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Microplastics in the Maldonado stream basin (Maldonado, Uruguay): evaluation and analysis of this new vector of pollution

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1. INTRODUCTION

Plastics and microplastics (MPs) are one of the most common and persistent pollutants in aquatic ecosystems worldwide. They have significant harmful effects on both marine and freshwater ecosystems. Numerous investigations were made in marine ecosystems but too little is known about the situation in freshwater ecosystems, and for this, the generation of basal information is a priority.

From the continent, plastic waste is transported through fluvial systems and urban drains to the oceans. When analyzing these contributions, it is essential to consider the characteristics of these dynamic systems from a watershed scale, including human activities and their influence areas.

The Maldonado stream, with a basin of about 1,400 km^2, is the main stream in Maldonado, Uruguay, and is a direct tributary of the Atlantic Ocean. In its basin, this stream crosses agricultural and livestock areas, and borders the cities of San Carlos and Maldonado. These different activities, and especially urban areas, contribute various pollutants, among which plastic waste stands out. This study provide the first assessment of MPs on the Maldonado stream basin.

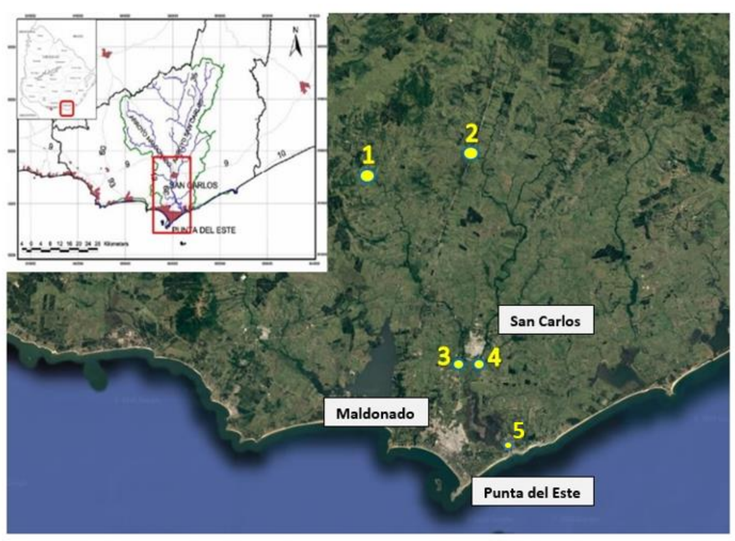

Figure 1. Location of the Maldonado stream basin. Sites 1 and 2 are located upstream San Carlos city. Sites 3, 4 and 5 are located downstream San Carlos city.

2. OBJECTIVES

General

- Carry out the first detailed analysis of the presence, distribution, and transport of microplastics in the Maldonado stream basin.

Specific

- Classify and quantify MPs according to type, size and colour.
- Determine the MPs density (items/m^3) in the different sampled sites.
- Evaluate the relationship between the main urban centers of the Maldonado stream basin with the abundance and composition of MPs.

3. METHODS

- Water samples were taken with a pump that filtered on average 1,25 m^3 of superficial water in five sites of the basin, throughout 2019 and with a seasonal frequency.
- Samples were filtered with a 100 µm mesh and the retained material was deposited in a glass petri dish for direct observation with a stereo microscope.
- The MPs found were measured, quantified and classified according to type (i.e. fiber, fragment, foam, pellets, films), size and colour.
- Just fibers greater than 1.0 mm and fragments greater than 0.5 mm were taken into account.
- A laboratory contamination control was placed near the stereo microscope and MPs found were verify with a microscope with polarized light.
- Statistic analysis were made with 2 ways ANOVA test after evaluating normality and homogeneity of variances.

Figure 2. Pump sampling of surface waters, and filter column.

4. RESULTS

- MPs average total densities in site 1 and 2 were 47,6, in 3 and 4 were 29,5 and in 5 were 50,7 items/m^3. On average, site 1 and 2 had the highest densities of MPs, while site 3 and 4 had the lowest.
- Fibers were the most represented type.
- Fibers densities had no significant difference between samples (f= 1,5 ; p= 0,2) or sites (f= 2,3 ; p= 0,08).
- Fragments densities had significant difference between samples, with October having the highest densities (f= 7,0 ; p= 0,003).
- Significant differences were found in total densities of MPs in sites (f= 3,1 ; p= 0,028) and month sampled (f= 3,3 ; p= 0,0049).

4. RESULTS

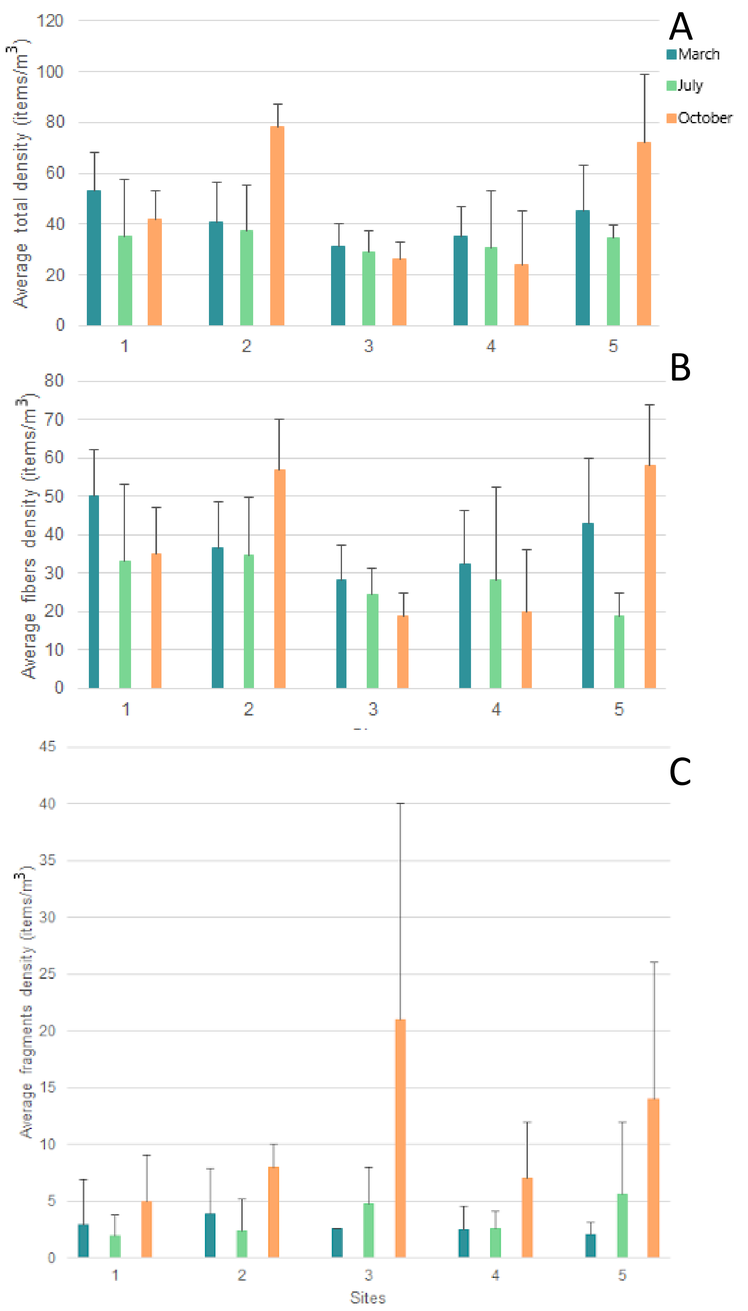

Figure 3. Average total density of MPs (A), fibers (B) and fragments (C) in each site, for the three sample periods.

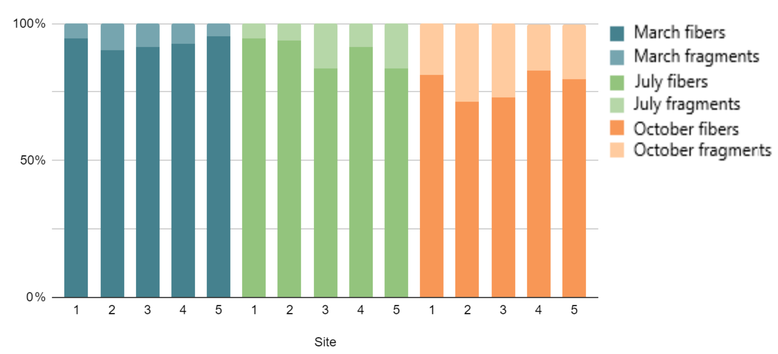

Figure 4. Percentage of fibers and fragments found in each site, for the three sample periods.

5. CONCLUSIONS

- The presences of MPs was ubiquitous in each site in March, July and October.
- The proximity to urban areas is not the only factor that determine the presence of MPs in freshwater systems.
- Other factors, such as wind may be influencing the dispersion of MPs (Gonzalez-Pleiter, et al., 2020).
- In site 5, the intrusion of the ocean to the Maldonado stream may be contributing with MPs.

Bibliography

González-Pleiter et al., 2020.[2] The Cryosphere. https://doi.org/10.5194/tc-2020-261