



ASSESSING THE RELATIONSHIP BETWEEN TOURIST ARRIVALS AND PET PLASTIC WASTE COLLECTION IN SRI LANKA: AN ANALYSIS FROM 2019 TO 2024

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Plastic pollution remains a major global environmental concern, with post-consumer polyethylene terephthalate (PET) waste forming a significant share of plastic debris. Sri Lanka, as a developing island nation and popular tourist destination, faces many challenges in managing plastic waste, particularly during periods of increased tourist arrivals. While previous studies have broadly examined plastic waste generation in tourism contexts, there are no proper studies related to PET plastics or to quantifying their relationship with tourism in Sri Lanka. This study addresses that gap by investigating the relationship between monthly international tourist arrivals and PET plastic waste collection volumes reported by a major private sector recycler from 2019 to 2024. The recycler collects PET from both formal and informal streams nationwide, and tourist arrival data obtained from the Tourism Development Authority. Descriptive analysis and Pearson correlation tests were applied to assess both direct and lagged relationships between two variables. Lagged analysis was conducted by shifting the PET waste data by one month to test for delayed impacts of tourism. Descriptive analysis revealed sharp declines in both tourist arrivals and PET collection in mid-2019 and early 2020, corresponding to Easter attacks and COVID-19 travel restrictions, respectively. PET collection gradually recovered from late 2021, and even as tourism recovery was more gradual, indicating that domestic consumption and improvements in collection infrastructure also influenced collection trends. Pearson correlation tests showed a statistically significant moderate positive correlation between tourist arrivals and PET collection ($r = 0.629$, $p < 0.05$). The lagged analysis also revealed a moderate correlation ($r = 0.430$, $p < 0.05$), suggesting that the effect of tourism on PET waste collection may not be immediate but may emerge in the following month due to delays in waste generation, collection, and transport processes. By linking the nationwide PET waste collection to tourism flows, this study provides new empirical evidence of tourism's contribution to plastic waste in Sri Lanka. The findings highlight the importance of seasonally responsive waste management strategies and can inform waste collectors, recyclers and local authorities in planning resource allocation during peak tourist seasons.

Keywords: PET plastic, tourism, waste collection, correlation analysis, lag effect

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INTRODUCTION

The cumulative global production of plastics has reached approximately 8,300 million metric tons to date (Geyer et al., 2017). Annually, between 4.8 million and 12.7 million metric tons of plastic waste are disposed of into the oceans by countries with coastlines bordering these bodies of water (Moore, 2024). A study revealed that 192 coastal countries collectively produced 275 million metric tons of waste plastics (Jembeck et al., 2015). Plastic pollution poses a significant threat to our oceans, natural environment, and wildlife. It accumulates in marine ecosystems, contaminating water bodies and harming marine life. Additionally, plastic waste finds its way into terrestrial environments, impacting ecosystems and endangering wildlife (Plastic Free Foundation, 2024). The destiny of plastic waste is dispersed as roughly 79% has amassed in landfills or the natural environment, about 12% has undergone incineration, and only around 9% has been recycled. (Cox et al., 2019).

In Sri Lanka, plastic waste generation is 938.42 MT/day (dailymirror.lk, 2025). Of those 336 local authorities of Sri Lanka collected only 32% of waste (300.30 MT) (parliament.lk, 2023), while the rest 68% (638.12 MT) of plastic waste was subjected to open burning, illegal dumping, discarded into water, and self-disposal. The most abundant solid waste management practice is open dumping, 261.82 MT dumped per day (Ministry of Environment, 2021). According to a 2021 World Bank report, Sri Lanka has one of the lowest recycling rates in South Asia, with only 6% of its waste being recycled. This is much lower compared to other countries in the region, like Bangladesh and India, which recycle 30% and 25% of their waste, respectively (Zaman, 2016). According to the National Action Plan on Plastic Waste Management 2021–2030, only 32% of PET plastic is recycled. Since the presence of larger private sector recyclers such as Eco Spindles, Viridis, a growth in PET collection and recycling has been observed during the last few years. According to Eco Spindles average monthly collection of PET plastics is about 250 MT (Ministry of Environment, 2021). This company has over 600 collection points and 19 baling sites, and a quantity of 09 tons of PET waste was collected and sent to factories daily. Eco Spindles recycles 250 tons of PET plastic each month (Ecospindles.com, 2024). At the Eco Spindles, polyester yarn fabrics, cleaning brush filaments, and paintbrush filaments were formed as the products of the recycling process (Palatuwa & Fernando, 2020).



The extensive use of plastic by tourists is a well-documented phenomenon (Zhang et al., 2023). Common examples include the use of PET bottles for food and beverages, plastic bags accompanying souvenir purchases, and single-use personal care items such as toothbrushes and toothpaste (Pham et al., 2023). PET bottles are one of the most used plastic types by tourists for food and beverage requirements. Driven by concerns for convenience and hygiene, these items are often discarded after a single use, contributing substantially to the generation of plastic waste.

Previous studies have highlighted tourists as the primary contributors to plastic litter in scenic areas (Pervez and Lai, 2022), and the volume of litter is positively correlated with visitor density. However, few studies have specifically quantified PET waste, and none have examined the linkage between tourism and PET waste collection in Sri Lanka. In addition, no specific studies have quantified the potential lag effect between PET waste generation and collection (Bezeraj et al., 2024).

1.1 Problem Statement

Post-consumer PET plastic waste generation has become a critical concern in Sri Lanka, driven by domestic consumption and seasonal influxes of international tourists. Tourist activities, particularly during peak seasons, contribute substantially to single-use plastic waste. However, no prior study has quantified the relationship between monthly international tourist arrivals and PET plastic waste collection. Additionally, no prior research has assessed lag effects that may occur between tourist inflow and waste collection activities. This study investigates whether changes in monthly tourist arrivals influence PET plastic waste collection in Sri Lanka from 2019 to 2024. The hypothesis is that higher tourist arrivals lead to increased PET waste collection, in either the same month or the following month. To test this, both raw and lagged Pearson correlation analyses were performed.

1.2 Objectives

Primary objective:

Analyse the relationship between monthly PET plastic collection and tourist arrivals in Sri Lanka from 2019 to 2024.

Specific objectives:

Examine monthly and annual trends in PET plastic collection and tourist arrivals from 2019 to 2024.

Assess the relationship between tourist arrivals and PET waste collection through Pearson correlation and lagged analysis.



1.3 Significance of the study

This study investigates the relationship between monthly PET plastic collection volumes and international tourist arrivals in Sri Lanka over six years (2019–2024), using a correlation analysis. This explores the potential lag effects between tourist arrivals and subsequent PET waste collection and can provide insights for waste collectors and recyclers. The findings are beneficial for more efficient and seasonally aligned PET collection strategies, support forecasting models for waste management, and guide targeted awareness campaigns in high-tourism zones.

METHODOLOGY

2.1 Study design

This study adopted a quantitative, correlational research design to evaluate the relationship between monthly PET plastic collection volumes and tourist arrivals in Sri Lanka from January 2019 to December 2024.

2.2 Data collection

Monthly data for six years (2019–2024) were compiled from two primary sources:

PET collection data: Monthly PET collection quantities (in kilograms) obtained from a leading private-sector PET recycler. The collections cover the entire island and include both formal and informal waste streams, sourced from households, hotels and restaurants, institutions, industries, beaches, and other waste-generating points.

Tourism arrivals: Monthly international tourist arrivals were retrieved from official records of the Sri Lanka Tourism Development Authority (SLTDA, 2025).

2.3 Statistical analysis

All the data sets were consolidated in Microsoft Excel 2016. Descriptive analysis was carried out to summarize key trends in PET waste collection and tourist arrivals over time. Annual totals and monthly averages were calculated to identify overall collection patterns and seasonal peaks using Microsoft Excel. To assess the linear relationship between monthly PET waste collection volumes and tourist arrivals, a Pearson correlation analysis was conducted using Minitab 19. To investigate potential delayed effects of tourism on PET waste generation, a lagged Pearson correlation analysis was performed. This shift one variable in time to test whether fluctuations in tourist arrivals in a given month are associated with PET collection in the subsequent month.



RESULTS AND DISCUSSION

The analysis presents monthly and annual trends of PET collection versus tourist arrival, highlighting patterns across the study period. In addition, Pearson correlation tests were conducted to evaluate the strength of association between tourist arrivals vs PET waste collection, followed by a lagged analysis to capture potential delayed effects.

3.1 PET collection and tourist arrival

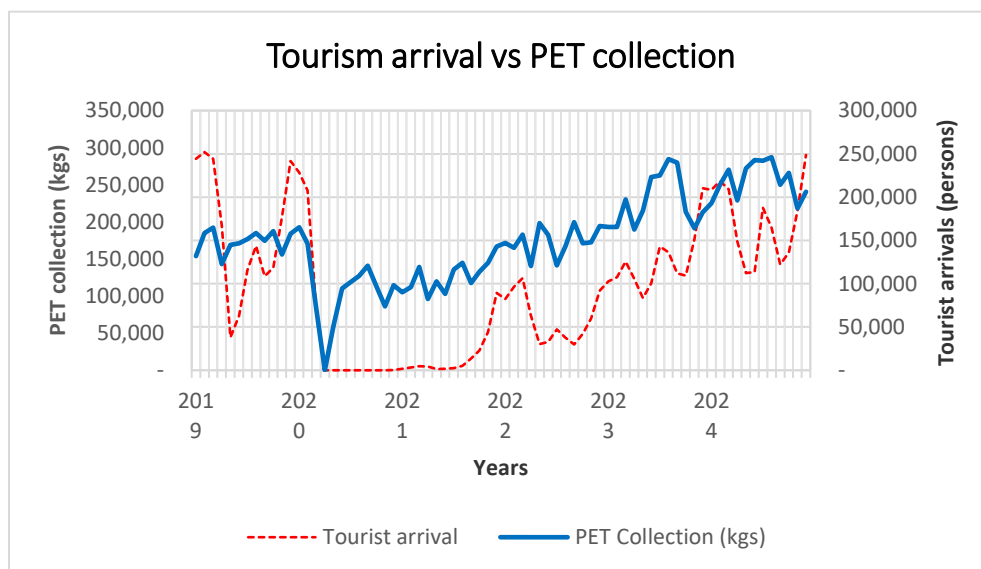


Figure 1: Monthly PET collection and Tourists' arrival in Sri Lanka 2019 – 2024. The figure illustrates trends in PET collection in relation to fluctuations in tourist arrivals, highlighting potential correlations between waste generation and tourist activity.

Figure 1 illustrates the monthly trends in PET plastic collection (in kilograms) and tourist arrivals (in persons) in Sri Lanka from 2019 to 2024. The PET collection data is plotted on the primary Y-axis (left), while tourist arrivals are plotted on the secondary Y-axis (right).

Tourist arrivals show a sharp decline in mid-2019, corresponding to the Easter attack that occurred in April and experienced a further substantial reduction from early 2020 due to the COVID-19 pandemic and the associated international travel restrictions. During the period from mid-2020 to early 2021, tourist arrivals dropped to nearly zero. This is also confirmed in another study, as there is no significant correlation between tourism and plastic waste generation for the years 2019, 2020, and 2021 (Jayasinghe et al., 2023). PET collection also experienced a noticeable decline during this time, as in April 2020, the company halted its operations for a month. This



simultaneous drop suggests a potential dependency between tourism activity and PET waste generation, particularly in areas where tourism is a major economic driver.

As tourism gradually resumed from late 2021 onward, a corresponding increase in PET collection is observed. From 2022 to 2024, both tourist arrivals and PET collection demonstrate upward trends, with periodic fluctuations. Since PET collection trends upwards more consistently, even when tourism fluctuates, it indicates that while tourism influences PET waste generation, other factors, such as domestic consumption and companies' efforts to enhance the collection, also play a role.

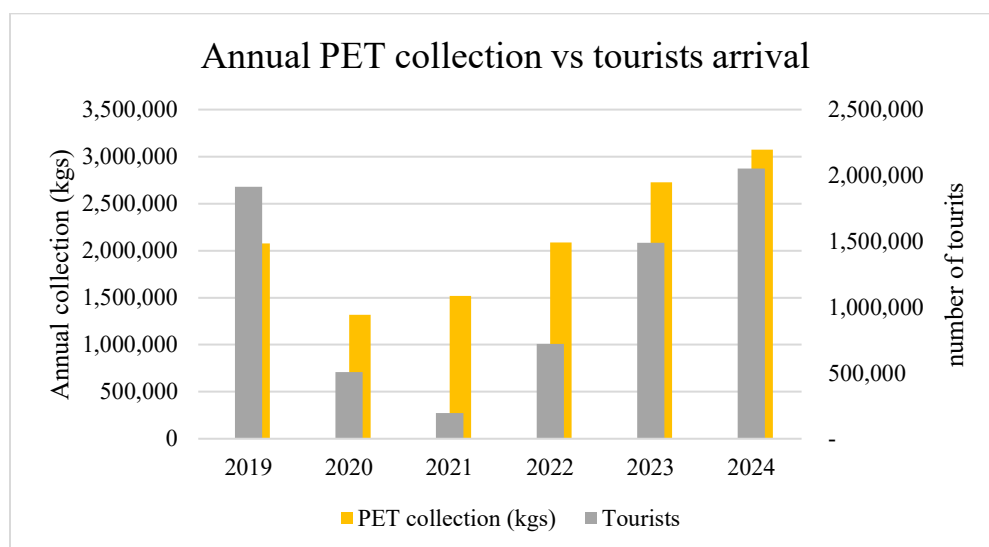


Figure 2: Annual trend comparison. This highlights year-to-year variations in collection volumes and tourist arrivals.

Figure 2 illustrates the annual comparison between PET plastic collection (in kilograms) and international tourist arrivals in Sri Lanka over the period 2019 to 2024. The chart presents both variables side by side, highlighting their overall trend. In 2019, both PET collection and tourist arrivals were relatively high and closely aligned, suggesting a potential relationship between inbound tourism and plastic consumption. Sharp declines in mid-2019 and 2020 corresponded to the Easter attack and COVID-19 travel restrictions, respectively. PET collection dropped by approximately 36%, while tourist arrivals declined even more drastically due to travel bans locally and internationally. In 2021, while tourist arrivals remained very low, PET collection showed a slight recovery. This may reflect increased domestic consumption. PET collection rose more rapidly than tourist arrivals, reaching pre-pandemic levels by 2023 and surpassing them in 2024, while tourism recovery was more gradual. However, during the period, the PET collection was influenced not only by tourism but also by other factors such as domestic consumption, improved collection infrastructure, and changes in recycling and policy practices.

3.2 Correlational Analysis

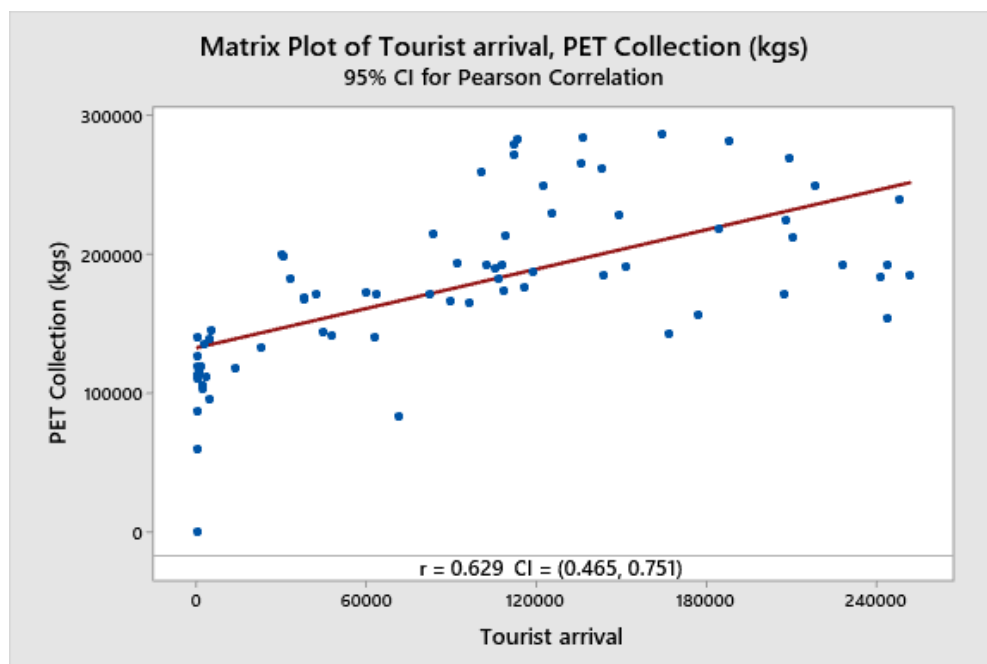


Figure 24: Matrix plot of PET collection vs tourist arrival. The plot visualises potential correlation between tourism activity and PET waste collection

A matrix scatter plot (Fig. 3) was generated to assess the linear relationship between monthly tourist arrivals and PET collection volumes. The person correlation coefficient was found to be $r = 0.629$, with a p -value < 0.05 , indicating a moderate positive correlation that is statistically significant at the 95% confidence level. This suggests that increases in tourist arrivals are moderately associated with increases in PET collection. This lack of correlation may be attributed to several disruptive events that affected tourism activity in Sri Lanka during this period. The Easter Sunday bomb attacks in April 2019 and the COVID-19 pandemic contributed to reduced tourist activity and irregular patterns in plastic waste generation (Jayasinghe, et al., 2023).

However, the spread of data points also implies that tourism is not the sole determinant of PET waste generation; other factors, such as domestic consumption, waste collection efficiency, and seasonal festival events (DataCalculus, 2025) may also influence PET collection volumes. Another study revealed that tourists play a significant role in generating plastic waste in outdoor areas, posing a serious concern for urban environments (Pandey et al., 2022). Tourism accounts for a relatively small proportion of overall waste generation in Europe, contributing to 6.7% of total waste produced by the broader services sector within the EU27 (EFA, 2011). However, on a per capita basis, tourists may generate up to twice as much solid waste as residents (Styles et al., 2017).

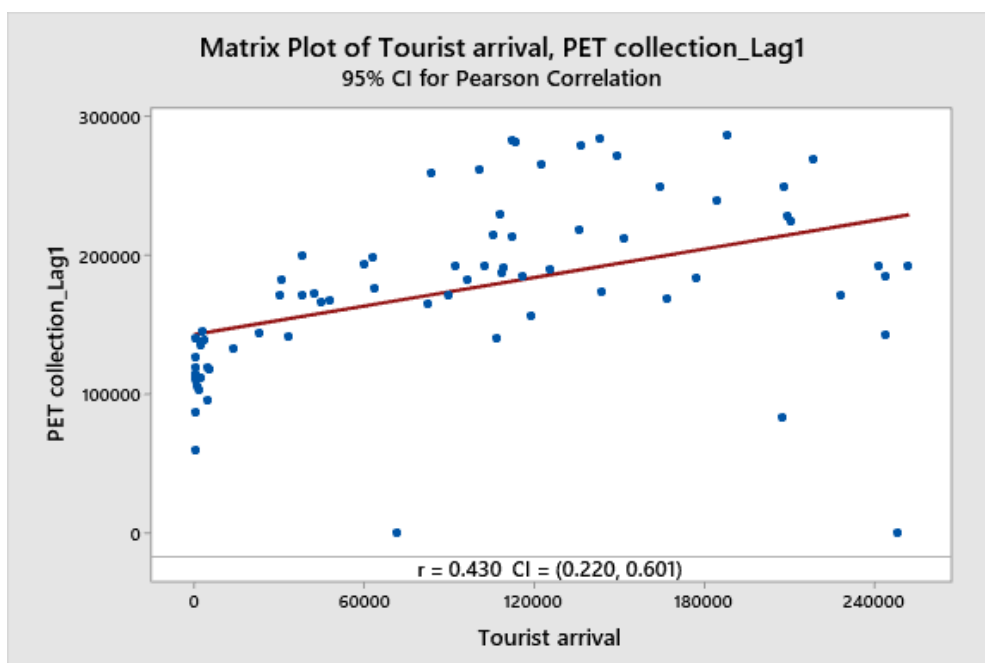


Figure 25: Matrix plot illustrating the relationship between monthly PET collection and tourist arrival, with one-month lag applied to PET collection data.

A lag analysis was performed to further investigate the temporal relationship between tourist arrival and PET waste generation by correlating tourist arrivals with PET collection in the subsequent month (lag 1). As shown in Fig. 4, the Pearson correlation coefficient $r = 0.430$, with a p -value < 0.05 , indicating a moderate and statistically significant positive correlation. This finding supports the hypothesis that PET waste generation and collection may respond with a time delay to increases in tourist arrivals. This delayed response may be attributed to the time required for waste generation, collecting logistics from collectors to recyclers, and reporting processes.

3.3 Limitations of the study

The PET waste collection data used in this study were obtained from a single major recycler. As reliable data from other recyclers was not available, the findings may not fully represent the total PET collection across Sri Lanka. Furthermore, international tourist arrivals are concentrated in a few key regions of the country, such as Galle, Matara, Ella, Arugam Bay, and Kandy (SLTDA, 2025). Because the data collection is reported at the national level and not by tourist destinations, the analysis shows the overall impact of tourism on PET collection rather than location-specific effects.



CONCLUSIONS/RECOMMENDATIONS

This study investigated the relationship between monthly tourist arrivals and PET plastic waste collection in Sri Lanka from 2019 to 2024. Raw correlation analysis revealed a moderate positive relationship ($r = 0.629$, $p < 0.05$), suggesting that higher monthly tourist arrivals are generally associated with increased PET collection during the same period. Lagged analysis, comparing tourist arrivals with PET collection in the subsequent month, also showed a significant correlation ($r = 0.430$, $p < 0.05$), indicating that tourism-related PET waste may not always be collected immediately. While tourism influences PET waste generation, other factors, including domestic consumption, infrastructure development, and local policy changes, also play a role.

The findings have practical implications for waste management strategies. Periodic increases in collection efforts and targeted awareness campaigns during peak tourist seasons can help capture additional PET waste efficiently. Improved coordination between recyclers, local authorities, and tourism stakeholders can enhance collection coverage and reduce littering. Effective PET management not only reduces environmental impacts such as plastic pollution in waterways and public spaces but also provides economic benefits by increasing the availability of recyclable material for the industry, supporting circular economy initiatives, and potentially generating revenue from recovered PET. Integrating tourism data into planning can thus optimize resource allocation, improve sustainability outcomes, and strengthen the economic and environmental performance of PET recycling in Sri Lanka.

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