Exploring the Adversarial Relationship between Tourism and Marine Pollution as an Incentive for Improving Waste Management Practices

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

It was not until the late 1960s that marine pollution was first mentioned in scientific literature. The research came as a result of observations of the ingestion of plastics debris by marine life including seabirds and turtles (Bergmann et al., 2015). Considering the oceans cover the majority of the earth's surface, it begged the question of just how much litter was in the oceans and what are its potential impacts? Today, a significant amount of research has been conducted in attempt to answer these questions. While it is impossible to measure exactly how much debris is in the oceans, five major garbage patches have been identified and the largest has been titled the Great Pacific Garbage Patch. Garbage patches are aggregations of marine debris and are typically associated with ocean gyres which are circulating ocean currents (Sesini, 2011). The garbage patches form from accumulating debris caught in the currents.

The overwhelming majority of ocean debris is plastic. The properties that popularized plastic in the first place are the properties which make it so detrimental to the environment. They are cheap, lightweight and corrosion-resistant. Their corrosion-resistance has allowed plastics to build up in the ocean since there is very little biodegradation (W.C. et al., 2016). Tighter international regulation was imposed on plastic debris in the 1970s and 1980s, but most of this targeted larger plastic debris. Recent research into microplastics, small plastic fragments and particles, has raised new concerns. They are ubiquitous in the ocean and much more difficult to regulate than larger plastic items (Bergmann et al., 2015).

There are four primary causes of marine pollution: sewage, tourism, fishing, and waste from ships. These can be categorized as either land-based or ocean-based. Sewage and tourism are the former and account for approximately 80% of the debris in the ocean (Sesini, 2011). The pollution of the ocean has well-documented and severe ramifications on marine ecosystems.

Risks to marine life include potential entanglement in debris, ingestion of plastics, the smothering of marine habitats, chemical toxicity and opportunities to introduce invasive species into communities (Bergmann et al., 2015). These environmental impacts hurt more than just marine ecosystems; they lead to significant economic losses for people and countries as well. The economic impacts of marine pollution are quite complex, difficult to quantify, and less researched than the environmental impacts. However, relatively direct economic losses can be seen in the cost of debris removal and losses in the tourism and fishing industries (Sesini, 2011).

Thus far, two industries have been identified as contributors and victims of marine pollution: fishing and tourism. I chose to focus specifically on the relationship between tourism and marine pollution and examine it through the lens of Star's (1999) definition of infrastructure, which is introduced later. Establishing the adverse relationship between marine pollution and tourism as infrastructure increases its tangibility and provides economic incentive for countries to adopt more sustainable waste management practices.

Case Context

The influx of people to beaches brought on by tourism leads to increased levels of littering (Garcés-Ordóñez et al., 2020). In a study of eleven beaches off the coast of Colombia, there was observed to be significantly higher concentrations of macrolitter during the high tourist season as opposed to the low tourist season (Krelling et al, 2017). Increased littering requires more frequent beach clean-ups or it leads to debris build-up and visually unappealing beaches which can in turn deter tourists from visiting. For example, in 2011, severe flooding of South Korea's Nakdong River led to massive debris build-up off the coast of Geoje Island during the

high tourist season. Between the costs of clean-up and the drop in visitors, an estimated $37 million US dollars were lost in revenue (Jang et al., 2014).

Although relatively under-researched in comparison to other facets of marine pollution, much of the literature regarding tourism analyzes it as either solely a source of pollution or a source of economic loss. However, there is opportunity to jointly examine both sides of the relationship. Moreover, a comprehensive analysis of the role of tourism provides a unique approach to addressing marine pollution due to the range of its scope. At the grassroots level, raising public awareness is an informal solution which impacts the behaviors of tourists whom are visiting beach destinations. However, formal policies and regulations also need to be established to effectively manage and prevent further pollution. Often times, environmental policies lose out in favor to economic policies. Yet, many coastal cities and countries have tourism as their primary sources of revenue. Understanding and emphasizing the economic impacts of marine pollution provides incentives for governments to seek sustainable solutions.

Furthemore, marine pollution ought to be addressed formally since it is an international issue. Due to ocean currents, debris can travel great distances and aggregations typically build up far from their origins. Thus, one country's pollution can have devastating impacts on the other side of the globe. Tourism also reflects the international nature of the problem as people travel all over the world to visit beach destinations. One country's efforts to raise awareness and protect their environment can be hampered by visitors that are either unconcerned or careless. Like many climate concerns, sustainable practices need to be implemented and supported on a global scale.

Star's Definition of Infrastructure

The relationship between tourism and marine pollution embodies the qualities of *infrastructure* as defined by Star (1999). Star defines infrastructure as having nine qualities, five of which were relevant to describing how marine pollution has grown to be a global problem and why it is so difficult to fix. The first three characteristics are embeddedness, reach & scope and embodiment of standards. These demonstrate how society has enabled marine pollution to grow in severity. Embeddedness refers to how infrastructure is so rooted in society and the environment that it can be difficult to differentiate singular aspects and relationships. Waste management is extremely complex and involves the production, distribution and final disposal of goods, all of which make it difficult to identify individual responsibilities and protocols throughout the process. Reach or scope is infrastructure's ability to have influence far beyond where it originated. Marine debris is carried great distances by currents. Its negative impacts are often felt in cities or countries far from its orgin regardless of how well they care for their own beaches. Embodiment of standards refers to how our treatment of infrastracure often represents a societal norm, and therefore it becomes easy to overlook the impact of our behaviors. People can become accustomed to seeing litter on beaches and start ignoring it or believing it is not their responsibility to clean it up. Ignoring one piece of trash feels like it has negligible impact, but when this happens thousands of times, the impact becomes significant and damaging.

While the previous qualities have hindered society from preventing marine pollution, the last two help explain why addressing the problem is so difficult. These attributes are infrastructure's nature to be invisible until broken and fixed in modular increments. Invisible until broken describes infrastructure's nature to be unnoticed and remain in the background until it breaks down in a way that demands attention. This is examplified when tourists begin avoiding

beaches when they become known for being dirty and unappealing. It is easy to ignore trash when it is in the middle of the ocean, but it is much harder to ignore when it is on the beach or in the water right in front of you. Lastly, infrastructure is fixed in modular increments due to its complexity and multiple relationships with various groups and other forms of infrastructure. It would be impossible to simply clear the ocean of plastic. First, efforts must be made to decrease the amount of plastic entering the ocean. Enacting this type of change involves creating legislation and awareness which occurs gradually.

The adverse relationship between marine pollution and tourism has devastating environmental and economical consequences. However, breaking it down and recognizing the relationship as infrastructure makes it a more tangible problem to policymakers and the public which is essential when seeking formal solutions.

Research Question and Methods

For my research, I was interested in the following question: how does the adversarial relationship between marine pollution and tourism incentivize countries into adopting more sustainable waste management practices? To answer this, I looked at formal policies and initiatives which seek to mitigate marine pollution through tourism management. First, I examined the practices of individual countries to gain insight into which types of formal regulation are most popular and feasible to implement. Then, I broadened my research to global initiatives which were likely to be more vague but were able to emphasize and address the global natue of marine pollution on a larger platform. Beyond merely identifying these practices, I sought to examine their effectiveness which is ultimately what matters.

Island countries with tourism-driven economies are perhaps the most vulnerable to the consequences of severe marine pollution. As such, they have greater economic motivation to regulate and maintain healthy coastal zones. Furthermore, due to their smaller size, it can be easier to implement newer and more radical policies than larger countries which operate on a much grander scale. I specifically looked at national destination pledges, the Seychelles' blue bond and plastic bans in the Caribbean. This allowed me to study a variety of approaches and their outcomes ranging from a focus on awareness to economic incentives to outright bans.

While the work of individual countries is important, so is the need to recognize the international impact of marine pollution. The effects of debris are typically felt far from its origin which makes it vital to create global solutions. International organizations, specifically the United Nations (UN) and the World Bank, have set out to do so through goals, initiatives and guidelines. These include the Global Plastics Initiative and the New Plastics Economy Global Commitment. Since these initiatives cannot be enforced, I was interested in how much support they garnered from larger countries and corporations.

Results

The adverse relationship between marine pollution and tourism has highlighted the economic motive—beyond just the environmental one—for countries to seek out sustainable tourism and waste management practices. Smaller island countries with tourism-driven economies are most immediately impacted by marine pollution and consequently are addressing it with greater urgency than larger countries. They have taken the lead in making the shift to cleaner practices through policies centered on awareness, higher product standards and economic

tools. A combination of approaches needs to be implemented on a global scale in order to truly save our oceans, and it will require joint efforts between the private and public sectors. Although the goals set by global initiatives cannot be enforced, they do build awareness by establishing what the standards ought to be.

The policies with the most concrete and successful action in addressing marine pollution are typically found in smaller, developed countries with a strong reliance on the tourism industry. Building awareness and convincing people to care about the environment is essential to changing behaviors. Since a significant portion of these countries' populations live or interact with their coasts in some manner, the connection to the environment likely already exists for citizens which eases implementation of sustainable policy. The next step is educating foreign visitors. Iceland was the first country to enact a national destination pledge in 2017 as a soft visitor intervention approach, and multiple countries have followed suit. Before or upon arrival, foreigners must sign a pledge committing themselves to be responsible tourists. The pledge provides loose guidelines on how to behave responsibly and uses emotive language to build a connection between the visitor and their destination (Albrecht & Raymond, 2021). The Finland pledge asks visitors to be "like a Finn" by "slowing down from within", and New Zealand's Tiaki promise is a call to care for New Zealand's "land, sea and nature, treading lightly and leaving no trace" (Raymond, 2020; TIAKI, 2018). To gauge the success of destination pledges, a study interviewed several tourism managers. Several believed tourists do not intend to damage the destination they are visiting but do not always know how to behave responsibly in a new place. They also noted the carefree attitudes of vacationers can leave them unintentionally less thoughtful about their behaviors (Albrecht & Raynond, 2021). Tourists may also be from countries with lower environmental standards. The pledges establish sustainability as a societal norm in the destination country and

create an expectation for respectful waste management and environmental interactions. They are a tool to engage and educate tourists while simultaneously welcoming them.

Increased environmental awareness throughout governments, citizens and tourists has generated the momentum to pass regulations on single-use plastics in several countries. Several states in the Caribbean have attempted to implement plastic regulation to varying degrees of success. The region has historically relied heavily on plastic packaging as most of their food and manufacturing goods are imported. However, their tourism-driven economy is based on their beautiful beaches which creates a vested interest in protecting their environment. The federal bans are necessary as the production and distribution of products is embedded in society such that it is difficult for individuals to conveniently avoid plastics. As of April 2020, thirteen countries had attempted to implement some type of ban on single-use plastics. One of the key facets in successful policy is providing ample lead time between the announcement of a policy and when it goes into place. Eleven of the countries provided a lead time less than six months which was not enough time for stakeholders to adapt and explore alternative options to their products and hindered the policies' success (Clayton, 2021). A slow transition to alternative products corresponds to infrastructure's characteristic of being fixed incrementally (Star 1999). However, it raises the question of if these policies properly reflect the urgency required to combat marine pollution before our oceans are irreparably damaged. Furthermore, these bans occurred in smaller countries with smaller populations. If six months was not enough time for them to adequately transition, it could take larger countries years.

Success in cleaner waste management practices is most achievable when the public and private sectors work together. Providing economic incentives can be an effective tool to changing industry practices. Seychelles is an archipelago of 115 islands off the east coast of

Africa. Its economy is driven by tourism and fisheries, making it extremely vulnerable to climate change and marine pollution. To increase the private sector's investment in sustainability, Seychelles launched the world's first sovereign blue bond in 2018 with financial backing from the World Bank. The Seychelles government purchased a $15 million blue bond from outside investors to finance sustainable marine and fishery projects (World Bank, 2018). Within ten years, Seychelles will pay back the money they borrowed plus interest. Ultimately, the goal is to enable a transition to sustainable fisheries by providing the economic buffer and tools to do so. Protecting their waters helps safeguard the future of their tourism industry. The World Bank hopes the blue bond model can be employed in other developing island and coastal countries (Navarro-Martin, 2019). Typical of infrastructure, addressing marine pollution is often avoided until it is visibly and undeniably causing harm. Economic incentives encourage countries and industries the motive to prevent marine pollution from getting to this breaking point. The blue bond's success offers the potential to build economies which thrive on sustainability rather than harmful practices.

The impact of marine pollution is most visible on smaller coastal and island countries as opposed to larger countries with broader economies. Therefore, it can be more difficult to garner international support for sustainable practices. The United Nations (UN) has identified 17 sustainable development (SD) goals for 2030. Two are relevant to my research: SD 12 calls for responsible consumption and production and SD 14 emphasizes the proper management of oceans and marine life ("Sustainable Development", 2015). In response to SD 12, the UN World Tourist Organization and UN Environmental Programme along with other organizations have created the Global Tourism Plastics Initiative. Over 110 tourism businesses and stakeholders are signatories. They have committed themselves to eliminating single-use or unnecessary plastic

packaging by 2025 and transition to reusable plastic or alternative packaging material (One Planet Network, 2022). Similarly, the New Plastics Economy Global Commitment has over 450 signatories from businesses, governments and other organizations, including companies responsible for over 20% of global plastic packaging. These signatories are reporting a decrease in plastic production after decades of exponential growth ("Global Commitment", 2018). Not only do these initiatives highlight a need to transition away from single-use plastics, but they mark a shift in the environmental expectations for manufacturing companies. Large initiatives can help create the massive shift in standards needed to change how coorporations and consumers view waste management.

While global initiatives have ambitious goals and address the international nature of marine pollution, they are not enforced which casts doubt on their success. However, members release public progress reports which establishes public accountability and provides further motivation to meet the goals. Most signatories agree that voluntary initiatives are not enough on their own to combat plastic pollution and believe a binding treaty is necessary ("Global Commitment", 2018). The governments and companies associated with these initiatives are the ones that are most likely to enact change on their own, but still a majority of plastic producers are unlikely to transition to more sustainable practices. This emphasizes the importance of public educations campaigns to continue to drive consumer awareness and demand for sustainable services. In tourism-driven economies, the governments and the industry have recognized the need to transition to sustainable practices. Even though their policies have been implemented to varying degrees of success, they need to be adopted by larger countries in order for plastic consumption and practices to significantly change. Smaller countries have stronger financial motivation due to their reliance on tourism whereas countries with other revenue sources do not

have the same urgency. However, without a change in practices globally, everyone will eventually suffer the consequences of marine pollution and our damaged oceans.

Discussion

Ongoing research and education campaigns have raised our awareness regarding the vitality of our oceans' health. The protection of the tourism industry has proven to be a strong motivator for many countries to begin phasing in more sustainable waste management practices. More broadly, goals to reduce greenhouse gases, reduce plastic production and shift to renewable energy signal an incremental transition to a sustainable economy, but it remains to be seen if the changes are happening quickly enough to prevent irreparable damage to the climate. Futhermore, many policies against marine pollution—and climate change as a whole—are merely focused on reducing our environmental damage rather than reversing it. We are far from even reaching a point of neutrality. Due to its global scope, combatting marine pollution requires a large scale change in infrastructure which corresponds to a change in societal behavior. People and coorporations need to have a higher set of standards for how they view and treat the environment. As is typical with many forms of infrastructure, measures against marine pollution have only occurred in recent years after trash has built up along shorelines and in the ocean to an extent which has made the problem blaringly obvious. The pitfall of marine pollution being an infrastructure problem is that the incremental changes to fix it require significant time. The environmental risks posed by marine pollution mean countries may not have the leisure of time that is usually required to address infrastructure issues. Thus, the environmental urgency highlights the importance of tackling it with a combination of public education campaigns alongside formal policy.

It is difficult to gauge the success of policies managing marine pollution since the regulation is so new. Most policies discussed in my research were enacted within the last five years. Therefore, a limitation of my research is that most of the analysis is speculation about the potential outcomes and successes of policies rather than measurable proof. The newness of the policy combined with the sheer vastness of pollution makes it difficult to quantify the problem and the effectivess of solutions. Moreover, since I was looking at countries where policies have been implemented, I did not study states which have a heavy reliance on tourism but have made little effort to regulate pollution. Therefore, future research could address these limitations by identifying methods to measure the success of regulation and analyze countries which have not prioritized lessening their environmental impact. It is equally important to understand their lack of regulation so that their concerns or inaction can be properly addressed. Since economic incentives have proven to be a strong motivator in smaller tourism-dependent countries, research should extend to identifying financial motivations for sustainability practices in larger countries with broader economies.

Studying the motivation behind policy has deepened my understanding of the development of legislation. Progress is accomplished efficiently when there is support from all stakeholders involved. My research has helped me understand that being an engineer is as much about the communication of an idea as much as the idea itself. Remembering this lesson throughout my career will help me operate both more efficiently and respectfully in the future.

Conclusion

Combatting marine pollution is part of a much larger call for sustainability and fighting climate change. Momentum has been shifting in favor of sustainability, but policies and practice ultimately only matter if they are effective. The incremental nature of fixing infrastructure corresponds to the gradual shifts which have been implemented to address marine pollution, but the environmental risks it poses means the problem must be treated with greater importance. My research has demonstrated the economic incentive provided by tourism has prompted more urgent action from tourism-dependent countries in enacting sustainable policies and raising awareness. Thus, research must continue to identify additional economic motivations for countries to adopt sustainable policies. This can come from government programs and mandates for cleaner practices or from building consumer demand to raise environmental standards throughout society. Ideally, it is a combination of both informal and formal actions.

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