotel has trash collection centers at the beach, in the town, and throughout the hotel property for the disposal and separation of trash. The hotel then collects the waste and brings it to a small management plant for processing. The organic waste is composted in several steps (including vermiculture) for use on the hotel grounds. The other waste is separated and plastic, aluminum, other cans, tetrabrik, and glass are all cleaned and dried. Scrap metal and used oil are also collected and stored. Contaminated plastic and paper and other non recyclable goods are burned in their multilevel incinerator oven as opposed to the open burning in the rest of the area. The separated trash is collected by a scrap recycler from Nicoya who pays for the aluminum, scrap metal, and used oil, but takes the rest of the trash for free. This is the best example of waste management in the area.

Awareness level in the area?

With past research indicating that in rural areas and developing countries a lack of understanding and awareness about plastic pollution and its impacts could be a major impediment to reducing its impacts (Gupta & Somanathan, 2011), the interviewed owners were asked about the level of awareness in the area and if they believed an educational program would be beneficial. There was a general consensus that some people realized that waste management was a problem in the area but that a more complex understanding of the issue was lacking, and the area could benefit from an educational program. One restaurant owner believed that the reason there is not a greater groundswell of complaints about the issue is the small population in the area. One noted that it is good for outsiders who may have seen places with even worse trash problems to warn the locals (who have not seen how bad it can get) about what can happen if steps to change are not taken. Some of the owners noted that the people in the area were not educated about waste management and the impacts that pollution has on the

environment; this impacts their consumption patterns according to the owners of the mini-supers leading to the locals desiring to use plastic bags as opposed to alternatives. Several owners noted that there needs to be a complete educational campaign reaching the whole community, "*everyone*", and the tourists to raise awareness and hopefully concern about the issue in the area. They note that the mentality needs to change "little by little", with one owner noting the need to educate the community on the benefits of reusable products. One owner noted a sense of apathy in the area, the people will not show up when meetings are called, something that could make an educational program hard to implement.

A common theme among the owners' responses to questions about awareness/need for education in the community was the potential benefits to focusing on the children in the community. Several owners noted that focusing on the children could create a cultural shift by educating them about plastic pollution before they develop the bad habits prevalent in the area. The owner of Pizza Tree noted that in Europe you learn about these environmental issues when you are young and it sticks with you into adulthood, telling a story of a Dutch man who recently came to the beach with a backpack and cleaned all of the plastic he found; but that many in the area had no respect for their environment and would simply throw trash on the ground. However, according to Turtle-Trax staff, partnerships with the school are difficult due to high teacher/administrative turnover.

Could Tourism Be Negatively Impacted?

With past research indicating that pollution in an area (specifically beaches) can suffer loss in tourism and revenues from increased pollution (Ballance, Ryan, & Turpie, 2000) it was important to see if the local business owners (whom are admittedly busiest during tourism high season) understand the potential loss of tourists due to worsening plastic pollution. Tourism is very important to the region, with the business owners all indicating that their busiest time of the year is during the tourist high season. With one owner noting that the town lives on tourism, it is the most sustainable source of good jobs. The business owners generally agreed that the tourism could be negatively impacted by plastic pollution. With several noting that of course tourists would be repelled by the trash. One minisuper owner reported that some tourists come and see the beach and turn around. The owner of one restaurant noted that there may be tourists who see trash on the beaches may say how dirty the people who live here are and leave. The manager of one restaurant did not really think tourism would be negatively impacted but that the pollution can leave a bad impression. The owner of another restaurant noted that the area was once in a guidebook noting that the beaches in the area were dirty, and that when tourists would see the pile of garbage at Costa de Oro they would turn around. The owner of one minisuper relayed a story of talking to a tourist who had been at the beach two years earlier and was now complaining that it was much dirtier than it had been the last time he was there and is now very ugly. The owner of one beachfront restaurant said its obvious that if you won't go somewhere if you know

its polluted and you won't go there if others tell you its polluted. Another owner said "yes of course, noted that there were mountains of trash, Tourists would stop and ask where to go, he would tell them that Playa Coyote is beautiful, but he knew that they would see all the trash. It was very bad. Ugly for the view and nature, lots of it in the sea, bags, diapers."

Emergent Themes:

The initial focus of this study was on the local businesses as they were assumed to be an important source of plastic products in the area. However, an emergent theme brought up by many of the business owners is the contribution of tourists (including those who are part time residents) to the waste problem in the area. This began in my first interview and continued to be brought up in nearly every interview. The area receives a large amount of tourists, especially during the season from December through Holy Week, according to the business owners and other locals the tourists are often Costa Rican nationals (especially during Christmas week and Holy Week). Tourists bring in even more trash and do not always properly dispose of it. The owners in the center of town complain that these tourists will bring their trash and leave it at the bus stop or in front of the businesses. Some mention that these tourists, being from other areas with better waste management (like San Jose or other central valley locations) may not understand how poor the waste management capacity is in the area: other owners say that the tourists just don't care. The tourists "don't understand their impact" on the area since they leave and do not see the aftermath. However, some of the business owners brought up the fact that the foreign tourists are generally more aware of the plastic pollution and environmental issues in general. The owner of one restaurant also noted that the foreign visitors are generally better educated about this issue, but that the Costa Rican tourists are causing more of a problem.

Discussion

This investigation confirmed what the staff of Turtle-Trax was concerned about, there is indeed a plastic pollution problem in the Coyote area of the Nicoya peninsula, due to several factors. Single-use plastics, the most dangerous plastics in terms of their potential for pollution (Sheavly & Register, 2007), were used by all 12 of the hospitality businesses in the area. The waste management in the area is inadequate to handle the volume and type of trash being produced in the area, creating massive potential for plastic to escape the waste stream.

Single-Use Plastics:

The high levels of single-use plastics being used in the San Francisco de Coyote area is a serious concern as these items have been prioritized in the literature for their high percentage of in previous studies of pollution. Changing the behavior in a long term sustainable manner requires understanding why the behavior is being performed in the first place, from the point of view of the actor (in this case the business owners) (Stern, 2000). This is a more complex issue than it

may have been assumed to be, with different business owners using different products for different reason, one approach will not be sufficient to change all of the behaviors; the proposed changes must be realistic and conform to the values held by the business owners (Stern, 2000). One example of an intervention which has already begun based on this research is the implementation of an awareness campaign to reduce the use of plastic drinking straws in the local restaurants. Based on the literature (PSI, 2015) the drinking straw is one of the main targets for any intervention in the Coyote area due to its ephemeral use and lack of necessity. The business owners believed they needed to provide the straws because their "customers wanted them", they do not want to disappoint their customers and potentially harm their business. Working from this context, the researcher created a small sign for the tables at all of the restaurants asking customers to say no to plastic straws. This fits in the context of the business values (Stern, 200), they are providing the straws to satisfy the customer, if the customer does not want the straw, then they are satisfying them by not providing one. The signs also feature a turtle and the Turtle-Trax, CREMA, and MIST logos; using the appeal of the charismatic mega-fauna has been effective in the past (Kollmuss & Agyeman, 2002) and informing the public as a credible source has been shown to be effective (Manning, 2003). The signs also feature the names and locations of all of the participating restaurants, making them a free promotional item for the businesses as well as the Turtle-Trax, CREMA, and the MIST program. The signs are aimed at straws specifically but they may also help to get the customer's to be more conscientious about their use of plastic in other aspects of their lives (PSI, 2015), possibly leading to more widespread impacts.

Interventions on the other single-use items should follow this same model of considering the reasons the businesses are choosing to use these specific products and tailoring a solution around those, whether it is increasing the availability of alternatives for take-away containers, or finding an alternative to the cutlery bag which is just as convenient but less wasteful. With plastic bags it may require an educational component to reduce demand from the community. Alternative products and/or behaviors suggested to the businesses need to conform to their needs and values or they will not change their behaviors in a meaningful, lasting way (Stern, 2000). As noted in the literature, plastic products are inexpensive to buy, but these prices do not incorporate the many negative externalities that these products inflict on the environment and society (Gupta & Somanathan, 2011). More education to the business owners about the true cost of these products (including the full dangers from dioxins and other contaminants released when burning and the potential negative impact on the local fisheries (Ocean Conservancy, 2015) may help influence their decision making when weighing incentives and disincentives for use. This ties into the need for a program to raise awareness and understanding of plastic pollution in the area. Past studies (Laner & Rechberger, 2009) have shown what this research discovered about the businesses in the Coyote area, that they do not have the numbers and accounting

to truly understand their impacts. Aiding these businesses in keeping track of their product use and costs could help to convince them of the long term benefits of switching from single-use plastics to alternative products/behaviors.

Both minisuper owners brought up their desire to see a law passed which would give them an excuse to not give plastic bags away for free, and while this will likely help it is unclear when this law may get passed if ever. In addition, past research has shown that in developing countries and especially rural areas there is a lack of enforcement for more state driven initiatives to reduce the impact of plastic waste which often hampers their effectiveness, meaning that other types of decentralized and non-mandatory initiatives may be more effective (Gupta & Somanathan, 2011). This means that bans on products may not be effective in places like the Coyote area, and convincing the businesses to reduce their use voluntarily would likely be more effective. However, this would depend on the businesses believing that these changes would not hurt their reputation amongst their customers and therefore their business.

Waste Management:

The study area is rural with very poor waste collection. Without exception those interviewed by the researcher believed that the municipality should be doing more to deal with the waste from the community and the municipality agreed. The limited resources available to the local authorities are typical of rural areas in developing countries (Vegter *et al*., 2014; Ocean Conservancy, 2015). The proximity of the study area to the ocean makes the open dumping of trash an even greater concern, with past studies of similar issues in developing countries coastal areas showing very high rates (up to 90%) of waste entering waterways (Ocean Conservancy, 2015). If the municipality follows through on their pledge to begin weekly collection for the entire area this could have a major impact on the pollution in the area. Since many people claim that they need to burn or dump their trash due to the long wait in between collections, thus more regular collection could help to alter the behavior of the residents.

While many of the businesses report sending their plastic, cardboard, and cans with a recycler, this service appears to be inconsistent and only collecting some of the products. The nearby Hotel Punta Islita has a deal with the recycler they deal with to take even the products that are not profitable when collecting those which are, thus ensuring that all of their waste is brought to an area where it can be better processed. Another great example of waste management in Costa Rica visited by the researcher is the community run plant in Tortuguero, Costa Rica, with it being an important tourist destination (with far more visitors than Coyote), remote and disconnected from its municipality, and an important turtle nesting beach this is a good example for the Coyote area. The Tortuguero plant is mostly community supported, with some aid from the municipality, however the plant generates money from its processing of trash into raw materials (plastic pellets, compost, glass shards/sand, etc.) and selling those materials. This turns the community's waste into an economic benefit by selling

what they normally dispose of and creating jobs for locals. It may be beneficial for the local municipality to investigate the possibility of setting up a system like that of the plant in Tortuguero, as it has some similar characteristics to the study area.

Other potentially high impact interventions which could be made in the area are minor infrastructure improvements, possibly building an incinerator for the area where people can more completely burn their garbage, preventing the plastic escaping from incomplete combustion. A physical container to keep dogs and vultures from the trash could help to prevent it from being torn apart in between collections, something the municipality is supposedly working on, but something that Turtle-Trax can try to keep pressure about (NOAA & UNEP, 2011).

Local Awareness and Education:

With all respondents believing that an education program for the community regarding plastic pollution and waste management would be beneficial it should be one of the main areas of focus in any program to deal with the issue. This is in line with past studies regarding plastic pollution in developing countries (Gupta & Somanathan, 2011). However, based on the information from the municipality's waste audit (showing that 65% of trash was organic) there needs to be general information about waste management (composting, separation, recycling, etc.). An educational program in the community would appear to be well received based on the interviews in this study, and could be a low cost and high reward investment (Gupta & Somanathan, 2011). However, as noted before it can be difficult to get a program like this off the ground in this community specifically, due to apathy and the lack of stability at the local school. Thus, Turtle-Trax will need to find a way to attract the attention of the community and find a way to make their outreach to the youth of the community more stable in the long run.

Modern social media and technology with their global reach and now near complete saturation of the population, will be increasingly important in bringing about cultural change (Eagle, Hamann, & Low, 2016). Past research has suggested using "demarketing" techniques, aimed at reducing consumer demand for a certain product or behavior, in this case single-use plastics; a powerful tool in this fight is the video, from a nearby researcher in Costa Rica of a plastic drinking straw being removed from sea turtle's nostril (Eagle *et al*., 2016). The use of charismatic mega-fauna like sea turtles has been shown to be more effective than campaigns focusing on more intangible issues, giving Turtle-Trax a potential advantage in any future campaign (Kollmuss & Agyeman, 2002). A possible strategy in Costa Rica would be the large marine conservation organizations and tourism operators creating a media campaign in the time before the two big domestic tourism weeks (Christmas and Easter) to inform the public more about their impacts on the beach and marine environment before they go on their vacation and hopefully alter their behavior. While a large traditional media campaign would be expensive, a campaign on social media to target Costa Ricans before their vacations,

using charismatic mega-fauna (sea turtles) and appealing to their targets' childhood connections to the beach may be impactful nationwide (Kollmuss & Agyeman, 2002).

Tourist Contribution to Pollution:

As noted in the findings, one issue which almost all of the business owners raised was the contribution of tourists to the trash problem in the area. This was backed up by the observations of the researcher during the tourist high season. This is an issue previously observed in rural tourist destinations in Costa Rica (Meletis, 2007). This is clearly an issue that these members of the community are concerned about, it is possible that some of the attention being brought to this issue is deflection of responsibility from the community's role in the waste problem in the area. The response about the tourists leaving the trash was generally more that the tourists did not understand the poor waste collection in the area and did not realize the impact they were having. This is something that seems plausible based the researcher's direct observation, the tourists were bagging their trash and piling it in areas for collection (which rarely or never occurred), suggesting that they were attempting to deal with it properly but did not understand the reality of waste collection in the area.

Trash piling up from the tourists is a potentially very serious issue because these tourists are camping/renting hoses right on the beach meaning the trash does not have to travel far to enter the ocean. This is an issue that Turtle-Trax/CREMA can work on by educating the tourists about their impacts and promoting a carry-in carry-out ethic regarding plastic and other waste. Past research has shown that educating tourists can be effective at getting them to change their behavior, especially "when applied to problem behaviors that are characterized by careless, unskilled, or uninformed actions." (Manning, 2003). Multiple source of information targeted at the tourists' values (different from the educational campaign for residents) are more effective than a single source, and in person interpretative programming is highly effective (Manning, 2003). A campaign where Turtle-Trax/CREMA staff and volunteers visited the beaches during the tourist high season (especially the two main weeks) and informed to the tourists about the poor waste collection and their impacts, they may have a significant impact. Research also suggests that delivering the information early (even during the planning stages of a trip) is another effective strategy (Manning, 2003). One tactic discussed with some of the business owners was to provide a letter to those who rent houses and cabinas to send to their guests before their trip warning them about the poor waste management and asking them to either bring less plastic or to carry-out what they bring. Past research has shown that campaigns built around tangible impacts and charismatic mega-fauna like sea turtles has been shown to be more effective than campaigns focusing on more intangible issues (Kollmuss & Agyeman, 2002, Manning, 2003). Research has also shown that information from sources which are seen as highly credible are more likely to be effective (Manning, 2003), Turtle-Trax has a great opportunity to use both of these

advantages in their pollution reduction campaign.

Final Thought

While this study began with the seemingly simple idea to reduce the impact of plastic pollution by focusing on the single-use plastics in the hospitality industry, it soon became clear that plastic pollution in the area was a complex issue. This involves issues from the supply of the plastic products to the customer demand, and the poor waste management requiring complex systems thinking to create any sustainable solution. A simple solution targeted at one part of the system will likely not solve the problem, but a multipronged approach may have success. The issue of plastic pollution in the area includes components in supply chain management, consumer behavior, environmental justice in tourism, technological and management deficiencies in waste management, and education and awareness deficiencies. It will require a long term multipronged effort from Turtle-Trax, CREMA, the local municipality, and the residents. But it is a problem which can be solved as long as the actors trying to affect change understand the complexity of the system and do not look for simple solutions to fix the whole problem but work in conjunction with other efforts to target other parts of the system.

References

Andrews, R. N. (1998). Environmental regulation and business 'self-regulation'. *Policy Sciences*, *31*(3), 177-197.

Ballance, A., Ryan, P. G., & Turpie, J. K. (2000). How much is a clean beach worth? The impact of litter on beach users in the Cape Peninsula, South Africa. *South African Journal of Science*, *96*(5), 210-230.

Beange, M., Clift, A., Arauz, R. (2015). PRETOMA 2015 Report: Southern Nicoya Peninsula Sea Turtle Nesting Beach Conservation Projects. Retrieved from http://turtle-trax.com/wp-content/uploads/2013/12/PRETOMA-Report-2015-Final.pdf

Carson, H. S., Colbert, S. L., Kaylor, M. J., & McDermid, K. J. (2011). Small plastic debris
changes water movement and heat transfer through beach sediments. *Marine Pollution Bulletin*, *62*(8), 1708-1713.

Cummings, L. E. (1992). Hospitality solid waste minimization: A global frame. *International Journal of Hospitality Management*, *11*(3), 255-267.

Derraik, J. G. (2002). The pollution of the marine environment by plastic debris: a review. *Marine Pollution Bulletin*, *44*(9), 842-852.

Eagle, L., Hamann, M., & Low, D. R. (2016). The role of social marketing, marine turtles and sustainable tourism in reducing plastic pollution. *Marine Pollution Bulletin*, *107*(1), 324-332.

Fauziah, S. H. & Nurul, A. A. I. (2015). Plastic Debris Pollution on Recreational Beaches: A Malaysian case study. *Applied Mechanics and Materials*. *768*. 804-809.

Gupta, K., & Somanathan, R. (2011). *Consumer responses to incentives to reduce plastic bag use: Evidence from a field experiment in urban India*. South Asian

Network for Development and Environmental Economics.

Hopewell, J., Dvorak, R., & Kosior, E. (2009). Plastics recycling: challenges and opportunities. *Philosophical Transactions of the Royal Society. 364*. 2115-2126.

Institute for European Environmental Policy (aka. IEEP). (2016). Single Use Plastics. Retrieved from http://www.ieep. eu/assets/2128/IEEP_ ACES_Product_ Fiche_Single_Use_ Plastics_Final_October_2016.pdf

Instituto Nacional de Estadistica y Censos (INEC). (2011). 2011-2025. Protecciones nacionales. Indicadores demográficos proyectados por años calendario. Retrieved from http://www.inec.go.cr/poblacion/estimaciones-y-proyecciones-de-poblacion

Jambeck, J. R., Geyer, R., Wilcox, C., Siegler, T. R., Perryman, M., Andrady, A., ... & Law, K. L. (2015). Plastic waste inputs from land into the ocean. *Science*, *347*(6223), 768-771.

Kollmuss, A., & Agyeman, J. (2002). Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior?. *Environmental Education Research*, *8*(3), 239-260.

Laner, D., & Rechberger, H. (2009). Quantitative evaluation of waste prevention on the level of small and medium sized enterprises (SMEs). *Waste Management*, *29*(2), 606-613.

Manning, R. (2003). Emerging principles for using information/education in wilderness management. International Journal of Wilderness, 9(1), 20-27.

McIlgorm, A., Campbell, H. F., & Rule, M. J. (2008). Understanding the economic benefits and costs of controlling marine debris in the APEC region (MRC 02/2007). *A report to the Asia-Pacific Economic Cooperation Marine Resource Conservation Working Group by the National Marine Science Centre (University of New England and Southern Cross University), Coffs Harbour, NSW, Australia, December*.

Michaelis, L. (2003). The role of business in sustainable consumption. *Journal of Cleaner Production*, *11*(8), 915-921.

Meletis, Z. A. (2007). *Wasted visits? Ecotourism in theory vs. practice, at Tortuguero, Costa Rica*. ProQuest.

Meletis, Z. A., & Harrison, E. C. (2010). Tourists and turtles: Searching for a balance in Tortuguero, Costa Rica. *Conservation and Society*, *8*(1), 26.

Nelms, S. E., Duncan, E. M., Broderick, A. C., Galloway, T. S., Godfrey, M. H., Hamann, M., ... & Godley, B. J. (2015). Plastic and marine turtles: a review and call for research. *ICES Journal of Marine Science: Journal du Conseil*, fsv165.

Ocean Conservancy. (2015). Stemming the Tide: Land-based strategies for a plastic-free ocean. Retrieved from http://www.oceanconservancy.org/our-work/marine-debris/stop-plastic-trash-2015.html

Ocean Conservancy. (2016). 30th Anniversary Coastal Cleanup: Annual Report. Retrieved from http://www.oceanconservancy.org/our-work/international-coastal-cleanup/2016-ocean-trash-index.html

Pirani, S. I., & Arafat, H. A. (2014). Solid waste management in the hospitality industry: A review. *Journal of Environmental Management*, *146*, 320-336.

Plastic Pollution Coalition (aka. PPC). (2016). Guide for Plastic Free Eateries.

Retrieved from http://www.plasticpollutioncoalition.org/plastic-free-eateries

Plot, V., & Georges, J. Y. (2010). Plastic debris in a nesting Leatherback Turtle in French Guiana. *Chelonian Conservation and Biology*, *9*(2), 267-270.

Product Stewardship Institute (aka. PSI). (2015a). Factsheet on the Marine Debris & Plastic Source Reduction Toolkit for Colleges & Universities. Retrieved from https://www.epa.gov/trashfree-waters/marine-debris-and-plastic-source-reduction-toolkit.

Product Stewardship Institute (aka. PSI). (2015b). Marine Debris & Plastic Source Reduction Toolkit for Colleges & Universities. Retrieved from https://www.epa.gov/trash-free-waters/marine-debris-and-plastic-source-reduction-toolkit.

Ray, G.C. (1988). Ecological diversity in coastal zones and oceans. In Wilson, E.O. & Peter,

F.M. (Eds.), *Biodiversity* (36-50). Washington D.C.: National Academy Press.

Ray, G. C., & Grassle, J. F. (1991). Marine Biological Diversity Program. *BioScience*, *41*(7), 453-457.

Reissier, J., Shaw, J., Wilcox, C., Hardesty, B. D., Proietti, M., Thums, M., & Pattiaratchi, C. (2013). Marine Plastic Pollution in Waters around Australia: Characteristics, Concentrations, and Pathways. *PLOS One. 8*(11).

Rochman, C. M., Browne, M. A., Halpern, B. S., Hentschel, B. T., Hoh, E., Karapanagioti, H. K., ... & Thompson, R. C. (2013). Policy: Classify plastic waste as hazardous. *Nature*, *494*(7436), 169-171.

Roos Lundström, F., & Mårtensson, A. (2015). The Journey of Plastic through Oceans: A study on quantifying micro plastic particles in ocean outside Costa Rican west coast. Retrieved from http://turtle-trax.com/wp-content/uploads/2013/12/The-Journey-of-Plastic-Trough-Oceans_Frida-Anna.pdf

Scott, Julia. (2011, June 19). Survey pinpoints sources of trash in San Francisco Bay. *The Mercury News*. Retrieved from http://www.mercurynews.com/2011/06/19/survey-pinpoints-sources-of-trash-in-san-francisco-bay/

Sharp, A., Høj, S., & Wheeler, M. (2010). Proscription and its impact on anti-consumption behaviour and attitudes: the case of plastic bags. *Journal of Consumer Behaviour*, *9*(6), 470-484.

Sheavly, S. B., & Register, K. M. (2007). Marine debris & plastics: environmental concerns, sources, impacts and solutions. *Journal of Polymers and the Environment*, *15*(4), 301-305.

Slavin, C., Grage, A., & Campbell, M. L. (2012). Linking social drivers of marine debris with actual marine debris on beaches. *Marine Pollution Bulletin*, *64*(8), 1580-1588.

Stern, P. C. (2000). Towards a Coherent Theory of Environmentally Significant Behavior. *Journal of Social Issues, 56*(3), 407-424.

Su, S., Yazhou, L., Maschal, E., & Yuejiao, H. (2015). *Plastic Reduction Case Studies* (Doctoral dissertation, Duke University). Retrieved from http://hdl.handle.net/10161/9640

Thiel, M., Hinojosa, I. A., Miranda, L., Pantoja, J. F., Rivadeneira, M. M., & Vásquez, N. (2013). Anthropogenic marine debris in the coastal environment: A multi-year comparison between coastal waters and local shores. *Marine pollution bulletin*, *71*(1), 307-316.

UNEP. (2014). Valuing Plastics: Valuing Plastics: The Business Case for Measuring, Managing and Disclosing Plastic Use in the. Consumer Goods. Retrieved from: www.unep.org%2Fpdf%2FValuingPlastic%2F&usg=AFQjCNEqDNDC3VPA5M14t5-BK1gjqnQ0Jw&sig2=byLPfJWLrsVFiKeU98NOwA

Vegter, A. C., Barletta, M., Beck, C., Borrero, J., Burton, H., Campbell, M. L., ... & Gilardi, K. V. (2014). Global research priorities to mitigate plastic pollution impacts on marine wildlife. *Endangered Species Research*, *25*(3), 225-247.

Williams, P. W., & Ponsford, I. F. (2009). Confronting tourism's environmental paradox: Transitioning for sustainable tourism. *Futures*, *41*(6), 396-404.

Wisconsin Department of Natural Resources (aka. WIDNR). (2008). Recycling and Waste Reduction in the Restaurant Industry. Retrieved from http://dnr.wi.gov/files/PDF/pubs/wa/WA1536.pdf

Weinstein, S. (2009). Main Ingredient in Marine Soup: Eliminating Plastic Bag Pollution through Consumer Disincentive. *Cal. W. Int'l LJ*, *40*, 291.