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Seasonal and longitudinal patterns of plastic pollution in a subtropical urban river

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Plastic contamination in rivers quickly changes over time and space, driven by factors such as land use, urbanization and population density, climatic conditions and river hydrology. Understanding the patterns and mechanisms behind these fluctuations is of major importance to estimate and evaluate plastic loads and to forward management strategies and policies. During a 18-month sampling campaign (May 2018 to October 2019) in the Hillsborough River Tampa (USA), we studied how seasonality and urban pollution affected plastic loads transported through the river. We sampled monthly at three sampling sites, strategically located to assess the release of plastic through urban runoff from Tampa, covering two wet seasons and one dry season. At each site, we conducted stationary sampling with a 500-µm mesh neuston net at five different positions through the width and depth of the river. Using an Acoustic Doppler Current Profiler, we also collected comprehensive data on flow characteristics and accurately estimated river discharge during sampling events. All samples were processed in the laboratory with state-of-the-art methods to separate plastic particles from water samples. Plastic particles were classified by size categories and a subset was identified using Raman spectroscopy. Results of this study shows a strong correlation between plastic loads and rainfall seasonality. For instance, mean concentrations close to the mouth of the river varied from less than 1 count/m^3 during the dry season (March-May) to up to 9 counts/m^3 during wet months (September). Furthermore, there was a substantial increase in loads as the river passed through the city, mostly peaking at the farthest downstream site close to the river mouth; while median concentrations at the site upstream from the city were 0.21 counts/m^3 (range of 0-1.68), median concentrations at the station close to the river mouth (in Downtown Tampa) were 1.16 counts/m^3 (range of 0.14-21.61 counts/m^3). During some months, however, loads were higher at the second site, located in the middle of a residential and commercial district. Differences in plastic loads along the river were explained by river flow accumulation and land use/land cover intensity, though small differences in concentrations between the middle site and the furthest downstream can be explained by differences in stormwater management practices between these two contrasting socioeconomic areas. This study generated a unique and comprehensive dataset on plastic loads and river hydrology on a watershed scale to evaluate drivers of plastic pollution and rivers as their pathway, providing a base for the development of management plans in urban rivers and solution strategies for plastic pollution in similar subtropical watersheds.