Barbados' Hidden Treasure

An Economic Valuation of Sea Turtles & the Snorkelling Tour Industry

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Abstract

The majority of arguments raised in favour of sea turtle conservation are reliant upon their ecological importance. However, these ecological arguments rarely succeed in persuading policymakers to implement conservation legislation. During a 2-month study, we were able to estimate an annual average of 20 green sea turtles (*Chelonia mydas*) along the west coast of Barbados upon which the "swim with turtles" snorkelling tour industry is reliant. We then estimated the total industry revenue based on the number of boats offering tours, the average number of tours offered by catamaran companies each day, and the average number of passengers taken on each tour, accounting for variations in high and low season. The estimated total annual revenue for the "swim with turtles" snorkelling industry is $33.8 million USD. The average revenue annually attributable to each individual green turtle is $1.7 million USD. We argue that this report ought to function as an economic incentive for ecological change, specifically the establishment of a greater number of marine parks to protect the endangered species that benefit Barbados' economy so greatly.

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The primary anthropogenic threats to sea turtles are summarized as follows:

- Turtles are often harvested because their eggs, meat, shell, and skin are still valuable in some Caribbean economies
- Their slow growth rate and late maturity make them vulnerable to exploitation for a longer period of time than most marine animals
- Fisheries by-catch is a major threat: Turtles are largely affected by fish nets, fish pots, and longlines
- Hatchlings and adults are disoriented by coastal lighting, which makes it difficult for nesting females to lay eggs and for hatchlings to find the ocean
- Growth, reproduction, and sex ratios may be affected by warming sea temperatures as sea turtles are ectotherms

(Fanning et al. 2011).

Introduction

Tourist fascination with sea turtles has fostered the growth of a "swim with turtles" snorkelling tour industry along the west coast of Barbados which accounts for approximately $33.8 million USD in annual tourism revenue. While popular snorkelling sites like Carlisle Bay still have daily turtle sightings, green (*Chelonia mydas*) sea turtles have suffered significant decline due to anthropogenic effects. Examples of these effects include, habitat degradation, pollution, and fisheries by-catch (Stewart et al. 2016). Schomburgk's 1848, *History of Barbados* provides a vision of Carlisle Bay in which the sea is so full of turtles, one could literally walk along their backs to reach the shore (Schomburgk 1848). However, research estimates that over the past three generations, nesting green sea turtle populations have decreased by up to 68% (Stewart et al. 2016).

Our report demonstrates that there is significant economic incentive for an ecosystem services approach to marine conservation. The relationship between tourists and green sea turtles that has evolved along the west coast of Barbados is just one example of the economic value a thriving marine ecosystem contributes to the tourism industry. We focus on green sea turtles in our report due to the "swim with turtles" snorkelling industry's reliance on them. The industry is reliant on green turtles because they are most easily habituated to human interaction and supplemental feeding (Parker 2016). However, we hope that our findings incentivize the implementation of legislation which benefits all species of turtles native to Barbados. With both the IUCN and WWF listing green sea turtles as an endangered species, it is time for humans to rethink the way they interact with the environment they are economically and ecologically reliant upon (Seminoff 2004; WWF 2016).

In a country where roughly 40 cents out of every dollar of the GDP is directly or indirectly attributed to the tourism sector, it is now more important than ever to protect the resources that encourage people to visit Barbados in the first place (WTTC 2015). The purpose of this report is to show policymakers and industry leaders that anthropogenic factors such as by-catch and habitat loss aren't just contributing to ecological degradation, they have a negative impact on the tourism industry. We argue that publicizing the revenue attributable to each individual turtle is an effective means of proving that sea turtles are worth far more to Barbados' economy alive than dead.

Background

When one thinks of the economic value of a sea turtle they are likely to think initially of the sale of turtle meat, shells, and eggs which is still legal in some parts of the Caribbean e.g. Nicaragua (Fanning et al. 2011). According to a local stakeholder, it is unlikely that the shell and meat of a single turtle would be sold on the balck market for greater than$350 USD (Miller 2016). While this stands in stark contrast to their non-consumptive value, arguments based on attributable tourism revenue are often overlooked. It is important to note that sea turtles in their entirety are already endangered to the point that they have likely ceased to perform their historical functions (Fanning et al. 2011) Replacing turtle fishing with the viewing of or non-consumption of sea turtles may not compensate fishers, but the attraction will likely boost tourism revenue in a way that positively impacts other industries (Troeng and Drews 2004). It is therfore worth considering the ecological and economic importance of sea turtles in order to incentivize the establishment of improved marine protection laws.

There are three main species of sea turtles in Barbados: hawksbill (*Eretmochelys imbricata*), green (*Chelonia mydas*), and leatherback sea turtles (*Dermochelys coriacea*). Hawksbills and leatherbacks have a status of critically endangered, and green sea turtles are endangered (WWF 2016). Green sea turtles, which this report will focus on, do not nest in Barbados. However, both hawksbill and leatherback sea turtles nest in Barbados and those nesting beaches ought to be protected. All sea turtles have economic value and are extremely ecologically important. However, as stated above, this report will focus largely on green sea turtles. Perhaps the greatest threat to turtle populations that must be addressed is the number of sea turtles lost to by-catch. The endangerment of sea turtles highlights the need to increase the number of marine parks in Barbados and improve commercial fishing techniques, to make them turtle-friendly.

Methodology & Findings

To estimate revenue attributable to reliable green sea turtles from the "swim with turtles" snorkelling tours, we gathered industry data from company websites and conducted interviews with industry experts regarding active ships, average passengers per day, prices, and number of trips per day of local Barbadian snorkeling tours that feature turtle sightings. Using these sources we were able to estimate the number of independent snorkelling tour companies currently operating along the West Coast of Barbados. Additionally, we identified several "glass bottom boat" operators that have been lumped into a single category for calculation purposes due to their small size and similar operations (capacity, price, trips per day, etc.). Through sources mentioned above we found the number of boats per company (and a low estimate of the number of glass boat operators) and the maximum capacity of each ship.

We then used a % of capacity filled multiplier for both high and low season. For high season (November to March) we assumed a 90% fill rate per day. We then multiplied this result by the average number of tours per day, 1.25, which was an independently corroborated number by several people in the industry. We then multiplied the high season passenger total per day (1706.6) by a low season passenger multiple of 30% to get a relative idea of how many people per day were viewing turtles between April and October (512).

Individual company price data was then used to find an industry average price per trip ($92 USD). This data was also found via company websites and interviews with industry experts. By multiplying the total number of passengers per day in high season by the number of days in said season (151) and then multiplying by the average price per trip, we found an estimated high season revenue of $23.7 million USD per season. Repeating the same process for low season, we found an estimated revenue of $10.1 million USD per season. The sum of high and low season revenue yielded an estimated annual industry revenue of $33.8 million USD.

(PPD in HS)(Days in HS)(PPT) +
(PPD in LS)(Days in LS)(PPT)
=Total Revenue

After surveying several companies, we have estimated that there are an average of twenty "reliable" turtles along the west coast of Barbados each year. Dividing total revenue by the estimated number of value producing turtles (ie. turtles that snorkeling companies consistently see), we found a yearly value per turtle of approximately $1.7 million USD. However, it is important to mention that for the current year, twenty turtles is a high estimate, with some placing the current viewable population at 5-10 "reliable" sea turtles.

Potential Lifetime Value

We have estimated the potential lifetime value of each reliable turtle. In order to do so, we have constructed a hypothetical in which all other Caribbean nations develop a "swim with turtles" snorkelling tour industry, similar to the one in Barbados. Sea turtles live between eighty and one-hundred years on average, taking approximately twenty years to reach maturity. As a conservative estimate for the potential lifetime valuation, we have assumed that given a healthy life, the sea turtles upon which the industry is reliant have sixty years of viewing potential. Using a 5% discount rate and a conservative 2% industry growth rate in our net present value formula, the hypothetical is constructed as follows: All things being equal, if similarly sized tourism industries were developed elsewhere in the Caribbean,

and laws prohibiting the poaching and sale of sea turtles enacted throughout the entire region, each viewable sea turtle would have a potential lifetime value of $49.0 million USD.

Opportunity Cost to Carribean Islands

This hypothetical assumes that other islands in the Caribbean develop turtle snorkelling tour industries that are similar in size, in which tours are offered at roughly the same cost. While this argument is assumption-based, and may overestimate the potential revenue of snorkelling tour industries on other Caribbean islands, it is intended to highlight the opportunity cost of snorkelling tour revenue that is forfeited by islands that currently lack such an industry.

It can be assumed that the true economic value of one sea turtle is much greater than the figure that has been presented and will likely grow each year.

Discussion

Limitations of Study and Suggestions for Future Endevours

It should be noted that the monetary figures presented in this report are conservative in many ways. Due to limited time and resources, this study did not take into account any revenue based on tourist accommodation and consumer spending while on the island. Assuming a certain percentage of tourists come to Barbados specifically to swim with turtles, the money spent by these tourists on industries other than snorkelling tours (food, hotels, tours, etc.) could be directly attributed to turtles. Thus, future efforts to determine the gross economic impact of the green turtle within the Barbadian economy could follow a similar valuation methodology to the 2011 Clua et al. paper on the total economic valuation of the sicklefin shark viewing industry.

Additionally, the study assumed that the tours were operating at 90% of their maximum capacity during high season. This is important to consider as many operators have reported working at 95% or greater of full capacity during the high season. With more time and resources, future studies should do more in depth research into what these fill rate numbers are and systematically apply them to each company.

A follow up study could also aim to assess tourists' willingness to pay for marine conservation. The implementation of a small conservation tax on those entering the country, much like the one currently in Belize, could fund future marine conservation projects within Barbados and is worth further investigation (PACT 2016).

As some operators noted, the snorkelling tour industry is growing substantially with more boats operating every year. This indicates greater potential annual revenue growth than the 2% that we have accounted for. Thus, it can be assumed that the true economic value of one sea turtle is much greater than the figure that has been presented and will likely grow each year. Therefore, tracking future growth as well as finding historical growth figures can further illuminate the economic intricacies of this industry.

As a form of ecological tourism, we also believe that there ought to be continued research into the betterment of practices within the turtle snorkelling tour industry. In their 2016 paper, Stewart et al. explore the impacts of "swim with turtles" snorkelling tours on green sea turtle health in Barbados. According to their study, green turtles that experienced supplemental feeding as a result of the tours experienced significantly higher growth rates, prolonged omnivorous feeding patterns, and potentially, a higher disposition to diseases such as, diabetes (Stewart et al. 2016). This highlights the need for continued research and potentially, for industry regulation. For any ecotourism sector, it is in the long-term best interest of those who profit from it to take steps to preserve and/or improve the health of the ecosystem upon which their business relies. In the case of the "swim with turtles" snorkelling tours, it is therefore in the long-term best interest of tour operators to take measures to ensure the health and safety of green sea turtles and their habitat. The Stewart et al. study also addresses the need to monitor the carrying capacity of turtle-viewing sites. Given the low number of reliable turtles and the comparatively high volume of tourists, we have exceeded the sustainable carrying capacity for human interaction with turtles at snorkelling sites.

Future Recommendations

Barbados is one of the few islands within the Caribbean that has laws protecting sea turtles. Section 7 of the Fisheries Act states that it is illegal to: Catch, harm, or possess any turtle product (Barbados Fisheries 1998). Breaching of this law will result in fines of up to $50, 000 BBD and/or two years in prison, but that is not enough to combat the negative impact of humans on sea turtles (Barbados Fisheries 1998). As it stands, there are no fishing regulations for Barbados that would help reduce the amount of turtles being caught as by-catch (Stewart et al. 2016). The lack of regulation which allows sea turtles to be lost to non-selective fishing techniques stand in direct opposition to the legislation which prohibits the poaching and sale of turtles/turtle eggs. The existing legislation in the Fisheries Act is an acknowledgement of their ecological value, but the lack of fisheries regulation outside of Carlisle Bay and Folkstone blatantly contradict that acknowledgement. The fatalities that result from entanglement and fisheries by-catch could be mitigated through the implementation of marine parks, turtle-friendly fishing gear requirements, turtle friendly coastline best management practices, and a conservation tax.

The establishment of protected areas within Barbados' waters and along its coasts would benefit the populations of economically and ecologically important sea turtles. Healthy and abundant green turtle populations have a vital role regarding the maintenance of marine ecosystems, specifically in coral reefs and grass beds. The establishment of marine parks serve a purpose for sea turtle populations and for Barbados' fisheries as a whole. Abundant turtle populations foster healthier, more resilient marine systems for Barbados, which in turn, foster stable fish populations (Wilson et al. 2004).

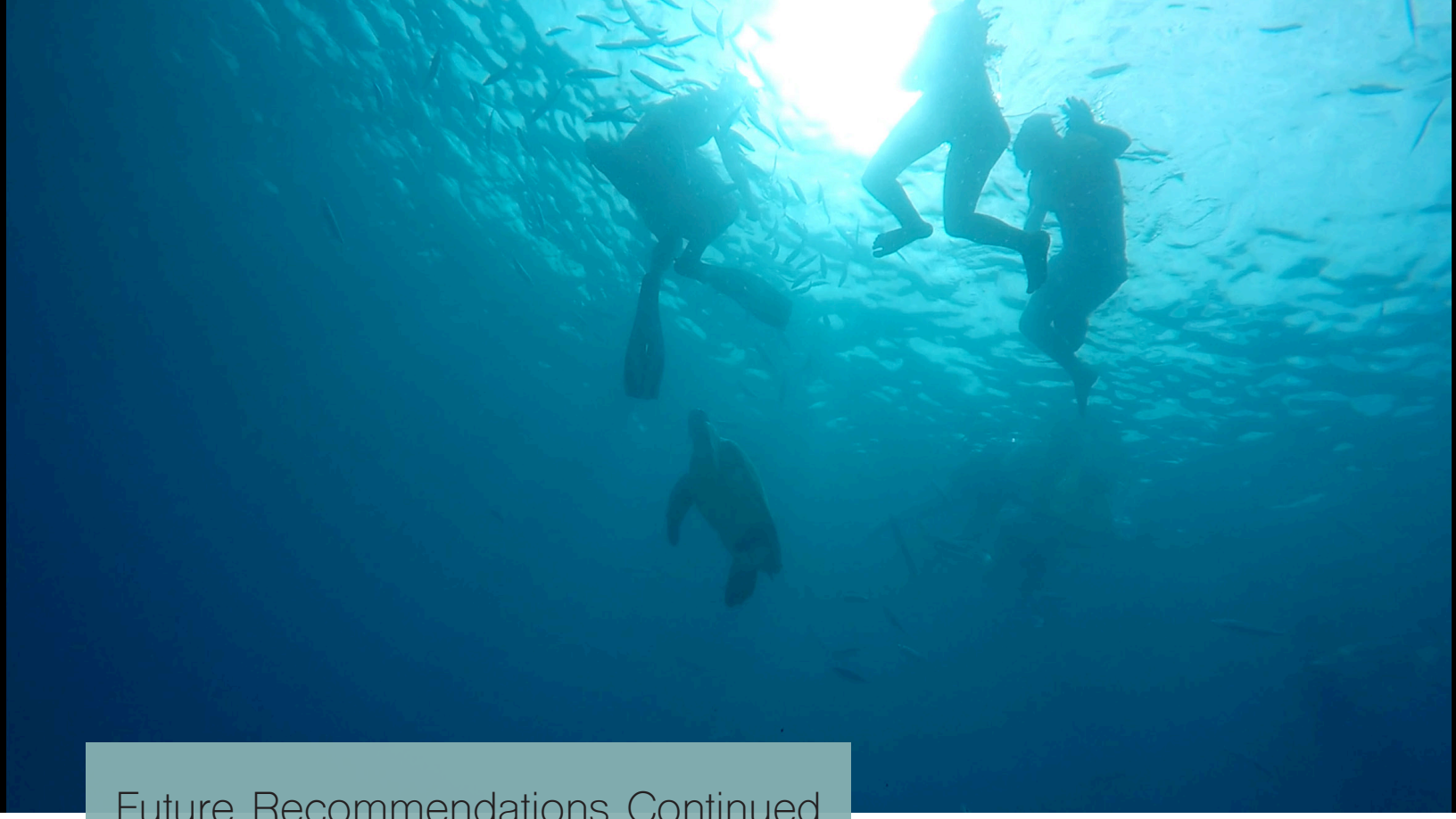
The legislation needed to establish marine parks and reserves in Barbados is preexisting, in the *Marine Areas (Preservation and Enhancement)* L.R.O., Chapter 392 states that:

3. (1) The minister may by order designate any portion of the marine areas of Barbados as restricted areas where he considers it necessary for

a. The preservation and natural beauty of;
b. The protection of the flora and fauna and wrecks found in it;
c. The promotion of the enjoyment by the public of; and
d. The promotion of scientific study and research in respect of such areas

(Government of Barbados, 1981).

Given the existing ecological and economic incentive, the lack of legislative implementation is indicative of an absence of governmental accountability when it comes to matters of environmental protection.



Future Recommendations Continued

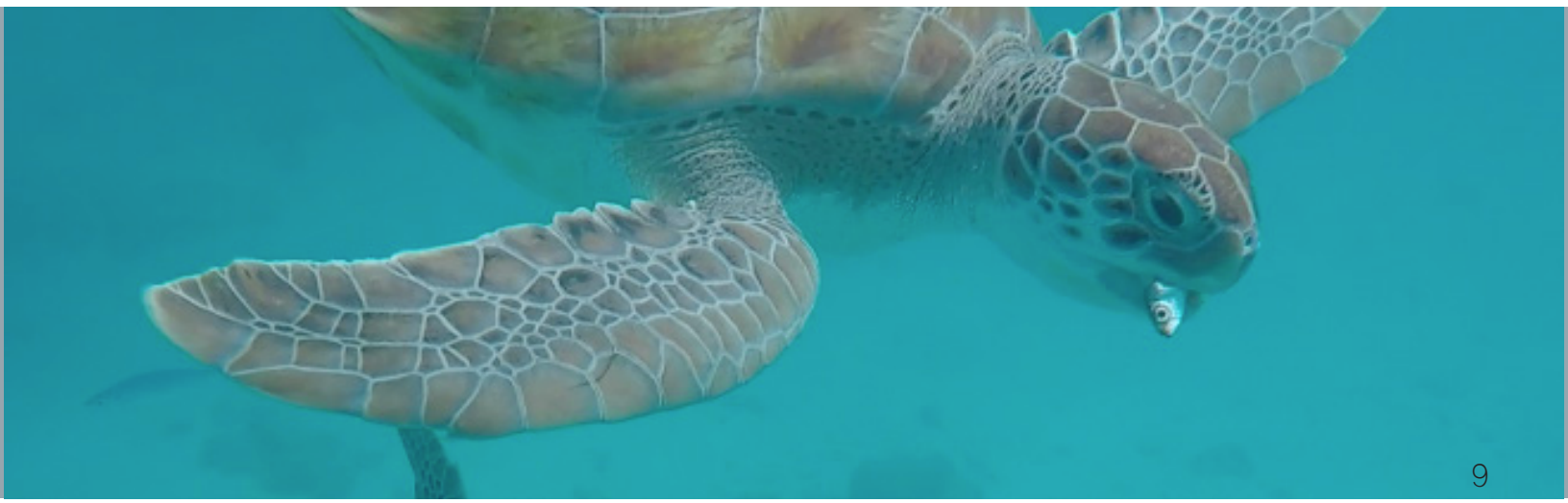
Specific fishing guidelines can also dramatically decrease sea turtle by-catch with little to no adverse effect on catch sizes (WWF 2016). In a study conducted by the NOAA Fisheries Pascagoula Laboratory and the NOAA Fisheries Miami Laboratory, encounters with leatherback and loggerhead turtles were reduced by 65 and 90 percent after switching from the traditional hook to the larger circle hooks and introducing simple bait changes. In some cases, the alteration of fishing practices effectively increased the catch rates of specific fish species (Watson 2005). Turtle Excluder Devices (TED's) have also been shown to be an effective means of reducing by-catch produced by trawling vessels and are becoming standard practice in many countries (NOAA 2016).

Additionally, implementing marine reserves alongside the west coast of the island would help reduce the number of hawksbill sea turtle mortalities. This would have significant impacts for local hawksbill populations as Barbados' beaches host a great number of nesting sites for this critically endangered species (WWF 2016). The implementation of turtle friendly lighting along the coast would also significantly help the survival of hawksbill hatchlings (Broadwell and Kendall 2012). Without compromising the safety of the public, the installation of embedded LED lights and low-lighting along pedestrian paths could have significant impacts on the survival rate of hatchlings (Broadwell and Kendall 2012). According to a study in Florida, implementing such changes resulted in a 98% decrease of hatchling disorientation (Broadwell and Kendall 2012). Such examples could be used to help develop best-management practices for coastal development and lighting for the island of Barbados.

At present, efforts undertaken by Barbados to conserve and encourage non-consumptive uses of sea turtles are often thwarted by the exploitation of the same population elsewhere in the Caribbean (Fanning et al. 2011). We argue that it is in the best interest of other Caribbean nations to research and establish a "swim with turtles" snorkelling industry, similar to the one in Barbados. The establishment of "swim with turtles" snorkelling tours in other parts of the Caribbean are important for economic reasons, but more importantly, it represents a shift away from poaching and other consumptive sea turtle uses. Snorkelling tours in Barbados cause green sea turtles to become accustomed to humans and supplemental feeding; this does not serve them well when they migrate to regions where poaching is still legal (Stewart et al. 2016) Such consumptive uses add to the endangerment of a profitable resource, contributing to potential tourism losses for the entire region.

Conclusion

With an estimated total annual revenue of $33.8 million USD, the value of the “swim with turtles” snorkelling tours and the green sea turtles upon which they are reliant cannot be overlooked. Premised on conservative estimates and a single tourism industry which directly attributes its revenue to green turtles, this report can be seen as the first step in determining the true economic value of a sea turtle. Turtle-focused snorkelling tours developed along the west coast of Barbados almost by accident; evolving from tourist fascination as turtles swarmed the boats of fisherman who tossed unwanted trimmings into the water (Stewart et al. 2016). Today, the snorkelling tours represent a precedent set by Barbados for the wider Caribbean community. “Swim with turtles” snorkelling tours are an untapped economic opportunity for many regions in the Caribbean, that still subscribe to less profitable, consumptive uses of sea turtles. It is in this sense that the turtle-focused snorkelling tour industry functions as an economic incentive for ecological change. Sea turtles are far too ecologically and economically valuable to remain on the endangered species list. The tourism revenue Barbados gains from non-consumptive green sea turtle use ought to be enough to incentivize the establishment of marine parks and the regulation of non-selective fishing practices that contribute to the endangerment of one of Barbados’ most valuable natural resources.



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