

Analyzing Seasonal and Locational Variations in Plastic Debris at Long Island Beaches



The Pinkerton Foundation

Niyat Issak¹, Makayla Sanchez¹, Dany Ikejemba¹, Allison DePerte²
¹ RISE (Rockaway Initiative for Sustainability and Equity)
² AMSEAS (Atlantic Marine Conservation Society)



Introduction

Plastic debris constitutes a major environmental challenge, profoundly affecting coastal ecosystems across New York. This study examines the prevalence and types of plastic waste—namely bags, balloons, beverage bottles, food wrappers, bottle caps, lids, and straws/stirrers—across five prominent beaches: Hallock Beach, Jones Beach, Point Lookout, Rockaway Beach, and Sunken Meadow. Utilizing seven years of data provided by the Atlantic Marine Conservation Society (AMSEAS), including detailed records from their systematic beach cleanups, this research focuses on plastic debris. The study investigates how seasonal patterns affect the distribution of marine debris. By analyzing both temporal variations and site-specific factors, this research aims to provide valuable insights into the dynamics of plastic pollution.

Methodology

Data were sourced from the Atlantic Marine Conservation Society (AMSEAS) covering seven years at Hallock Beach, Jones Beach, Point Lookout, Rockaway Beach, and Sunken Meadow. Systematic sampling was conducted along transects at each site across different seasons. The study focused on plastic debris types: bags, balloons, beverage bottles, food wrappers, bottle caps, lids, and straws/stirrers. We recorded quantities and averaged the data from AMSEAS cleanups. Data were analyzed and visualized using Microsoft Excel. Trends and patterns in debris distribution were identified, and quality assurance included consistency checks and peer review.



Results

The analysis of marine debris on Long Island beaches from 2017 to 2024 reveals several key trends. Figure 2 illustrates the distribution of plastic debris types, with food wrappers and containers comprising 33.5% of the total debris, followed closely by bottle caps, caps, and lids at 31.7%. Figure 3 shows seasonal variation, highlighting significant increases in debris during the summer months (July–September), which correlates with higher beach visitation. In 2020, a marked reduction in debris was observed, attributed to decreased beach activity due to COVID-19 restrictions. This trend was particularly noticeable at high-traffic sites such as Jones Beach and Rockaway Beach. In 2021, debris levels surged as restrictions eased, underscoring the rebound of single-use plastics and associated waste. Figure 4 depicts this increase, emphasizing the need for targeted interventions.

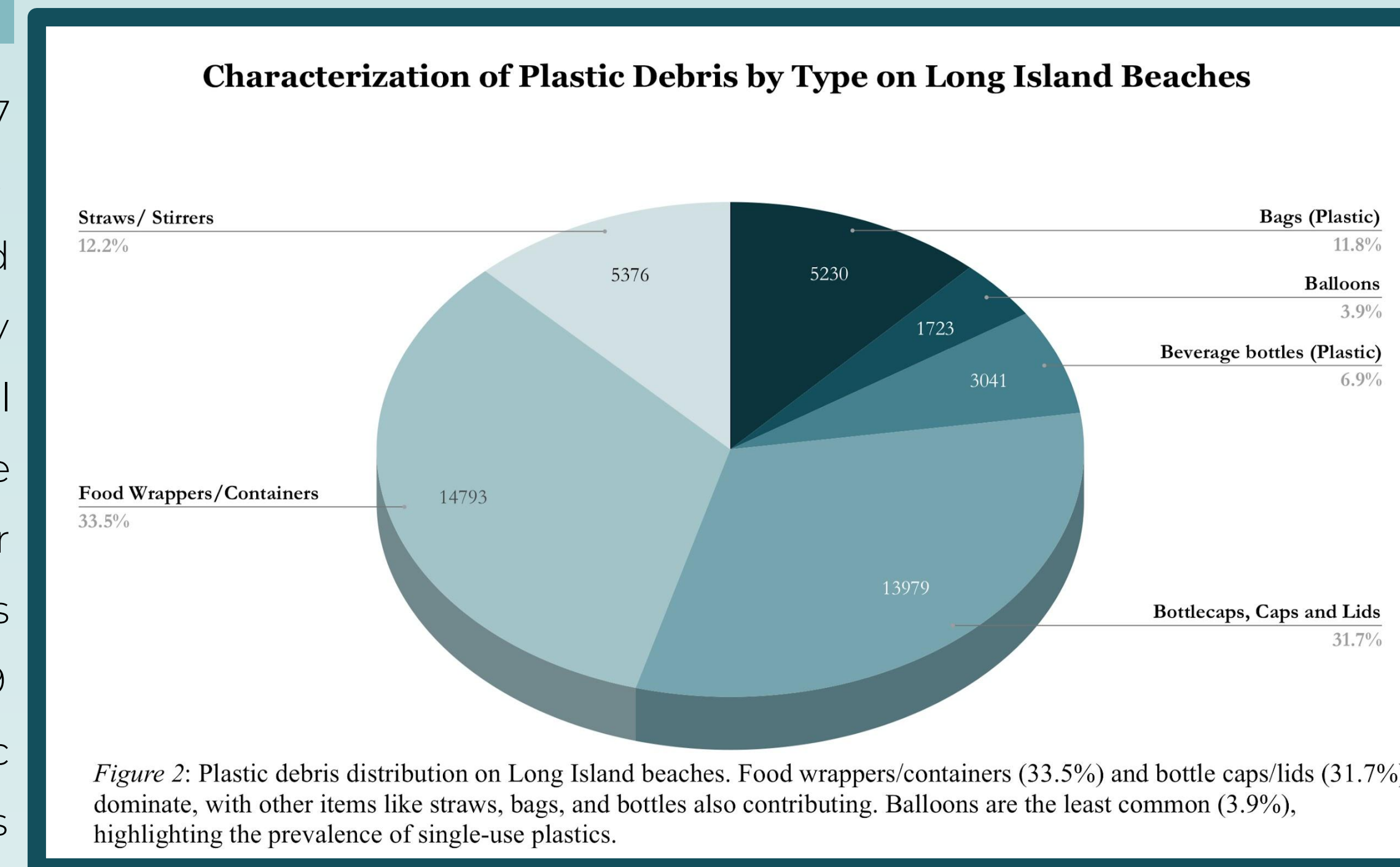


Figure 2: Plastic debris distribution on Long Island beaches. Food wrappers/containers (33.5%) and bottle caps/lids (31.7%) dominate, with other items like straws, bags, and bottles also contributing. Balloons are the least common (3.9%), highlighting the prevalence of single-use plastics.

Conclusion

Our findings reveal that seasonal variations and external factors, such as pandemic-related changes in beach usage, significantly impact marine debris accumulation. Notably, the data suggest that implementing a real-time debris monitoring system, integrated with local beach activity data, could provide a proactive approach to managing and mitigating debris. This system would utilize sensors and automated data collection to dynamically adjust cleanup efforts based on current debris levels and visitor patterns. This approach, not yet discussed in existing literature, offers a practical solution for effectively reducing marine debris and can be tailored to respond to both seasonal fluctuations and unexpected events.

References

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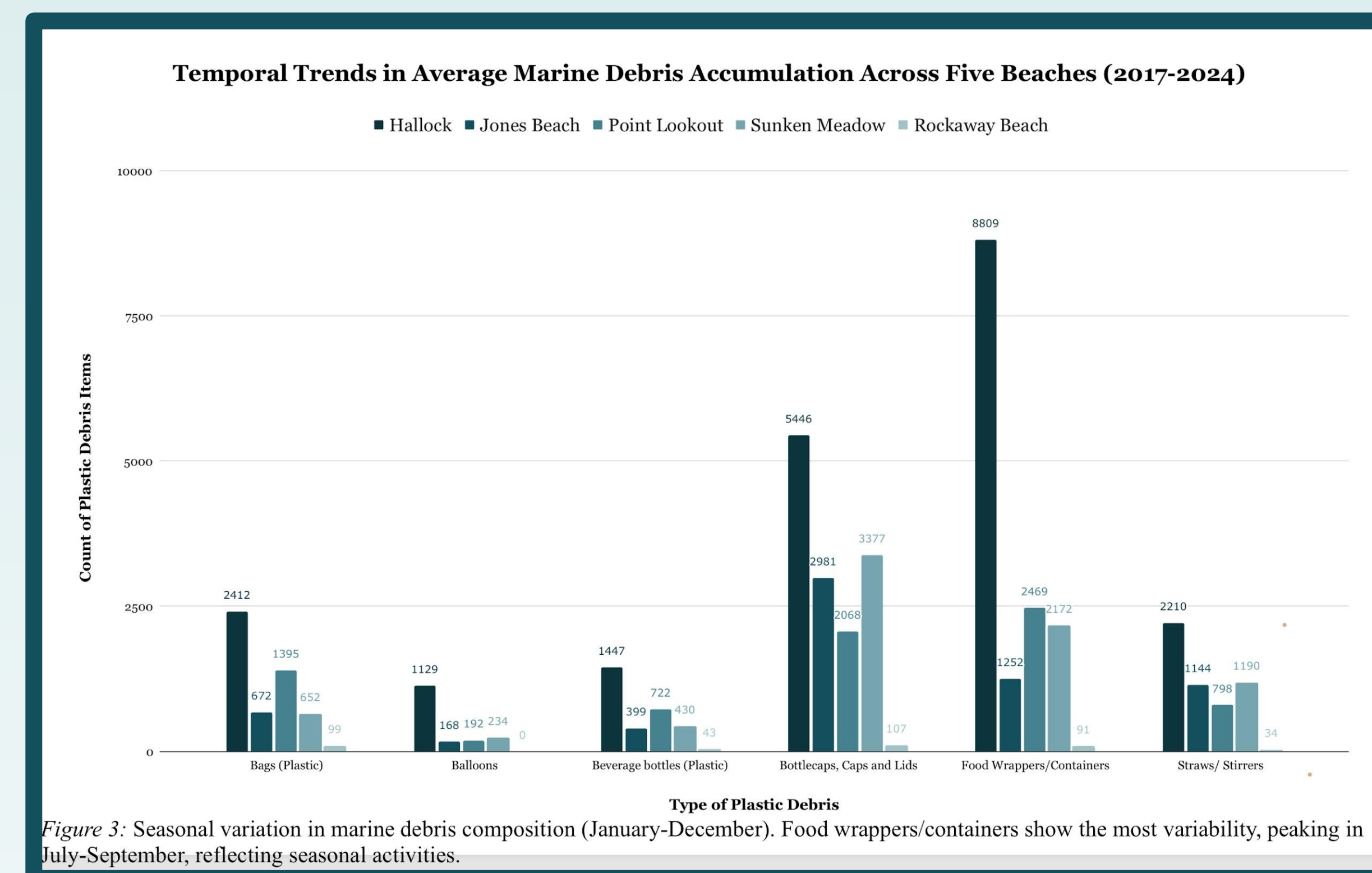


Figure 3: Seasonal variation in marine debris composition (January–December). Food wrappers/containers show the most variability, peaking in July–September, reflecting seasonal activities.

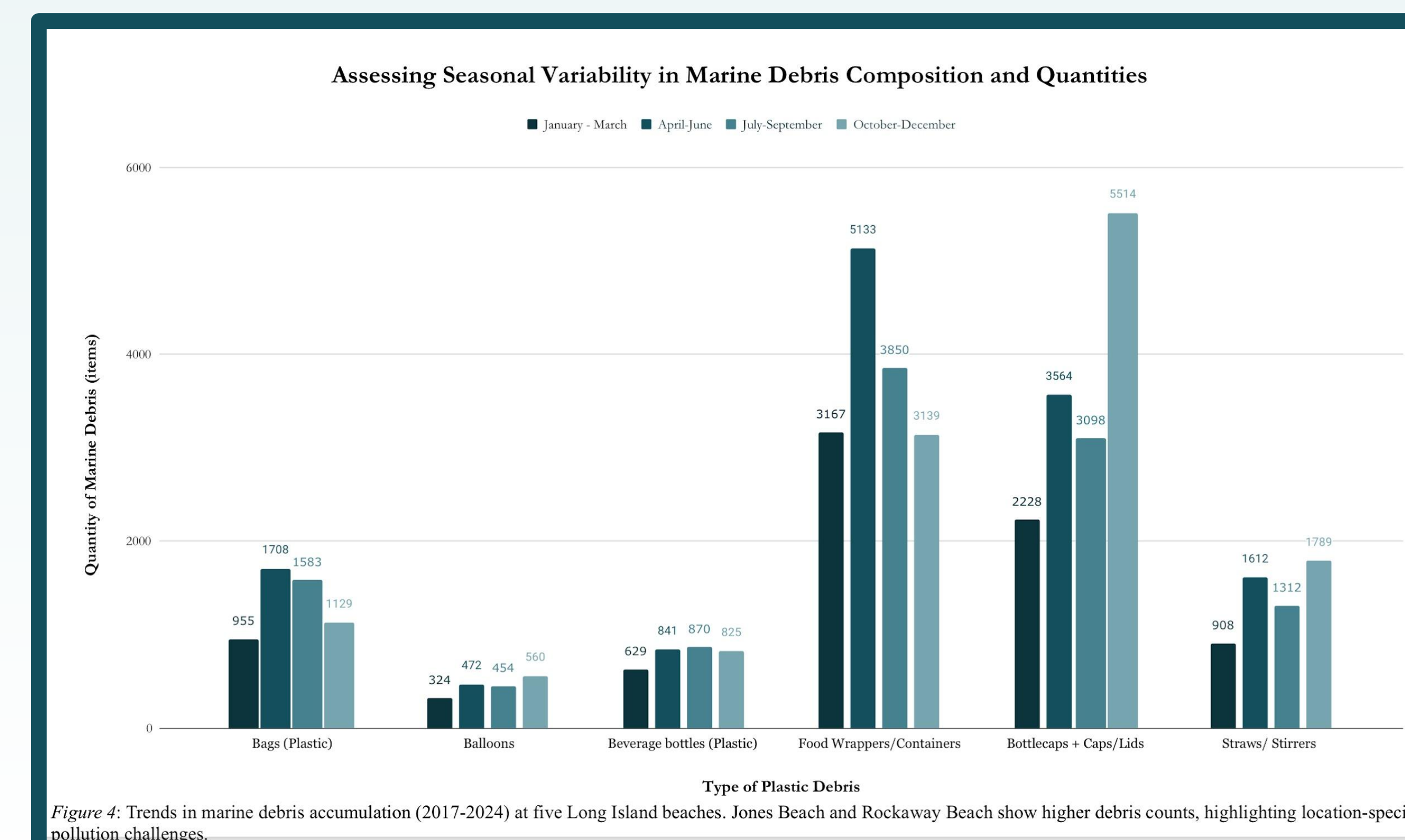


Figure 4: Trends in marine debris accumulation (2017–2024) at five Long Island beaches. Jones Beach and Rockaway Beach show higher debris counts, highlighting location-specific pollution challenges.