Chapter 13
Cruise Ship Waste Management:
A Systematic Review and Research Gap Analysis

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ABSTRACT

Large cruise ships, capable of accommodating over 6,000 passengers and 1,500 crew members, generate substantial waste, necessitating effective management strategies to mitigate environmental impacts. This study employs a systematic literature review to identify key themes and research gaps in cruise waste management research. Using the PRISMA flow method, 47 relevant research articles were selected based on relevance. The data from these articles were analysed using bibliometric and content analysis techniques. The key themes identified include plastic waste, microplastic waste, food waste, wastewater, and waste management strategies. The study revealed significant research gaps that demand immediate attention and action concerning the effectiveness of waste management strategies, socio-economic considerations, interdisciplinary approaches, regulatory compliance, food waste disposal methods, regional collaborations, policy initiatives, and integrated waste management approaches.

1. INTRODUCTION

Cruises are currently one of the fastest-growing segments in the tourism sector. In 2009, the global ocean cruise industry carried approximately 17,8 million passengers. As of 2019, this figure peaked at 29,7 million (Statista, 2020.). Cruise

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ships operate in all the earth's oceans, often in pristine coastal waters and sensitive marine ecosystems. They tend to concentrate their activities in specific coastal areas and repeatedly visit the same ports, thereby creating a significant cumulative impact at the local scale due to overcrowding, which can strain local resources and infrastructure (Toneatti et al., 2020). These ships are often described as floating cities that accommodate thousands of passengers, and there is a growing trend to increase ship sizes, which exacerbates the issue by further intensifying the environmental and infrastructural pressures on the visited areas (Cerveny et al., 2020). The scale of waste generation by a large cruise ship, which can accommodate more than 6000 passengers and 1500 crew members, is overwhelming, necessitating effective waste management strategies to mitigate its environmental impact.

The waste generated by cruise ships primarily falls into five categories: sewage, greywater, oily bilge water, solid waste, and hazardous waste (EPA, 2008). Sewage, often called "black water" on cruise ships, consists of human waste, whereas greywater includes wastewater from sinks, baths, showers, laundry facilities, and kitchen areas. Oily bilge water, which is a mixture of water, oily fluids, and lubricants from the ship's engine rooms, and solid waste, which encompasses food scraps, garbage, refuse, sludge, rubbish, and other discarded materials, contribute significantly to the waste output of cruise ships. Additionally, hazardous waste refers to materials that risk human health or the environment. Copeland (2011) calculated the average waste production for a cruise ship with 3000 people during a week-long cruise. It generates 795 m^3 of sewage, 3785 m^3 of greywater, 95 m^3 of oily water, and 8 tons of solid waste. In an earlier study, Butt (2007) reported that although cruise ships represented less than 1% of the world's merchant fleet, they would account for 25% of all waste generated by these ships. This problem caused by cruise-generated waste is expected to become even more relevant due to the current growth trend of the cruise industry (Xu, 2016).

The escalating concerns surrounding the environmental impact of leisure cruises have become a focal point in recent discussions, particularly regarding the excessive generation of waste, leading to consequences on both ports and primary sea routes (Butt, 2007; Klein, 2011). These cruise ships tend to concentrate their activities within specific coastal regions, frequently revisiting the same ports, thereby amplifying the cumulative impact at a local level. Furthermore, isolated yet substantial waste discharge incidents, accidental or intentional, can trigger considerable adverse consequences (Krenshaw, 2009). As reported by the Environmental Protection Agency in 2008, it has been noted that daily, a substantial cruise ship has the potential to produce a significant amount of waste. This includes 74,000 gallons of sewage, 249,000 gallons of grey water, 5300 gallons of bilge water, 50 tons of garbage, 12,000 bottles, 12,000 cans, and 10 tons of hazardous waste.