Occurrence and concentration of microplastics in an urban river

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1. Background

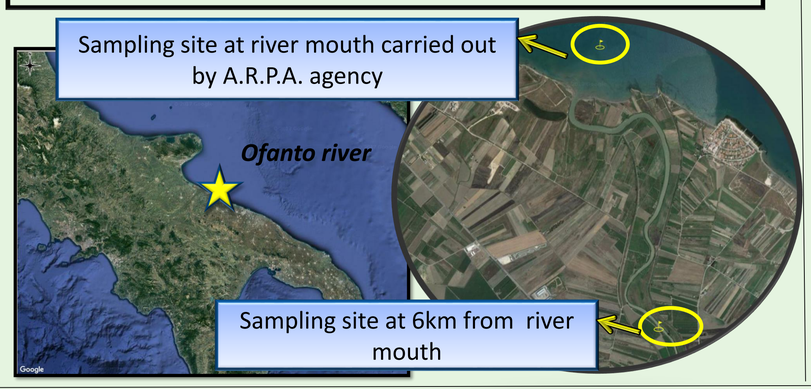
- A very high percentage of microplastics (MP) that reach the sea come from inland waters and are closely connected with consumption styles
- Studies of MP in freshwater systems are scarce respect to those focused on marine habitats
- Temporal data are missing. In general, measurements are based on individual time points.

2. Aim of the work

Determine the microplastic occurrence (quality and quantity) in an urban river and assess the hypotheses that microplastics amounts would be higher in proximity to urban sources, and vary temporally in response to weather phenomena and seasonal trends.

3. Study Area

Ofanto river: South Italy
Lenght: 170 km
Average flow: 14,30 m³/s
Mouth:Adriatic Sea, through Barletta and Margherita di Savoia cities.



4. Sampling strategy

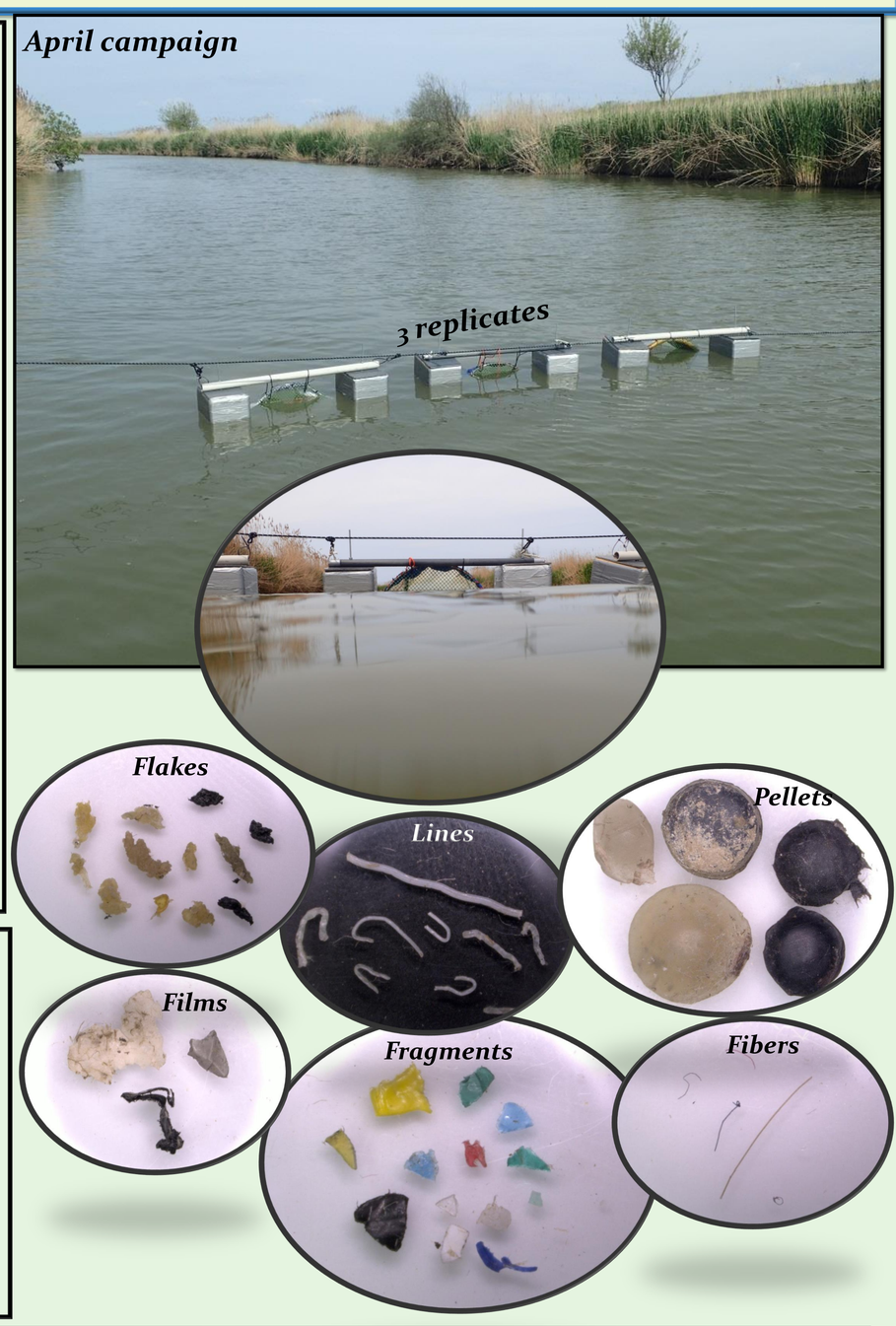
Two sampling campaigns planned:

• **February 2017**
2 set of samples collected in two different timetables:

- 11:00-13:00 (3 replicates)
- 13:00-15:00 (3 replicates)

• **April 2017**
- 11:00-13:00 (3 replicates)
- 13:00-15:00 (3 replicates)

Typology of samples: superficial water
Depth of sampling: 50cm
Net: Plancton net
Mesh size: 300µm
Lenght: 2,5 m
Diameter: 55 cm



5. Water sample process

I. Extraction and purification of MP samples (Wet Peroxide Oxidation and density separation) (Arthur et al., 2009)
II. Enumeration, categorazation and quantification of MP by visual sorting with digital microscope
III. Validation of visually based MP identification was achieved using Pyrolysis GC-MS.

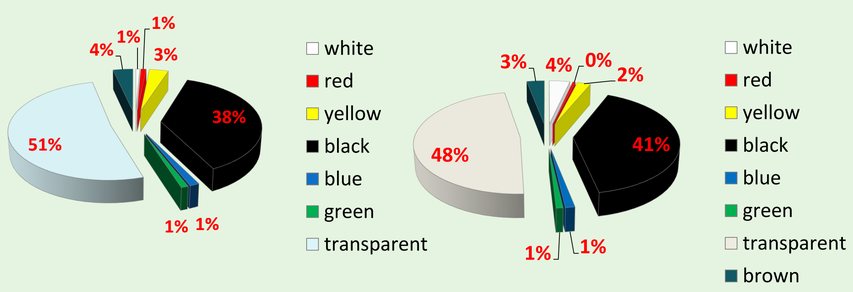
6. Data analysis

The composition of MP was studied in term of **size, shape, color** and **polymer type**. Results from the six replicates are expressed as mean values (± DEV. ST.) of number of particles per cubic meter (p/m³). Concentration differences between February and April campaigns were evaluated using the nonparametric Mann–Whitney U-Test because the data were not normally distributed and could not be transformed for normal distribution. Mann–Whitney U-Test was performed with STATGRAPHICS Centurion Software.

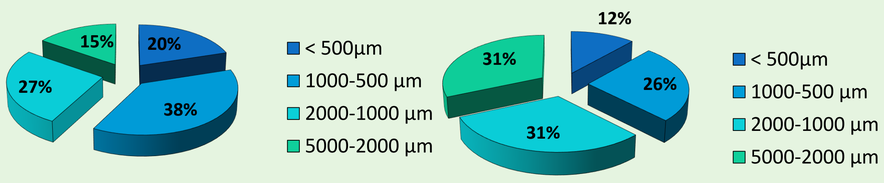
7. Results

February campaign *April campaign*

7.1 Colour

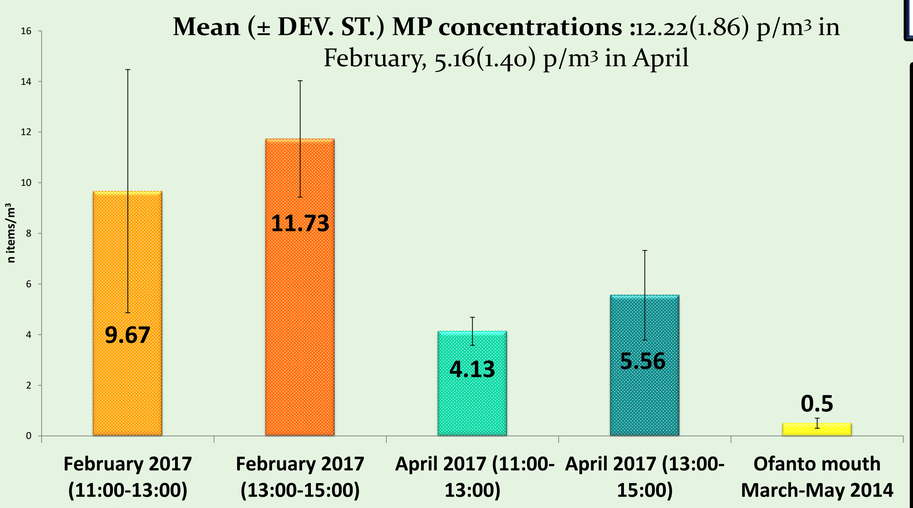


7.2 Size



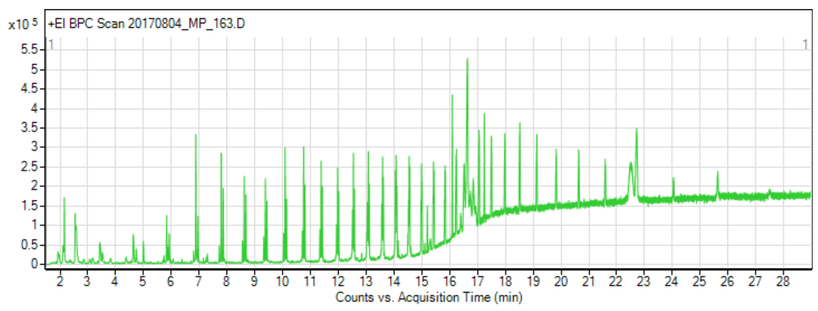
7.3 Concentration

Mean (± DEV. ST.) MP concentrations :12.22(1.86) p/m³ in February, 5.16(1.40) p/m³ in April

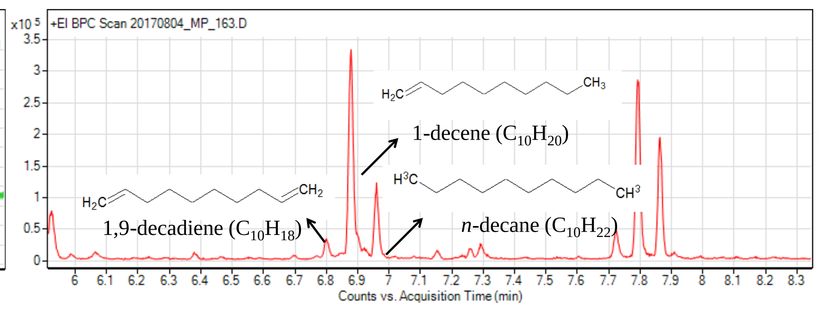


Polymer type

To unequivocally identify single polymers, specific decomposition products from pyrograms were chosen as indicators for polymer characterization. Identification of the marker compounds was done by matching their relative spectra with the F-Search database v3.4.2 delivered by Frontier Lab (Koriyama, Japan). A total of five polymer were identified: polyethylene (PE), polypropylene (PP), polystyrene (PS), polyvinylchloride (PVC), polyurethane (TDI-PUR). All samples contained at least three polymer types: PE, PP and PS. PE accounted for 77% of the total particles identified, followed by PS (12%), PP(10%), PVC (0.9%) and PU (0.4%).



Total ion chromatograms (TIC) of a PE MP sample.



Total ion chromatograms (TIC) of a PE MP sample with detailed view of the characteristic decomposition products of PE.

8. Discussion and conclusion

✓ MP concentrations found in Ofanto river are comparable to or greater than those reported in other river studies, although there are few other river studies with which to compare
✓The MP abundances found in Ofanto river are much more higher respect to those reported in 2014 at the Ofanto mouth confirming the important role of rivers as overlooked source of MP
✓There is a statistically significant difference between the concentration of microplastics found during the Ferbruary campaign and that one found during the April campaign (Mann–Whitney U Test = 18.00; p-value = 0.028) suggesting a seasonal variability due probably to runoff-events
✓PE is the most recurrent polymer identified in Ofanto river followed by PS and PP.

9. References

Arthur C., Baker J. and H. Bamford. 2009. Proceedings of the international research workshop on the occurrence, effects and fate of micro-plastic marine debris, Sept 9-11, 2008. NOAA Technical Memorandum NOS-OR&R-30. 49 p.

10. ACKNOLEDGMENTS

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