



OPEN ACCESS

EDITED BY

Costas Velis,
University of Leeds, United Kingdom

REVIEWED BY

Kiriaki M. Keramitsoglou,
Democritus University of Thrace, Greece
Asela Kulatunga,
University of Exeter, United Kingdom

*CORRESPONDENCE

Roxanne E. D. Graham
✉ w2005412@alumni.wmu.se

RECEIVED 28 May 2024

ACCEPTED 11 October 2024

PUBLISHED 10 December 2024

CITATION

Graham RED (2024) Plastic policy hypocrisies: evaluating the efficacy of bans and alternatives in the Eastern Caribbean. *Front. Sustain.* 5:1439958. doi: 10.3389/frsus.2024.1439958

COPYRIGHT

© 2024 Graham. This is an open-access article distributed under the terms of the [Creative Commons Attribution License \(CC BY\)](https://creativecommons.org/licenses/by/4.0/). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Plastic policy hypocrisies: evaluating the efficacy of bans and alternatives in the Eastern Caribbean

Roxanne E. D. Graham*

World Maritime University–Sasakawa Global Ocean Institute, Malmö, Sweden

This study critically examines the socio-economic impacts and practical challenges of implementing plastic policies and regulations such as bans in Caribbean small island developing states (SIDS), within the broader context of global environmental efforts. By employing a mixed-methods approach, the research uses qualitative data from expert interviews from the Windward Islands in the south-east of the Caribbean, and on the ground observations and documentation of plastic and alternative usage in the island of Grenada. The findings highlight a significant “plastic policy hypocrisy,” where bans on single-use plastics exist alongside a heavy reliance on imported goods predominantly packaged in plastic. This contradiction points to a broader issue in environmental policymaking, where surface-level solutions like bans are employed without addressing underlying systemic challenges, such as inadequate recycling infrastructure or lack of export opportunities for recyclable materials. The research highlights how these policies, though well-intentioned, may fall short in practicality and global alignment. The study highlights the need for holistic, globally informed, and context-sensitive approaches to marine environmental related policies in Caribbean SIDS. Emphasizing the integration of ecological, economic, and cultural dimensions, it advocates for regional and international collaboration to enhance marine litter specifically plastic policy development and technical expertise.

KEYWORDS

marine plastic pollution, plastic policy hypocrisy, marine litter, waste management, Caribbean SIDS, plastic bans, plastic alternatives

1 Introduction

The Caribbean Sea, a region marked by significant ecological importance and is a well known premier global tourist destination, faces a pressing environmental crisis. This crisis is primarily fueled by the growing challenges of marine litter and plastic pollution, with the Caribbean registering one-third more plastic waste per kilometer than the global average [United Nations Environment Programme (UNEP), 2019c; World Bank, 2019; Kanhai, 2022]. These environmental concerns are further exacerbated by complex waste management issues and a lack of adequate infrastructure, presenting substantial risks to the region’s biodiversity, tourism, and fisheries. These sectors form the economic backbone of the Caribbean (UNEP, 2019a; Kanhai, 2022; Fay and Morrison, 2007; Kinnaman, 2010; Riquelme et al., 2016; Diez et al., 2019; UNCTAD, 2017; Mycoo, 2020, 2022). The spread of plastics and other debris in Caribbean waters is especially detrimental to its rich biodiversity, endangering numerous marine species and fragile coral reef ecosystems (Siung-Chang, 1997; Eakin et al., 2010; Good and Bahr, 2021; Kanhai, 2022). Furthermore, the ecological damage has severe repercussions on the region’s economic resilience, particularly affecting tourism and fisheries that depend

heavily on the health of these natural resources (Cózar et al., 2014; Jambeck et al., 2015; Gould et al., 2020; Peterson, 2020; The Nature Conservancy, 2020; Baker, 2022; Trenchi, 2023).

In response to the escalating environmental crisis of marine plastic pollution in the Caribbean Sea, a significant number of Caribbean nations have enacted prohibition on single-use plastics (UNEP, 2019a,b; Abril Ortiz et al., 2020). This policy shift is designed to curtail the substantial influx of plastic waste that is exacerbating the deterioration of the region's marine environment (UNEP, 2019a; Abril Ortiz et al., 2020). These bans focus on items like plastic bags, straws, and expanded polystyrene (EPS) foam containers (UNEP, 2019a,b). Graham (2023b), research highlighted that in the Windward Islands of the Eastern Caribbean, the most common and significant regulatory measures in place are the bans on plastic and Styrofoam. According to UNEP (2018), continued enforcement of these bans is anticipated to lead to a decline in the utilization of plastic bags and Styrofoam, thereby reducing their presence in landfills. For instance, before the introduction of the ban, Grenada reported a decrease in plastic waste, from 16.4% of total waste in 2009 to 13.7% in 2018, as documented by the Grenada Solid Waste Management Authority (Grenada Solid Waste Management Authority (GSWMA), 2019). This reduction can be attributed to the profitable recycling and reuse practices of local enterprises and small businesses, particularly concerning plastic bottles (Gesellschaft für Internationale Zusammenarbeit (GIZ) 2015). With the continuation of these bans and related initiatives, a further reduction in plastic waste is anticipated.

While actions like the single use plastic ban are instrumental in reducing pollution and fostering sustainability, they also bring about socio-economic repercussions. These include impacts on local industries and shifts in consumer habits, necessitating a balanced approach to governance (Jambeck et al., 2015; Cózar et al., 2014). Navigating the economic and cultural complexities associated with plastic usage in the Caribbean is a significant challenge. The pervasive presence of plastic products in daily life, driven by their affordability and convenience, highlights the complexity of transitioning away from a dependency on plastics. To ensure policy measures are environmentally beneficial and socio-economically viable, it is crucial to consider these factors comprehensively. Achieving a balanced approach necessitates a careful examination of the local context, ensuring that efforts to reduce plastic usage do not adversely affect the cultural and economic fabric of Caribbean societies (Valenzuela-Levi, 2021).

It is important to also consider the broader global inconsistencies and challenges associated with implementing plastic reduction initiatives like plastics bans. A primary issue is the lack of a unified definition for "plastic bag," which significantly hampers efforts to curb their usage. Parker (2021) highlights this issue by pointing out that globally, there are seven different definitions of a "plastic bag," leading to varying standards across countries—for instance, France bans bags less than 50 microns thick, while Tunisia sets the limit at 40 microns. Moreover, the enforcement of these bans encounters numerous obstacles. The resistance from plastic manufacturers, the emergence of black markets for banned products, and the overall difficulties in enforcement illustrate the complexity of implementing such environmental policies effectively (Jamaica Gleaner, 2018; Muposhi et al., 2021). Scholarly research supports these observations, detailing the limited success of plastic bag bans. Muposhi et al. (2021) conducted a systematic literature review that sheds light on several contributing factors to this limited success, including the absence of

viable alternatives, limited state capacity for monitoring and enforcement, the prevalence of black markets, and the significant influence of the plastic industry. Additionally, research focusing on consumer consciousness and behavior toward the plastic bag ban in Kenya offers further insights into the multifaceted nature of these challenges. The study by Omondi and Asari (2021) strongly suggests the need for a comprehensive approach that addresses both the demand and supply sides of plastic usage. By understanding consumer attitudes, behavior, and the impact of the ban, policymakers can develop more effective strategies to reduce plastic waste.

Therefore, addressing plastic bag usage requires consideration of definitions, enforcement challenges, and consumer behavior. This study investigates the socio-economic challenges of plastic bans in the Windward Islands, aiming to enhance understanding of these issues and the overall strategies for combatting plastic pollution. It explores the intricate dynamics of relevant policies implementation, and its effects in a region often overlooked in global environmental discussions. This research also contributes to the global effort to combat marine plastic pollution by providing insights into the challenges Caribbean communities face especially with the bans, thereby informing policymakers, environmental organizations, and stakeholders. Moreover, the complex nature of marine plastic pollution requires comprehensive and practical approaches beyond mere bans. In summary, the study aims to suggest potential strategies which tackle both the demand and supply of plastic usage and to help bridge the gap between the global discourse and local realities regarding marine plastic pollution.

2 Methodology

2.1 Data collection

This study results were derived from semi-structured interviews conducted with 13 experts and policymakers within government organizations (GOs), such as key departments, agencies, and authorities overseeing fisheries, maritime issues, water, the environment, disaster management, tourism, and waste (refer to Supplementary material S1) and two key representatives from regional organizations with relevant projects and programs across most of the islands. These individuals play a pivotal role in shaping and implementing policies pertinent to environmental matters including marine plastic pollution across the five English-Speaking Windward Islands. In the Caribbean, governments are the predominant policy influencers (Hinds, 2019). The list of participants also included representatives from regional organizations with projects and programs that support plastic waste initiatives across most of the islands. The majority of interviews were conducted via Zoom (one in-person).

The findings presented herein derive from a targeted analysis of responses to a subset of questions, part of a broader questionnaire developed for a thesis project. These questions (see Supplementary material S2), focused on exploring marine litter including marine plastic pollution management with a specific focus on cross-boundary partnerships and collaborations for marine litter and climate change impacts on marine litter, and were administered during a series of interviews conducted from December 22, 2022, to February 28, 2023. The findings in this report are derived from participant responses to themes surrounding support, cooperation,

collaboration, and management challenges associated with marine debris and plastic pollution (see [Supplementary material S3](#)).

The interviews strictly adhered to ethical guidelines throughout the data collection process. Ethical approval was granted by The World Maritime University Research Ethics Committee, ensuring the research met stringent standards. The interviews were further transcribed using Otter.ai software. Raw data (including the interview recordings and transcriptions) were anonymized and stored on a secured drive.

In addition to the interviews, a distinct case study was carried out in Grenada March 2023. This study focused on documenting the usage of plastic and its alternatives in areas where packaging occurs often, such as *inter alia* supermarkets, pharmacies, food vendors, and variety stores. This information was also anonymized and stored on a secure drive. To ensure objectivity and avoid any biases during the observation phase, data collection was strictly binary, based on a simple “yes” or “no” criteria for questions that surrounds the topic of packaging alternatives at checkout, availability of single-use plastic items, recycling and reusability promotion, incentives for reusability, and loose produce packaging (for supermarkets and market vendors only).

2.2 Data analysis and integration

The transcribed interview data were analyzed thematically with the aid of NVivo software, aiming to identify themes from the responses. NVivo enables the automated extraction of themes and related subthemes from a text set ([Jackson et al., 2019](#)). The key focus area included “Marine Plastic Pollution,” emphasizing terms (individually and in combination) like “marine litter,” “marine debris” “plastics,” and “plastic pollution.” The analysis further delved into emerging sub-themes including “Contributory Factors” looking at different “sources and causes,” highlighting “single-use plastics” and “packaging waste.” Attention was also given to strategies for addressing these issues and were categorized under the sub-theme “Policy and Regulation,” with a focus on “plastic bans,” “waste management,” and “mitigation strategies.” “Innovation and Alternatives” was also an emerging sub-theme, which examined recyclable and biodegradable materials, and potential circular economy models. This is also where the case study documentation exercise also came in useful. The exploration also extended to a final sub-theme “Community and Behavioral Responses,” looking into “consumer behavior” and “responses to alternatives.”

2.3 Limitations to the study

The study utilized an integrated approach combining factual data (such as operational information) and professional opinions, which, while informative for policymaking, did not involve a direct, detailed analysis of the participants’ responses. As a result, certain subtleties or individual insights from participants may not have been fully captured or explored. Time constraints partially contributed to this too.

To address these limitations and ensure unbiased findings, several strategies were employed. First, professional opinions were cross-referenced with factual operational data to minimize subjectivity. Additionally, a clear framework for integrating the data and opinions was maintained, ensuring that the analysis remained focused on

objective insights relevant to policymaking. While time constraints limited a detailed analysis of individual responses, a priority was placed on collecting a diverse range of input to capture broader perspectives, helping to reduce the potential bias introduced by the limitation.

3 Findings and discussion

3.1 Marine plastic pollution contributory factors

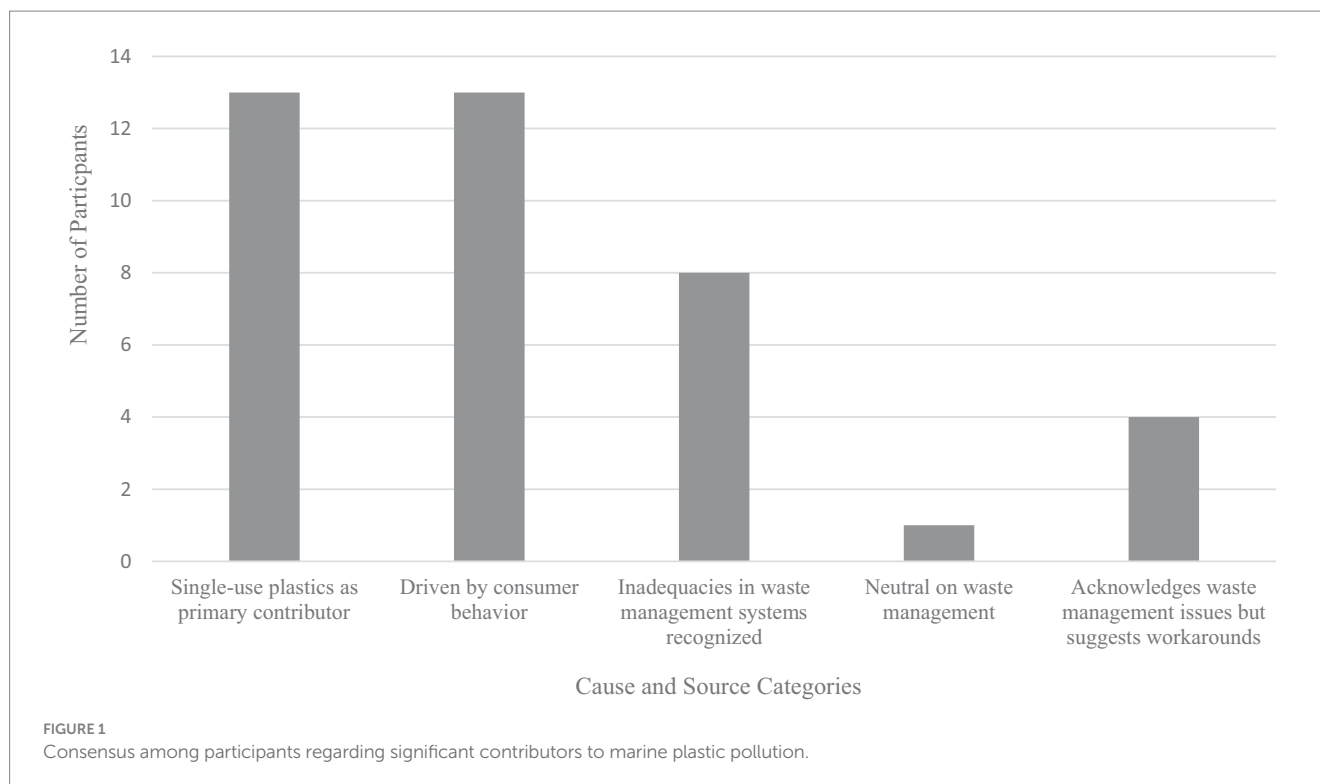
3.1.1 Participants’ perspectives on sources and causes

The analysis revealed unanimous consensus among the participants regarding the significant role of single-use plastics in contributing to marine plastic pollution. All respondents (100%) identified these materials as the primary contributors, while highlighting their prevalent discovery on beaches and coastal areas ([Figure 1](#)). The investigation into the drivers behind the accumulation of single-use plastics in marine and coastal environments pointed to consumer behavior as a unanimous concern. All participants (13/13) acknowledged a convenience culture that propels the use of disposable plastics. Moreover, a majority (8/13) cited inadequacies in waste management systems as exacerbating the problem. When prompted about waste management, the remaining participants acknowledged it as a significant issue. However, opinions diverged slightly, with one participant remaining neutral and four recognizing longstanding inadequacies in waste management but also suggested that there is potential for improvements within existing frameworks.

3.1.2 Contributory factors: a wider lens

In the Eastern Caribbean, a significant challenge impacting environmental management is the inadequate infrastructure and resources for effective waste and plastic management. Many of these islands lack essential facilities for recycling and waste processing, leading to a considerable increase in environmental pollution. This infrastructural deficit is a critical factor that undermines the effectiveness of policies like plastic bans, as limited alternatives and recycling options are available ([Kaza et al., 2018](#)). The situation is exacerbated by the financial and human resource limitations dedicated to environmental management. Caribbean island states frequently face budgetary constraints that make it difficult to invest in necessary infrastructure and technology for waste management and pollution control. This financial challenge is further intensified by a lack of trained personnel and specialists in waste management and environmental protection, leading to difficulties in both policy implementation and operational efficiency. As a result, not only is the development of new waste management facilities hindered, but the maintenance and effectiveness of existing facilities are also negatively affected.

Moreover, the impact of global trade dynamics and external policies significantly influences the environmental challenges faced by these island nations. The importation of goods, a large portion of which are packaged in single-use plastics, contributes substantially to the waste problem ([UNEP, 2004](#); [UNEP and One Ocean Hub, 2022](#)). Additionally, policies and regulations in larger countries can have far-reaching effects on smaller nations. For instance, the decision by major economies to restrict the import of recyclable waste has shifted



the waste management burden onto smaller, less equipped nations, exacerbating their challenges in managing waste effectively. This situation highlights the crucial role of global trade and policy decisions in shaping the environmental landscape of the Caribbean. It supports the need for international cooperation and the development of equitable policy frameworks that consider the unique challenges faced by smaller states in managing environmental pollution.

3.2 Policy and regulation

3.2.1 Participants' perspectives on plastic bans and other regulations

Noted from the interviews was a gap between policy and implementation. Approximately 10 out of 13 participants (77%), pointed to a fundamental challenge in the discrepancy between environmental policy intentions in general and their practical application. This gap is notably pronounced in the management of marine related issues including litter and plastic pollution, where policies, although theoretically designed to mitigate such issues, frequently fall short in real-world execution. This has been observed on an international scaled as well according to [Clapp and Swanston \(2009\)](#). One such example is the implementation of the plastic ban, which, as reported by Participant 6, was instituted without any proper research. This lack of thorough preparatory analysis reinforces the importance of evidence-based policymaking and the need for comprehensive evaluation and consultation before the enactment of environmental regulation.

Seven participants expressed concerns that the marine-related regulatory frameworks in the Eastern Caribbean, often linked to marine debris issues, are perceived as lacking scientific evidence, being outdated, or not specific enough. Although only expressed by 7

participants, this perspective is crucial in the face of environmental challenges that are continually evolving due to factors such as changes in consumption patterns, advancements in materials, and the dynamics of global trade. The feedback indicates the need for regulatory frameworks that are flexible and responsive, capable of integrating new information and adapting to changing circumstances.

It is essential to acknowledge the ongoing initiatives aimed at mitigating marine plastic pollution in the Caribbean region. According to the insights provided by participants 2, 3, and 12, there is a consensus on the need to sustain or increase investment in these efforts. Moreover, a strategic approach to securing funding involves aligning projects with prevalent global themes and terminologies, such as the "circular economy." Given that effective waste management is a foundational element of the circular economy framework, it is advisable to craft funding proposals that emphasize this connection. This approach not only aligns with current environmental and economic paradigms but also enhances the potential for attracting financial support from global funding entities interested in promoting sustainable practices.

Main examples of ongoing initiatives include the "Regional Marine Litter Management Strategy for the Wider Caribbean Region, 2021," which updates the initial "Caribbean Regional Action Plan on Marine Litter (RAPMaLi), 2014." This strategy aims to deliver a comprehensive response that encompasses solid waste management improvements, public education, and enhanced cooperation, guided by UNEP. Additionally, the Cartagena Convention, through its protocols such as the Protocol Concerning Pollution from Land-Based Sources and Activities (LBS Protocol), provides a legal framework to directly address marine litter at its source. Another key initiative is the "Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (GPA)," managed by UNEP. This program assists Caribbean countries in developing

national and regional action plans to reduce marine litter, including plastics. It serves as a platform for sharing knowledge, best practices, and technologies, fostering regional collaboration to tackle marine pollution challenges.

Also, the Organization of the Eastern Caribbean States (OECS) RePLAST and ReMLit programs represent significant steps toward addressing marine litter in the Eastern Caribbean. The RePLAST OECS project, under the umbrella of the ReMLit initiative, has been instrumental in promoting a culture of waste separation and recycling, aiming for a sustainable circular economy. According to [Unite Caribbean \(2023\)](#), the initiative has so far collected over 150,000 lbs. of plastic and has thus been observed to help extend the lifespan of landfills, reduce urban flooding, and enhance community engagement in environmental stewardship for future sorting and proper disposal.

According to Participants 3 and 4, at the national level, individual countries like St. Lucia have crafted and, in many other cases, are crafting tailored marine litter policies and regulations, showcasing a proactive approach to developing localized solutions. Moreover, Participant 2 highlighted the long-standing commitment to combat plastic pollution, demonstrating that such efforts are not a recent phenomenon. This participant referenced the establishment of the Non-Biodegradable Waste Control Act of 2018 in response to initiatives that began as early as 2015. The act was the result of concerted efforts by a dedicated committee formed specifically to address the issue of plastic waste. Furthermore, participant 2 pointed to Grenada's active involvement with the Ellen MacArthur Foundation's initiatives. As part of this engagement, Grenada has pledged to provide annual reports detailing its ongoing actions and achievements in the fight against plastic pollution. These initiatives are indicative of a broader commitment to waste management and the promotion of a circular economy. As for bans as a form of regulation, they are widely recognized as a component of a more comprehensive strategy or broader framework aimed at combating marine litter in the region ([UNEP, 2019a](#)).

Moreover, a primary challenge in effectively implementing policies against plastic pollution, as expressed by 61.5% of participants, revolves around the issue of enforcement and compliance. Ensuring adherence to plastic bans and waste management regulations, both on land and sea is significantly hampered by a lack of resources dedicated to enforcement actions prevailing resistance to change among the public. This scenario is further complicated by the societal reluctance to adopt new practices, thereby amplifying the difficulty in achieving widespread compliance. Several participants echoed more related and specific challenges, with Participant 12 succinctly encapsulating the collective insights.

“Addressing the challenge of plastic pollution and solid waste management requires a comprehensive and coordinated approach. Historically, initiatives like the World Bank-funded Solid Waste Management Project have highlighted the critical issues of fragmented laws and unclear enforcement authority. This ambiguity in regulation, coupled with the inherent conflict of interest when service providers are also enforcers, significantly undermines our efforts. We've seen, across various jurisdictions and attempts, that the lack of clarity, inconsistent fines, and a slow judicial process exacerbate the problem. Moreover, despite numerous projects aimed at strengthening enforcement capacity, we continuously encounter barriers such as lack of political will and competing priorities. The

complexity of managing marine-based sources of pollution adds another layer of difficulty, emphasizing the need for both national and international solutions. Innovative financing mechanisms, like integrating waste management costs into utility bills, have shown promise but are not universally applied. Ultimately, effective waste management and pollution control demand not only clear and consistent legislation but also a shift in societal attitudes and priorities.”

3.2.2 Challenges in the plastic ban and regulations: a wider lens

The inadequacy of waste management infrastructure, particularly in terms of recycling facilities, presents a substantial barrier. [Graham \(2023a\)](#) highlights the paradox faced by the Windward Islands where products marked as recyclable are imported without the presence of local facilities to process them or the capability to export them for recycling. This disconnect between the recycling goals set by policies and the practical capability of existing infrastructure is stark. Several studies discussed how the geographical and logistical constraints of SIDS significantly impact their ability to manage waste effectively, including recycling ([Malindretos, 2012](#); [Kensen, 2019](#); [Elgie et al., 2021](#); [Wang et al., 2021](#)). Furthermore, [Andrady and Neal \(2009\)](#) argue that environmental challenges often necessitate leveraging regional and global knowledge, technology, and innovation—a notion that reinforces the importance of a collective approach to waste management. The frequent omission of waste management infrastructure from discussions and prioritizing the circular economy unveils a crucial gap ([Graham, 2023a](#)). Without a functional waste management and recycling system, the foundation necessary for a circular economy and sustainable practices within the region is missing.

Additionally, economic and social factors emerge as significant hurdles, particularly regarding the shift from plastic products to sustainable alternatives. These factors bring to light the delicate balance required between advancing environmental goals and managing economic impacts. This balance shows the necessity for policies that not only support environmental objectives but also foster economic resilience and encourage social acceptance of new, sustainable practices.

Another challenge lies in altering public awareness and behavior. While awareness campaigns have been successful to some extent in educating the public, changing deep-seated consumer behaviors has proven to be a slow and challenging process. This difficulty highlights the vital role of education and engagement in shifting societal norms toward more sustainable consumption patterns.

Lastly, the transboundary nature of plastic pollution highlights its global extent. This illustrates that environmental impacts of waste are not confined to national borders, thus presenting a substantial challenge that requires a coordinated international response for effective management. This global dimension highlights the insufficiency of localized efforts to address a problem inherently international in scale. Specifically, Caribbean Small Island Developing States (SIDS) find themselves at a unique intersection of environmental vulnerability and opportunity. Affected by debris carried by the prevailing currents of the North Atlantic Gyre, as documented by the [World Bank \(2019\)](#), and by debris transported by south equatorial currents that originate above Venezuela, stretching into the North Atlantic gyre ([Hurley et al., 2019](#)), these nations are positioned to

advocate strongly for enhanced access to technology, resources, and expertise. This predicament provides substantial grounds for Caribbean SIDS to leverage international partnerships. Such collaborations could offer pivotal support in navigating the complexities of global trade and environmental stewardship, pushing toward more sustainable waste management and circular economic practices.

However, a significant challenge remains the reluctance of wealthier nations—many of whom are among the largest polluters—to provide substantial financial support in the form of grants or other non-repayable funding. This reluctance has been evident in climate treaty negotiations, where financial commitments are often hesitant or fall short of what is needed (Roberts and Parks, 2006; Baer, 2012; Schulan and Heilinger, 2024). Such inadequacy limits the ability of smaller nations, particularly SIDS, to address environmental issues effectively. This can also be inferred in the context of plastic pollution, where wealthier countries produce the majority of plastic waste, and smaller nations import goods packaged in plastics but are then left to manage the environmental impacts locally and internationally, including transboundary legacy plastics carried by ocean currents (Jambeck et al., 2015) and evident in the Caribbean region (Ambrose and Walker, 2023; Walker, 2024). The lack of crucial financial support undermines the capacity of these vulnerable nations to implement meaningful solutions that would benefit not only their own environments but also contribute to global sustainability efforts.

3.3 Innovation and alternatives

3.3.1 Participants' perspectives: exploring compostable, biodegradable and "recyclable" materials and the potential for circular economy models

The transition toward compostable and biodegradable materials, particularly within circular economy frameworks, represents a pivotal strategy to mitigate the accumulation of persistent waste in terrestrial and marine environments. Such materials are not only eco-friendly but also decompose naturally, substantially reducing their environmental footprint and lessening impacts on marine ecosystems and the broader environment (Moshood et al., 2022).

Nonetheless, the findings reveal considerable challenges associated with adopting current alternatives to traditional plastics. Over 40% of participants reported that they are well aware of the general dissatisfaction of the expense and unavailability of alternatives, especially during the transition phase when plastic bans were instituted. Additionally, there was a lack of education and awareness about the ban among ordinary citizens, as well as impracticalities associated with the alternative materials offered (refer to Section 3.4).

The data in Figure 2 reveals significant challenges in the transition toward a circular economy. Notably, there is a complete absence of incentives for reusability, as all observations indicated "No" for this factor. This lack of incentives may hinder efforts to promote sustainable practices. Similarly, the promotion of recycling and reusability shows a predominantly negative outcome, indicating a need for greater educational efforts and awareness campaigns to support these initiatives.

The availability of single-use plastic items presents a mixed picture, with roughly equal instances of "Yes" and "No." This suggests that while some progress has been made in reducing these items, there is still a substantial presence of single-use plastics in the market. These findings highlight critical barriers to adopting alternative materials and emphasizes the need for comprehensive strategies to address these challenges. This feedback is essential for developing targeted interventions that can effectively support the transition to eco-friendly materials.

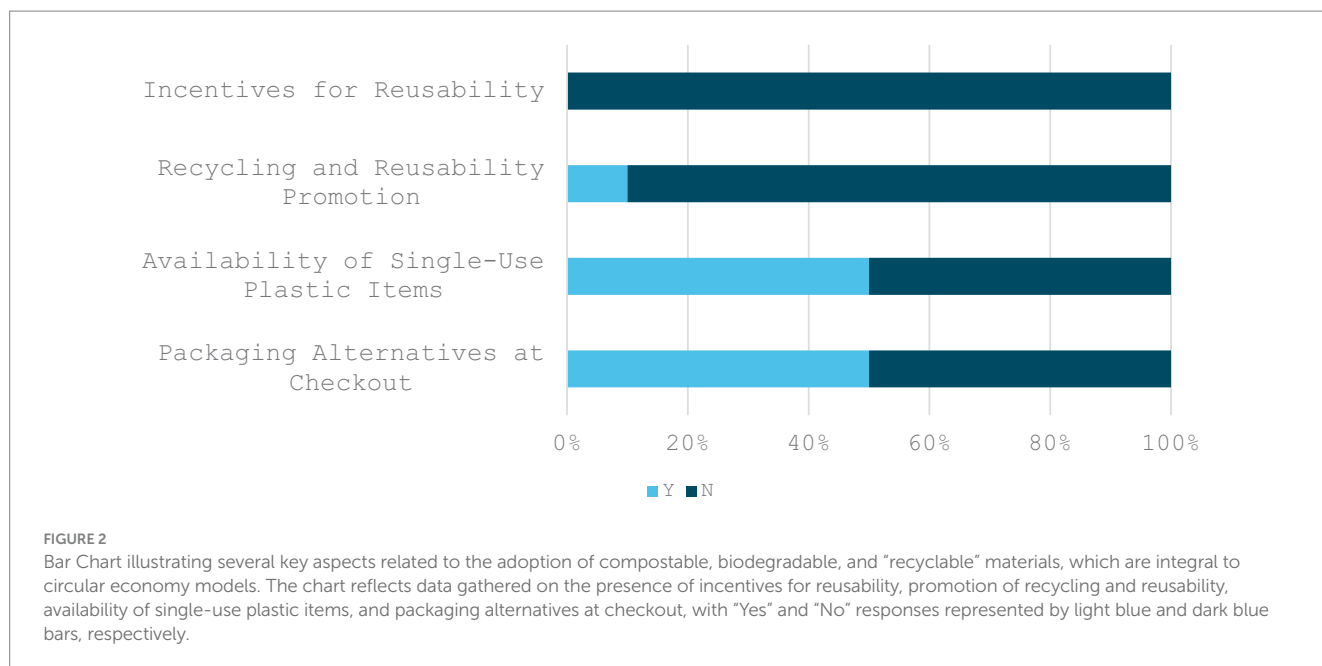
When examining the data closely, it becomes apparent that businesses lacking availability and packaging alternatives are predominantly small enterprises, such as small variety stores, small-scale food, and market vendors (refer to Supplementary material S4). This limitation becomes particularly acute in the context of a plastic ban, suggesting a need for substantial support and innovation in packaging solutions tailored for these enterprises. The impact of the plastic ban on these businesses is significant. It not only constrains their operations but also prompts concerns about the sourcing of plastic packaging. Some businesses might still be using plastic due to illegal importation or insufficient enforcement of the ban. Others might be utilizing their existing stock or relying on exemptions allowed under the ban. This situation shows the necessity for enhanced regulatory enforcement and support mechanisms to aid small businesses in transitioning to environmentally friendly alternatives.

It is also important to note that a similar assessment was conducted among supermarkets and market vendors regarding their packaging practices for fruits and vegetables. The findings revealed that none of the participants (0 out of 6) reported selling produce entirely loose without plastic packaging (refer to Supplementary material S4). Furthermore, in five out of the six cases, fruits and vegetables were packed in single-use clear bags or wrapped in cling wrap. This prevalent use of non-biodegradable plastic packaging not only contributes to environmental pollution but also hinders progress toward regulatory efforts aimed at reducing plastic waste.

3.3.2 Innovation and alternatives: a wider lens

The shift toward a circular economy faces numerous obstacles, including inadequate incentives for reusability and the persistent use of single-use plastics. A product's recyclability depends on the availability of recycling infrastructure. Graham (2023a) notes that although global industries are emphasizing the circular economy and exploring substitutes for traditional packaging materials, particularly plastics, these alternatives, such as recyclable plastics, still end up accumulating in the open-air landfills of the Windward Islands.

The effectiveness of a circular economy depends significantly on the willingness of consumers and businesses to adopt sustainable practices. However, as highlighted in the literature, without effective incentives, such as rewards or economic benefits, consumers and collectors are less likely to engage in behaviors that support system circularity. The distinction between passive and active return approaches in circular economies is crucial, with the latter generally more effective due to its focus on value creation through incentives (De Giovanni, 2022). The effectiveness of incentives in promoting sustainable behaviors within the circular economy is well-documented in the scientific literature. A systematic review by Kurniawan et al. (2021) highlights those aligning incentives with circular economy



principles significantly motivates sustainable actions and policies (Kurniawan et al., 2021). Furthermore, empirical evidence suggests that economic-financial gains from circular production practices are crucial, yet underexplored areas that define the financial viability and attractiveness of adopting circular economy models (Gonçalves et al., 2022). These studies suggest that the transition to a circular economy not only requires effective incentive mechanisms but also a deeper understanding of their economic impacts. These insights can guide businesses and policymakers in structuring incentives that not only encourage circular practices but are also financially sustainable.

Educational efforts and awareness are equally critical in promoting recycling and reusability. A guide for public authorities on boosting the circular economy underscores the role of incentives in addressing market failures that hinder the adoption of circular practices. These incentives not only help in steering markets toward sustainability but also play a pivotal role in driving behavioral changes that are necessary for the successful implementation of circular economies. These incentives are designed to price negative externalities and improve the competitiveness of value chains, thereby yielding net environmental benefits (Katrakis et al., 2021). By pricing negative externalities and enhancing value chain competitiveness, these incentives yield net environmental benefits.

Moreover, the continuous presence of single-use plastics indicates a mixed success in their reduction. This ongoing challenge highlights the need for international collaboration and innovative approaches to waste management, particularly in SIDS, where the impact of such pollution is disproportionately severe. At this juncture, it's crucial for international organizations to intensify their efforts.

The International Union for Conservation of Nature (IUCN) plays a pivotal role in facilitating international cooperation among Small Island Developing States (SIDS) to address plastic pollution, which is critically relevant for these regions. SIDS are disproportionately affected by plastic waste due to their geographic locations at the crossroads of major ocean currents, making them dumping grounds for global marine debris. The IUCN's advocacy for a robust international treaty on plastic pollution showcases the essential active

participation of SIDS in global environmental governance. This involvement is not only about managing the immediate impacts of pollution but also about advancing a broader circular economy approach that promotes resource efficiency and waste reduction. The emphasis on a comprehensive treaty that encompasses the entire lifecycle of plastics reflects a strategic push toward sustainability that aligns with the principles of the circular economy, vital for SIDS whose economies and environments are intrinsically linked to their natural surroundings (IUCN, 2023).

Similarly, UNEP supports SIDS through customized initiatives that enhance their transition toward a circular economy. These initiatives are tailored to address the unique environmental and economic challenges faced by SIDS, promoting sustainable waste management and resource efficiency. By fostering local recycling innovations and reducing reliance on imported materials, UNEP's programs help build resilient local industries and mitigate the environmental impacts of waste. This strategic international support is crucial, as it complements local efforts and aligns with broader global sustainability goals, demonstrating the essential role of cooperation in overcoming the persistent challenges of single-use plastics and promoting circular economic practices (International Institute for Sustainable Development, 2022; UNEP, 2022).

Moreover, studies in sectors like construction have shown that a more systematic approach is required, involving the identification, and addressing of knowledge gaps across various dimensions such as economic, environmental, and methodological aspects. This approach is crucial for the advancement and effective implementation of circular economy practices (Gasparri et al., 2023). Insufficient research likely preceded the implementation of plastic bans in Grenada and other Caribbean islands because there may have been a lack of awareness about the specific challenges and potential unintended consequences in these regions, such as limited or failing alternatives (discussed further in Section 3.4), impacts on local economies, and rough transition with negative public perception.

Furthermore, the adoption of a life cycle perspective is instrumental in understanding the full environmental impact of

materials proposed as alternatives to conventional plastics (Park et al., 2024; Guo et al., 2023). A plausible scenario demonstrating these impacts has been considered and can be viewed in the [Supplementary material S5](#). Life Cycle Assessment (LCA) provides a comprehensive method for examining the environmental effects associated with all the stages of a product's life from cradle to grave (i.e., from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling) (Alhazmi et al., 2021; Gandhi et al., 2021; Ram and Sharma, 2017). LCAs can help determine the most environmentally preferable options within a group of competing products or processes, making it an essential tool in environmental decision-making (Alhazmi et al., 2021; Kousemaker et al., 2021; Finnveden et al., 2009).

When evaluating alternatives such as biodegradable, compostable, and recyclable materials, it is crucial to consider each material's production impacts, usage efficiency, and end-of-life options (Geyer et al., 2017). For instance, the production of biodegradable plastics is overall known for its harmlessness—often requiring less energy and results in lower carbon emissions compared to traditional plastics (Shen et al., 2020; Song et al., 2009). However, their environmental benefit is contingent upon proper industrial composting facilities, which may not be available in all regions (Hopewell et al., 2009). Recyclable materials, on the other hand, can significantly reduce waste, but the feasibility of recycling depends heavily on the local recycling technologies and market demand for recycled materials (Ragaert et al., 2017). Each alternative must be scrutinized not only for its functional capabilities but also for its lifecycle emissions and waste outcomes.

3.4 Community and behavioral responses

3.4.1 Participants' perspectives: consumer behavior and the adoption of alternatives to plastic

Culturally, the reliance on plastic is deeply engrained into the daily routines of Caribbean communities. According to Phillips et al. (2020), the use of plastic, especially for packaging imported goods, is a necessity shaped by the logistical constraints of island economies. Moving away from plastic thus requires a shift in long-established consumption patterns and cultural norms, demanding both infrastructural improvements and changes in consumer behavior and attitudes toward plastic.

Each participant agreed that consumer response or behavior is pivotal in the success of plastic policies. An emerging issue raised by at least 70% of the participants was the introduction of alternatives like paper straws and wooden utensils has elicited mixed reactions. It was generally expressed that while some consumers have embraced these changes, others find the alternatives unsatisfactory, impacting their daily life and perception of environmental measures. This discrepancy shows a significant gap between the objectives of environmental policies and actual consumer practices. The continued preference for plastic-packaged goods reveals that alternative solutions are either not fully accepted, lack accessibility, or fail to attract consumers.

The mixed reactions to alternatives such as paper straws and wooden utensils further illuminate the complexities involved in shifting consumer habits. These alternatives, while environmentally friendly, often face challenges in terms of functionality, convenience, and consumer acceptance. For instance, paper straws become soggy quickly,

bioplastics [polylactic acid (PLA)] straws cracks easily, and wooden utensils, such as forks and spoons, have been criticized for their practical limitations: forks can sometimes have splinters, and spoons are too flat for effectively consuming soup, which is a common street food dish in Caribbean islands (see photographic evidence highlighted in [Supplementary material S6](#)). EPS alternatives, biodegradable foam, also cannot withstand heat. This discrepancy indicated the challenge of finding a balance between environmental concerns and practical consumer needs. It illustrates the importance of developing alternatives that not only aim to reduce environmental impact but also align with consumer expectations and satisfaction for functionality and ease of use (Brooks et al., 2018), especially in Low- and Middle-Income Country (LMIC) SIDS, where the price of food and beverages is relatively high.

3.4.2 Community and behavioral responses: a wider lens

In many regions, especially in less-developed island nations, the lack of viable and economical alternatives poses a significant challenge to the effective implementation of plastic bans. Valenzuela-Levi (2021) highlights the unintended environmental consequences that can arise when alternatives to single-use plastics, such as paper or biodegradable options, are not sustainably sourced or produce higher environmental footprints. For instance, bio-plastics PLA straws while biodegradable, require specific conditions for composting which are typically only available in industrial settings. This requirement can limit their practicality for reducing plastic pollution if adequate facilities are not accessible (Costa et al., 2023). Moreover, the degradation of bioplastics like PLA, can vary and sometimes lead to unexpected environmental impacts, such as changes in soil nutrients or toxicity issues due to incomplete biodegradation. These factors necessitate careful consideration of the ecological footprint of bioplastics (Ali et al., 2023).

This situation further complicates the narrative around plastic bans, suggesting that policy decisions need to be informed by a comprehensive understanding of how all stakeholders are affected and the environmental impacts of alternatives.

Despite the implementation of these bans, there remains a strong reliance on plastic-packaged goods among consumers. This pattern indicates that while policies aim to reduce plastic usage, the continued preference for plastic-packaged goods suggests that alternatives have not been fully embraced or may not be sufficiently available or appealing to consumers. Transitioning away from plastic necessitates more than just policy changes; it requires cultural and behavioral shifts (Popovic et al., 2019). These shifts involve altering long-established habits and preferences, which is no small agenda. Consumers have grown accustomed to the convenience of plastic packaging, and breaking away from this norm requires concerted effort. According to Popovic et al. (2019), changing consumer behavior takes time—sometimes decades—and involves consistent messaging via education and awareness campaigns. Additionally, the collective mindset must evolve to the point where communities recognize the environmental impact of plastic and actively seek alternatives.

However, the current implementation of plastic bans can sometimes create a perception of hypocrisy among consumers. In countries where grocery items, from vegetables wrapped in cling wrap to imported products packaged in plastic, are still widely available, consumers find themselves purchasing plastic-packaged goods while being denied plastic bags due to their perceived environmental harm. This scenario highlights a critical gap in policy, as measures seem to address only part

of the plastic problem, leaving the larger issue of plastic packaging unaddressed. This disjointed approach undermines the overall effectiveness of plastic bans and emphasizes the need for comprehensive strategies that consider the full lifecycle and impact of plastic products.

3.5 Critical analysis of findings in the context of existing research

This research enriches the dialog surrounding the challenges and potential strategies for combating marine plastic pollution, particularly in the Caribbean SIDS context, by emphasizing the unique nature of policy implementation, societal responses, and infrastructural constraints. The findings from this study resonate with and extend existing research by highlighting persistent gaps in waste management infrastructure, the socio-economic implications of plastic bans, and the complex dynamics of consumer behavior.

Against the backdrop of the high carbon footprints of celebrities (Gössling, 2019; Barros and Wilk, 2021) and developed nations (and adopting alternatives that burden society financially and create practical difficulties due to their inefficiency and limited effectiveness heightens perceptions of inequity and inconsistency in global environmental efforts). The focus on these groups is pivotal as they often lead in consumption trends and public discourse on environmental practices, yet their substantial impact contrasts sharply with the more modest means and smaller scale impacts of lower-income populations. The alternatives presented in the case of Grenada, while intended to be eco-friendly, often fall short of expectations, leading to frustration and skepticism of the true viability in addressing environmental issues. This also raises questions about whether such relatively small-scale initiatives are substantial enough to make a meaningful difference in addressing the vast and complex issues of global environmental degradation and climate change.

The strain of adopting these environmental standards, often marked by inefficiency and practical difficulties, not only underlines the infrastructural and policy gaps that Caribbean islands face but also brings to light the significant economic and social implications for local communities. These challenges, coupled with the behavioral and cultural hurdles in aligning with global environmental policies, underscore the complexities involved in making substantive environmental changes in Caribbean SIDS. This sets the stage for examining how these global practices impact local realities, and whether the measures taken are plausible.

In relation to infrastructure and policy gaps, previous research has consistently shown that effective waste management systems are fundamental to addressing environmental challenges, including marine plastic pollution. This study's findings underscore the inadequacies in recycling and waste processing facilities in the Caribbean, which parallel the global challenges faced by other small island developing states (SIDS) as noted by authors like Malindretos (2012) and Wang et al. (2021). The critical gap between the goals of plastic reduction policies and the practical ability to implement these policies due to infrastructural limitations reinforces the need for integrated approaches that combine policy innovation with infrastructure development. This aligns with the broader literature that calls for a synergy between environmental policies and the necessary logistical and material support to make them effective (Andrady and Neal, 2009; Graham, 2023a).

The socio-economic repercussions of plastic bans, as identified in this research, mirror the complexities documented in prior studies. The transition away from plastic, while environmentally strategic, poses significant challenges for local economies and consumer habits (Jambeck et al., 2015; Cózar et al., 2014). The current study adds depth to this discussion by illustrating how these bans impact small businesses and local industries, which often struggle to find viable alternatives to plastic packaging. This reflects broader findings in the literature, which emphasize the need for policies that do not merely prohibit but also provide or stimulate the development of alternative solutions (Valenzuela-Levi, 2021; Omondi and Asari, 2021).

The findings related to consumer behavior and the effectiveness of policy measures resonate with previous studies that stress the importance of aligning environmental policies with community values and practices (Phillips et al., 2020; Brooks et al., 2018). The reluctance to adopt alternatives like paper straws or biodegradable products highlights the cultural and practical preferences that influence consumer choices, which is consistent with observations by Popovic et al. (2019) regarding the slow and complex process of changing consumer behavior. The study adds to the discourse by suggesting that successful policy implementation requires not only the provision of alternatives but also a concerted effort to shift cultural norms and consumption patterns through education and engagement.

4 Emerging underlying issues and conclusion

A central finding in this research is the inherent contradiction in plastic policies, which are often perceived as hypocritical. This perception stems from the stark contrast between the intentions of these policies and their practical outcomes in local contexts. A significant contributor to this discrepancy is the heavy dependence on the importation of products predominantly packaged in plastics. Despite the implementation of plastic bans, this reliance on imported, plastic-wrapped goods perpetuate a cycle of plastic consumption, highlighting deeper systemic issues, such as infrastructural inadequacies, economic dependencies on imported goods, and entrenched cultural habits, all compounded by the logistical complexities unique to island geographies.

In LMICs, particularly in the Caribbean, these systemic issues become even more pronounced. The critical need to promote sustainable practices arises from various environmental challenges. Firstly, the widespread reliance on single-use plastics and other non-biodegradable materials has led to significant environmental degradation, notably in marine ecosystems. This problem is exacerbated by the inadequate waste management and recycling infrastructure in many island nations, resulting in improper disposal and the accumulation of waste. Secondly, there is often a notable gap in awareness among both the public and private sectors about the environmental impact of their consumption patterns and business practices. This lack of awareness can lead to unsustainable choices that further contribute to environmental harm.

Addressing these issues requires an integrated effort to enhance public awareness and implement permanent educational programs. Raising awareness about the general environmental impact of everyday actions is crucial in fostering a culture of sustainability. Educational programs can play a pivotal role in informing individuals and organizations about the benefits of eco-friendly practices and the long-term advantages of preserving natural resources. These initiatives

can encourage the adoption of sustainable habits, such as reducing plastic use, recycling, and supporting eco-friendly products and services. However, it is important to note that for consumers, this requires access to sustainable options that can easily be integrated into their daily lives. By creating an environment where sustainable choices are encouraged and facilitated, long-term environmental sustainability can be achieved, which can influence supply and demand, and potentially increase investment in locally grown produce. This suggests that as more people opt for sustainable options, it could shift market dynamics to favor eco-friendly products and encourage investment in local agriculture and sustainably-produced, locally-made products, benefiting both the environment and the local economy.

Looking ahead, future studies could allocate more time and resources to conduct a detailed analysis of participants' responses. This enhanced focus will allow for a more comprehensive understanding of what feeds policy makers' and experts' insights beyond operational and functional information, helping to address and reduce the risk of overlooking critical nuances. Future studies could also include feasibility assessments of the local and regional markets for recycled products, evaluating demand, potential niche markets, export opportunities, economic viability, and the impact of regulations to ensure the sustainability and profitability of recycling initiatives in Caribbean SIDS. Lastly, future research could benefit from a detailed analysis of existing waste collection networks and the strategic placement of recycling and incineration facilities to optimize waste management in Grenada and other islands of Eastern Caribbean. Such analysis is crucial as it can help identify critical gaps and inefficiencies within current infrastructures, enabling the development of more effective and sustainable waste management solutions. Additionally, understanding the geographical and logistical specifics of waste collection can guide policymakers and stakeholders in making informed decisions about where to allocate resources and how to design facilities that align with environmental, economic, and social goals of the region.

Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#), further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by World Maritime University Research Ethics Committee. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

References

- Abril Ortiz, A., Sucozhañay, D., Vanegas, P., and Martínez-Moscoco, A. (2020). A regional response to a global problem: single use plastics regulation in the countries of the Pacific Alliance. *Sustain. For.* 12:8093. doi: 10.3390/su12198093
- Alhazmi, H., Almansour, F. H., and Aldhfeeri, Z. (2021). Plastic waste management: a review of existing life cycle assessment studies. *Sustain. For.* 13:5340. doi: 10.3390/su13105340

Author contributions

RG: Conceptualization, Formal analysis, Methodology, Visualization, Writing – original draft, Writing – review & editing.

Funding

The author declares that financial support was received for the research, authorship, and/or publication of this article. This work would not have been possible without the generous funding by The Nippon Foundation of the World Maritime University (WMU) - Sasakawa Global Ocean Institute as well as for The Nippon Foundation and WMU-Sasakawa Global Ocean Institute's 'Closing the Circle Programme: Marine Debris, Sargassum and Marine Spatial Planning' in the Eastern Caribbean.

Acknowledgments

I am especially grateful for the invaluable support and guidance provided by my PhD supervisors, Professor Ronan Long and Associate Professor Zhen Sun. Special thanks is also extended to the participants of this research including senior-level representatives and experts from the various relevant governmental ministries and agencies, across the Windward Islands.

Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/frsus.2024.1439958/full#supplementary-material>

- Ali, S., Isha, , and Chang, Y. C. (2023). Ecotoxicological impact of bioplastics biodegradation: a comprehensive review. *PRO* 11:3445. doi: 10.3390/pr11123445

- Ambrose, K. K., and Walker, T. R. (2023). Identifying opportunities for harmonized microplastics and mesoplastics monitoring for Caribbean Small Island developing states using a spatiotemporal assessment of beaches in South Eleuthera, The Bahamas. *Mar. Pollut. Bull.* 193:115140. doi: 10.1016/j.marpolbul.2023.115140

- Andrady, A. L., and Neal, M. A. (2009). Applications and societal benefits of plastics. *Philos. Trans. R. Soc. B Biol. Sci.* 364, 1977–1984. doi: 10.1098/rstb.2008.0304
- Baer, P. (2012). Who should pay for climate change? not me". *Chi. J. Int'l L.* 13:507.
- Baker, D. (2022). "Caribbean tourism development, sustainability, and impacts" in *Contemporary Issues Within Caribbean Economies*, 235–264.
- Barros, B., and Wilk, R. (2021). The outsized carbon footprints of the super-rich. *Sustainability* 17, 316–322. doi: 10.1080/15487733.2021.1949847
- Brooks, A. L., Wang, S., and Jambeck, J. R. (2018). The Chinese import ban and its impact on global plastic waste trade. *Sci. Adv.* 4:eaat0131. doi: 10.1126/sciadv.aat0131
- Clapp, J., and Swanston, L. (2009). Doing away with plastic shopping bags: international patterns of norm emergence and policy implementation. *Environ. Polit.* 18, 315–332. doi: 10.1080/10644010902823717
- Costa, A., Encarnação, T., Tavares, R., Todo Bom, T., and Mateus, A. (2023). Bioplastics: innovation for green transition. *Polymers* 15:517. doi: 10.3390/polym15030517
- Cózar, A., Echevarría, F., González-Gordillo, J. I., Irigoien, X., Úbeda, B., Hernández-León, S., et al. (2014). Plastic debris in the open ocean. *Proc. Natl. Acad. Sci.* 111, 10239–10244. doi: 10.1073/pnas.1314705111
- De Giovanni, P. (2022). Leveraging the circular economy with a closed-loop supply chain and a reverse omnichannel using blockchain technology and incentives. *Int. J. Oper. Prod. Manag.* 42, 959–994. doi: 10.1108/IJOPM-07-2021-0445
- Diez, S. M., Patil, P. G., Morton, J., Rodriguez, D. J., Vanzella, A., Robin, D. V., et al. (2019). Marine pollution in the Caribbean: Not a minute to waste. Washington, DC: World Bank Group.
- Eakin, C. M., Morgan, J. A., Heron, S. F., Smith, T. B., Gang, L., Álvarez-Filip, L., et al. (2010). Caribbean corals in crisis: record thermal stress, bleaching, and mortality in 2005. *PLoS One* 5:e13969. doi: 10.1371/journal.pone.0013969
- Elgie, A. R., Singh, S. J., and Telesford, J. N. (2021). You can't manage what you can't measure: the potential for circularity in Grenada's waste management system. *Resour. Conserv. Recycl.* 164:105170. doi: 10.1016/j.resconrec.2020.105170
- Fay, M., and Morrison, M. (2007). *Infrastructure in Latin America and the Caribbean: Recent developments and key challenges*. Washington, DC: World Bank Group.
- Finnveden, G., Hauschild, M. Z., Ekvall, T., Guinée, J. B., Heijungs, R., Hellweg, S., et al. (2009). Recent developments in life cycle assessment. *J. Environ. Manag.* 91, 1–21. doi: 10.1016/j.jenvman.2009.06.018
- Gandhi, N., Farfaras, N., Wang, N. H. L., and Chen, W. T. (2021). Life cycle assessment of recycling high-density polyethylene plastic waste. *J. Renew. Mater.* 9, 1463–1483. doi: 10.32604/jrm.2021.015529
- Gasparri, E., Arasteh, S., Kuru, A., Stracchi, P., and Brambilla, A. (2023). Circular economy in construction: a systematic review of knowledge gaps towards a novel research framework. *Front. Built Environ.* 9:1239757. doi: 10.3389/fbuil.2023.1239757
- Geyer, R., Jambeck, J. R., and Law, K. L. (2017). Production, use, and fate of all plastics ever made. *Sci. Adv.* 3:e1700782. doi: 10.1126/sciadv.1700782
- Gesellschaft für Internationale Zusammenarbeit (GIZ) (2015). Reducing the input of plastic litter into the ocean around Grenada Applicability and effects of selected instruments. Available at: https://www.giz.de/en/downloads/giz2015_marine-litter-instruments_grenada.pdf
- Gonçalves, B. D. S. M., Carvalho, F. L. D., and Fiorini, P. D. C. (2022). Circular economy and financial aspects: a systematic review of the literature. *Sustain. For.* 14:3023. doi: 10.3390/su14053023
- Good, A. M., and Bahr, K. D. (2021). The coral conservation crisis: interacting local and global stressors reduce reef resiliency and create challenges for conservation solutions. *SN Appl. Sci.* 3:312. doi: 10.1007/s42452-021-04319-8
- Gössling, S. (2019). Celebrities, air travel, and social norms. *Ann. Tour. Res.* 79:102775. doi: 10.1016/j.annals.2019.102775
- Gould, W. A., Castro-Prieto, J., and Álvarez-Berrios, N. L. (2020). "Climate change and biodiversity conservation in the Caribbean islands" in *Encyclopedia of the World's Biomes*, 114–125.
- Graham, R. E. (2023a). Proposed solutions for marine debris in the Windward Islands-perspectives from key policy makers and policy influencers. *Front. Mar. Sci.* 10:1065299. doi: 10.3389/fmars.2023.1065299
- Graham, R. E. (2023b). The marine litter issue in the Windward Islands-a pathway to responses using the DPSIR framework. *Front. Environ. Sci.* 11:1150722. doi: 10.3389/fenvs.2023.1150722
- Grenada Solid Waste Management Authority (GSWMA) (2019). Grenada solid waste management authority national experience on waste statistics. Solid waste characterization. Available at: <https://unstats.un.org/unsd/envstats/meetings/2019-Grenada/documents/Session%204.5.1%20GSWMA%20National%20experience%20in%20waste%20statistics.pdf>
- Guo, X., Zhao, Y., Zhao, H., Lv, Y., and Huo, L. (2023). Multidimensional evaluation for environment impacts of plastic straws and alternatives based on life cycle assessment. *J. Clean. Prod.* 404:136716. doi: 10.1016/j.jclepro.2023.136716
- Hinds, K. (2019). *Civil society organisations, governance and the Caribbean community*. Springer International Publishing. Available at: <https://link.springer.com/book/10.1007/978-3-030-04396-4>
- Hopewell, J., Dvorak, R., and Kosior, E. (2009). Plastics recycling: challenges and opportunities. *Philosophical Transactions of the Royal Society B: Biol. Sci.* 364, 2115–2126. doi: 10.1098/rstb.2008.0311
- Hurley, K., Fox, A., Harlow, E., Vargas-Guerra, A., and Gibson, J. (2019). Marine debris and biodiversity in Latin America and the Caribbean. *USAID Global Environmental Management Support Program*.
- International Institute for Sustainable Development (2022). ISLANDS initiative to help SIDS manage hazardous chemicals and waste. Available at: <https://sdg.iisd.org/news/islands-initiative-to-help-sids-manage-hazardous-chemicals-and-waste/>.
- IUCN (2023). Small Island developing states call for ambitious global plastics treaty – INC-2. Paris. Available at: <https://www.iucn.org/story/202306/small-island-developing-states-call-ambitious-global-plastics-treaty-inc-2-paris>.
- Jackson, K., Bazeley, P., and Bazeley, P. (2019). Qualitative data analysis with NVivo. Sage Publications. Available at: <https://www.torrossa.com/en/resources/an/501847>.
- Jamaica Gleaner. (2018). Challenges could undermine success of plastic bag ban. Available at: <https://jamaica-gleaner.com/article/lead-stories/20181231/challenges-could-undermine-success-plastic-bag-ban>.
- Jambeck, J. R., Geyer, R., Wilcox, C., Siegler, T. R., Perryman, M., Andrady, A., et al. (2015). Plastic waste inputs from land into the ocean. *Science* 347, 768–771. doi: 10.1126/science.1260352
- Kanhai, L. D. K. (2022). Plastic pollution – a threat to the Caribbean's coastal marine. University of the West Indies (UWI) – environment. Available at: https://sta.uwi.edu/uitoday/archive/march_2022/article13.asp.
- Katrakis, E., Nacci, G., and Couder, N. (2021). Incentives to boost the circular economy: A guide for public authorities. Minato City: European Commission.
- Kaza, S., Yao, L., Bhada-Tata, P., and Van Woerden, F. (2018). Waste generation and management. In *What a waste 2.0: a global snapshot of solid waste management to 2050*. World Bank. doi: 10.1596/978-1-4648-1329-0
- Kensen, M. (2019). Assessing the limitations of integrating energy and environmental standards into seaports of small island developing states. World Maritime University Dissertations. 1166. Available at: https://commons.wmu.se/all_dissertations/1166
- Kinnaman, T. C. (2010). Solid waste Management in the Caribbean. *J. Eastern Caribbean Stud.* Bucknell University, 38–60. Available at: http://digitalcommons.bucknell.edu/fac_journ/544/
- Kousemaker, T. M., Jonker, G. H., and Vakis, A. I. (2021). LCA practices of plastics and their recycling: a critical review. *Appl. Sci.* 11:3305. doi: 10.3390/app11083305
- Kurniawan, T. A., Avtar, R., Singh, D., Xue, W., Othman, M. H. D., Hwang, G. H., et al. (2021). Reforming MSWM in Sukunan (Yogyakarta, Indonesia): a case-study of applying a zero-waste approach based on circular economy paradigm. *J. Clean. Prod.* 284:124775. doi: 10.1016/j.jclepro.2020.124775
- Malindretos, G. (2012). "Logistics in small islands: challenges for sustainable supply chain solutions" in 2nd International Conference SUPPLY Chain.
- Moshood, T. D., Nawani, G., Mahmud, F., Mohamad, F., Ahmad, M. H., and AbdulGhani, A. (2022). Sustainability of biodegradable plastics: new problem or solution to solve the global plastic pollution? *Curr. Res. Green Sustain. Chem.* 5:100273. doi: 10.1016/j.crgsc.2022.100273
- Muposhi, A., Mpinganjira, M., and Wait, M. (2021). Considerations, benefits and unintended consequences of banning plastic shopping bags for environmental sustainability: a systematic literature review. *Waste Manag. Res.* 40, 248–261. doi: 10.1177/0734242x211003965
- Mycoc, M. (2020). "Opportunities for transforming informal settlements in Caribbean small island developing states" in Proceedings of the international conference on emerging trends in Engineering and technology (ICoNETech-2020).
- Mycoc, M. (2022). Building urban resilience in the Caribbean: policies, practices and prospects. SDG knowledge hub | IISD. Available at: <https://sdg.iisd.org/commentary/guest-articles/building-urban-resilience-in-the-caribbean-policies-practices-and-prospects/>.
- Omondi, I., and Asari, M. (2021). A study on consumer consciousness and behavior to the plastic bag ban in Kenya. *J. Mater. Cycles Waste Manag.* 23, 425–435. doi: 10.1007/s10163-020-01142-y
- Park, D., Lee, H., and Won, W. (2024). Unveiling the environmental gains of biodegradable plastics in the waste treatment phase: a cradle-to-cradle life cycle assessment. *Chem. Eng. J.* 487:150540. doi: 10.1016/j.cej.2024.150540
- Parker, L. (2021). Global treaty to regulate plastic pollution gains momentum. *Natl. Geogr.* Available at: <https://www.nationalgeographic.com/environment/article/global-treaty-to-regulate-plastic-pollution-gains-momentum>
- Peterson, R. (2020). Over the caribbean top: community well-being and over-tourism in small island tourism economies. *Int. J. Community Well-Being* 6, 1–38. doi: 10.1007/s42413-020-00094-3
- Phillips, W., Thorne, E., and Roopnarine, C. (2020). Economic implications of the ban on single-use plastics in the Caribbean: A case study of Trinidad and Tobago. Available at: <https://repositorio.cepal.org/entities/publication/8fcf1bc-87de-4615-8da2-f239917587ee>
- Popovic, I., Bossink, B. A., and van Der Sijde, P. C. (2019). Factors influencing consumers' decision to purchase food in environmentally friendly packaging: what do we know and where do we go from here? *Sustain. For.* 11:7197. doi: 10.3390/su11247197

- Ragaert, K., Delva, L., and Van Geem, K. (2017). Mechanical and chemical recycling of solid plastic waste. *Waste Management*. 69, 24–58.
- Ram, A., and Sharma, P. (2017). A study on life cycle assessment. *Int. J. Eng. Adv. Technol.* 6, 197–201.
- Riquelme, R., Méndez, P., and Smith, I. (2016). Solid waste Management in the Caribbean: proceedings from the Caribbean solid waste conference. Water and sanitation division, April 2016 (technical note no. IDB-TN-935). Inter-American Development Bank. Available at: <https://publications.iadb.org/publications/english/document/Solid-Waste-Management-in-the-Caribbean-Proceedings-from-the-Caribbean-Waste-Management-Conference.pdf>.
- Roberts, J. T., and Parks, B. (2006). A climate of injustice: Global inequality, north-south politics, and climate policy. *Ethics Int. Affairs*. 22, 229–230. doi: 10.1111/j.1747-7093.2008.00150.x
- Schulan, A., and Heilinger, J. C. (2024). Three injustices of adaptation finance—a relational egalitarian analysis. *J. Agric. Environ. Ethics* 37:15. doi: 10.1007/s10806-024-09932-2
- Shen, M., Song, B., Zeng, G., Zhang, Y., Huang, W., Wen, X., et al. (2020). Are biodegradable plastics a promising solution to solve the global plastic pollution? *Environ. Pollut.* 263:114469. doi: 10.1016/j.envpol.2020.114469
- Siung-Chang, A. (1997). Untitled. *Environ. Geochem. Health* 19, 45–55. doi: 10.1023/a:1018438119034
- Song, J. H., Murphy, R. J., Narayan, R., and Davies, G. B. H. (2009). Biodegradable and compostable alternatives to conventional plastics. *Philos. Trans. R. Soc. B Biol. Sci.* 364, 2127–2139. doi: 10.1098/rstb.2008.0289
- The Nature Conservancy. (2020). Caribbean impact report 2020. Available at: <https://www.nature.org/content/dam/tnc/nature/en/documents/TNC-Caribbean-2020-Impact-Report.pdf>.
- Trenchi, A. (2023). Cascading crisis threatens Caribbean's unique biodiversity. Global Americans. Available at: <https://theglobalamericans.org/2023/08/cascading-crisis-threatens-caribbeans-unique-biodiversity/>.
- UNCTAD (2017) Climate change impacts on coastal transport infrastructure in the Caribbean: enhancing the adaptive capacity of Small Island developing states (SIDS), climate risk and vulnerability assessment framework for Caribbean coastal transport infrastructure. UNDA project 1415O. Available at: https://unctad.org/system/files/official-document/dtltlb2018d1_en.pdf.
- UNEP (2004). Caribbean environment outlook. *United Nations Environment Programme*. Available at: <https://www.unenvironment.org/resources/report/caribbean-environment-outlook>
- UNEP. (2018). Fourth meeting of the scientific, technical and advisory committee (STAC) to the protocol concerning pollution from land based sources and activities in the wider Caribbean. Available at: https://wedocs.unep.org/bitstream/handle/20.500.11822/33273/WG.39_INF.8-en.pdf?sequence=1&isAllowed=yFourth.
- UNEP. (2019a). The Caribbean addresses the scourge of plastic pollution. United Nations Environment Programme. Available at: <https://www.unenvironment.org/news-and-stories/story/caribbean-addresses-scourge-plastic-pollution>.
- UNEP. (2019b). The future of the Caribbean is single-use plastic-free. UNEP. Available at: <https://www.unep.org/cep/statement/future-caribbean-single-use-plastic-free>.
- UNEP. (2019c). The Caribbean addressing marine litter with regional framework: Cartagena Convention Secretariat & Pollution (LBS) protocol. Available at: <https://wedocs.unep.org/bitstream/handle/20.500.11822/30913/MLitter2019.pdf?sequence=1>.
- UNEP. (2022). Island nations get new lifeline to beat pollution. Available at: <https://www.unep.org/news-and-stories/press-release/island-nations-get-new-lifeline-beat-pollution>.
- UNEP and One Ocean Hub. (2022). Plastic pollution case-study: Barbados June 2022. Available at: <https://leap.unep.org/sites/default/files/inline-files/Plastic%20Pollution%20Case%20study%20Barbados.pdf>.
- Unite Caribbean (2023). Accelerating change in water and waste management: insights from the 32nd Caribbean water conference. *Water and Waste*. Available at: <https://unite-caribbean.com/en/category/water-and-waste/>
- Valenzuela-Levi, N. (2021). *Waste*: by Kate O'Neill Cambridge: polity, 2019, 240 pp., £55.00 (hardback), £15.99 (paperback), £11.99 (e/book), ISBN: 978-0-745-68743-8.
- Walker, T. R. (2024). The tropics should not become the world's plastic pollution problem. *J. Trop. Fut.* 1, 12–24. doi: 10.1177/27538931231165273
- Wang, K. C. M., Lee, K. E., and Mokhtar, M. (2021). Solid waste management in small tourism islands: an evolutionary governance approach. *Sustain. For.* 13:5896. doi: 10.3390/su13115896
- World Bank (2019). Available at: <https://blogs.worldbank.org/opendata/caribbean-beaches-are-littered-single-use-plastics>.