

# Has cruise tourism pushed marine ecosystems to the ‘tipping-point’ of their physical-ecological carrying capacity? – Perceptions of stakeholders.

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## Introduction

The Caribbean is four times more dependent on tourism than any other region in the world. The region is considered an ‘ecological hot-spot’. Consequently, most of the world’s cruises (35.4%) come to the Caribbean and over time the number and size of vessels has increased bringing more passengers with each call. SDG 14 addresses the need to conserve and sustainably use marine resources. Marine protected areas (MPAs) were developed for this reason however, to date only 1% of the ocean is protected. Human well being is dependent on the ‘ecosystem services’ provided by the marine environment. In the context of tourism these include: provisioning, regulating and recreational services. Demands being made on marine ecosystems from increased tourism activity, places added pressure on these ecosystems, weakening their ability to provide services. This threatens the ecological foundation on which the Caribbean islands are dependent. Appropriate measures are therefore needed to minimize the impacts whilst maximising tourism’s potential for generating positive benefits.

## Literature review

Many authors have noted that cruise tourism will continue to grow in the Caribbean but cautioned that this growth rate cannot be sustained because there are limits to growth and have stressed the need for islands to determine the carrying capacity for this activity. Conversely others have noted that the tourism policies of many Caribbean islands make mention of the need to determine carrying capacity but it is seldom ever conducted.

Researchers have proposed several measures to address problems of this nature however, these studies have focused on developed countries and the approaches used have been specific to the terrestrial environment. Furthermore, environmental and cultural differences limit the applicability of these approaches to other jurisdictions and hence a modified approach adaptable to other environments is warranted. The ultimate goal of this research is to develop a “carrying capacity framework” for managing cruise visitors in marine spaces in Small Island developing States (SIDS), where incomparable challenges are faced. This paper specifically presents the findings of the first phase of the research, in which a baseline study was conducted on one of the islands in the Caribbean.

## Methodology

This study was conducted in the month of January, within the peak cruise ship season. A concurrent triangulation mixed method design was employed. Purposive sampling was used to collect qualitative data from two strata of the cruise industry: (i) elite stakeholders - eight semi-structured interviews (40 minute each) comprising 15 open-ended questions and (ii) experienced fishermen – two focus groups (60 minute each). Concurrently, random sampling was used to collect qualitative data via structured interviews from: (i) 250 repeat cruise visitors who disembarked from 14 cruise ships and (ii) 40 tour-boat operators. Qualitative and quantitative results were analysed using thematic analysis and SPSS respectively. A series of

themes emerged from the qualitative data and a matrix was developed in order to identify the themes occurring most frequently. These themes were then integrated and triangulated with the findings of the quantitative data from the structured interviews.

## Results

The quantitative and qualitative findings of this research suggest that the demands of the growing cruise industry and its activities may be contributing to the changes observed in the marine environment and hence may affect the environment's ability to provide ecosystem services. Physical-ecological carrying capacity indicators relevant to the marine environment were chosen based on those proposed by Coccossis and Mexa. These indicators included: depletion in fish populations, coral damage, pollution of the harbor, oil slicks on water surfaces near reefs and an increase in solid waste at beaches and reefs.

Results showed that 16.7% of cruise visitors, 45% of the tour operators/guides, 62.5% of interviewees and 100% focus groups noted changes in the marine environment over time that were linked to these indicators. Firstly, the number and size of cruise ships visiting the island has increased over the years resulting in extensive expansion of port infrastructure including dredging of the channel and extending the berths. Consequently, there has been loss of marine flora and fauna and an increase in sediment content in the harbor and its environs diminishing its aesthetic and provisional value. Secondly, fishermen noticed a decrease in the overall population and types of fish. This was noted to have occurred simultaneously with the increase of cruise arrivals on the island. One factor proposed as having contributed to this decrease was the unauthorized use of fishing priority areas by dive boats operators and their guest which resulted in the disturbance and destruction of fish traps and equipment set by fishermen and fueled conflict. Furthermore, cruise ships sometimes cross the path of fish traps and equipment adding to these disturbances.

Thirdly, the large numbers of dive boats and catamarans anchored around the reefs simultaneously, contributed to anchor damage to the reefs. Additionally, the consequent overcrowding at reefs by the guests from these vessels added to the damage given that >200 guests frequently snorkeled and dived at the same time, touching and breaking the corals. Fourthly, oil slicks from vessel engines were observed on the surface of the water by the fishermen and tour-boat operators which they noted, negatively affect water quality and marine life especially fish. Finally, increased visitor activity due to fast growth of cruise tourism contributed to overcrowding at popular beaches, leading to contamination of land and marine resources with solid waste particularly on weekends and public holidays.

When the data were triangulated, the results of the qualitative data were confirmed by the findings of the quantitative data thereby adding validity and reliability to these results. Moreover, the frequency with which all interviewees raised the issue of unregulated use of the marine space by the informal industry (unregistered boats) suggests that there is cause for concern and this may be one of the drivers behind the aforementioned changes.

Level of threat to the physical-ecological carrying capacity

Capacity levels for the physical-ecological parameter of TCC (EC 2000)	Research Questions	Indicator (Coccossis & Mexa 2004)	Evidence from the research findings.	Threat to 'tipping point'
Acceptable levels of congestion or density of key areas e.g. coral	Is the level of congestion of coral reefs under threat of exceeding the	Damage to coral reefs	Anchor damage due to increased numbers of vessels; reef touching due to overcrowding (>200	High

reefs	acceptable level?		snorkelers per site; >29,000 reef touches per year).	
<b>Maximum acceptable loss of natural resources without significant degradation of ecosystem functions and biodiversity loss.</b>	Are natural resources under threat of exceeding the maximum acceptable loss?	Loss of marine flora and fauna (e.g. fishes)	Dredging of channel and port expansion in Castries; Increased noise pollution and turbulence from boat engines; oil slicks on the water; reduction in fish population.	High
<b>Acceptable levels of water and noise pollution on the basis of tolerance or the assimilative capacity of local ecosystems</b>	Is the level of noise and water pollution under threat of exceeding acceptable levels?	Water quality	Increased number of small vessels; increased noise pollution and turbulence from boat engines; oil slicks on the water; Release of human waste from small vessels.	High
<b>Intensity of use of transport in the marine environment, infrastructure and facilities.</b>	Is the intensity of use of transport in the marine environment exceeding acceptable levels?	No. of accidents/incidents in the marine environment.	Increase in the number of licensed and unlicensed small vessels; increase in conflict among users; harassment of guests on the beach; increase in crime against visitors.	High
<b>Use and congestion of utility facilities and services</b>	Are facilities and services under threat of congestion and overcrowding	Management and disposal of solid waste	Increased littering at popular beaches; increase in solid waste (plastic) found at coral reef sites	High

## Conclusion

These results suggest that it is perceived by stakeholders in the tourism industry that the intensified level of cruise tourism and its attendant activities in the marine environment may be pushing the physical-ecological carrying capacity level to its tipping point.

## Further work

Further work needs to be done to establish a framework for managing the increasing numbers of cruise visitors and their activities in the marine environment in Caribbean. This framework should be applicable to all Caribbean islands giving due consideration their varied physical and socio-cultural environments.

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