The seasonal cycle of micro and meso-plastics in surface waters at Ría de Vigo

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Abstract

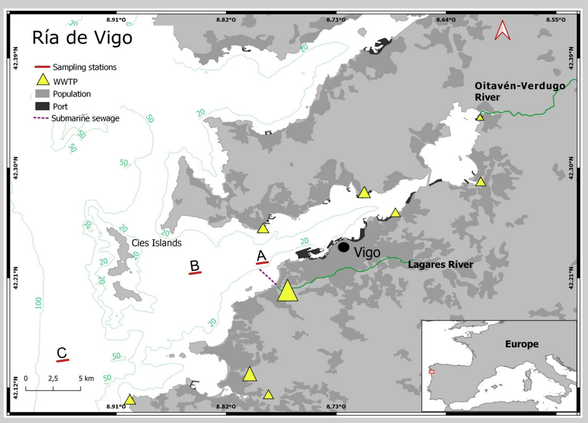
Despite the many studies of microplastics in the marine environment, only few have focused on temporary variations at a seasonal scale [1]. However, this variability needs to be taken into account for monitoring purposes, intercomparability of studies, model validation, etc.

This work focused on studying temporal variations at an annual scale of micro (< 5 mm) and mesoplastics (> 5 mm) concentrations in surface waters in the Ría de Vigo[2].

Three sampling stations were selected along the transverse axis of Ría de Vigo and were monthly sampled for one year employing manta trawl net (330 µm). The main shapes of both micro and mesoplastics were fibers followed by paint sheets, being black the main color in both cases.

The results showed high seasonal variability for micro and mesoplastics but similar spatial distribution.

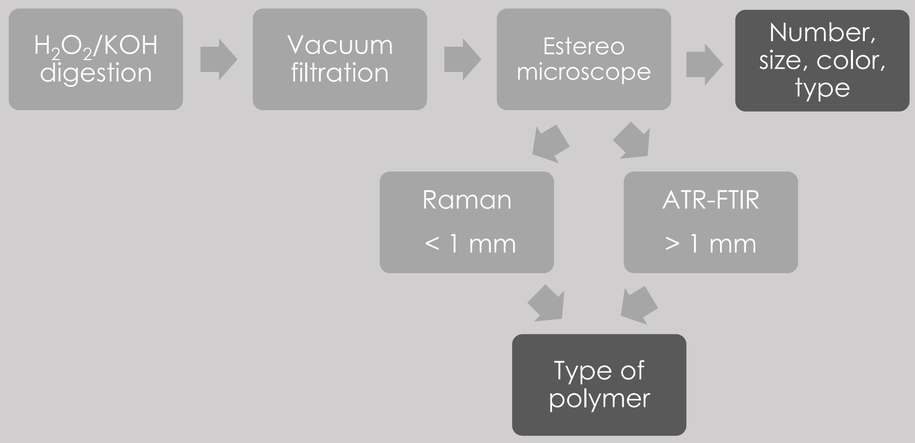
Sampling



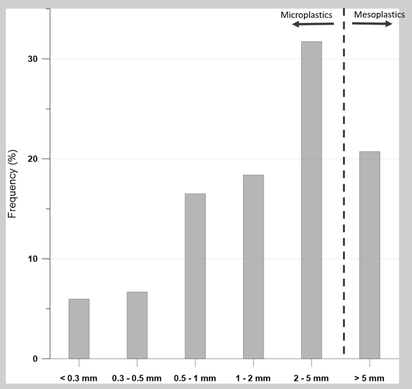
Surface water samples using manta trawl nets (mesh size 330 µm) were taken monthly at three stations for one year during the Vigo Radial cruise for a total of 32 samples.

The manta was towed for 10 min at a vessel speed of ~3 knots. Samples were washed using filtered seawater (0.200 mm) and then transferred to amber glass bottles and frozen at -20 °C until analysis.

Analysis

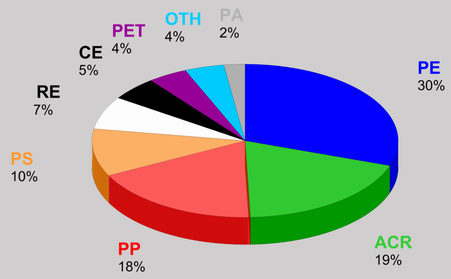


Plastic size distribution and composition



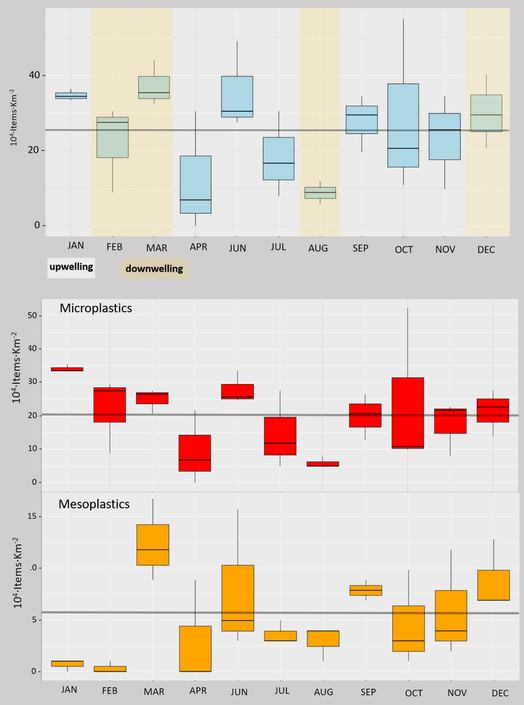
Microplastics were 79% of the total (677 particles). Particles larger than 5 mm, i.e. mesoplastics, comprised 21% of the total plastic particles (177 particles).

Microplastics between 2 and 5 mm were the most abundant.



Around 30% of plastics analyzed were Polyethylene (PE), 19% were acrylates, 18% were Polypropylene (PP) and 10% were Polystyrene (PS).

Montly evolution …



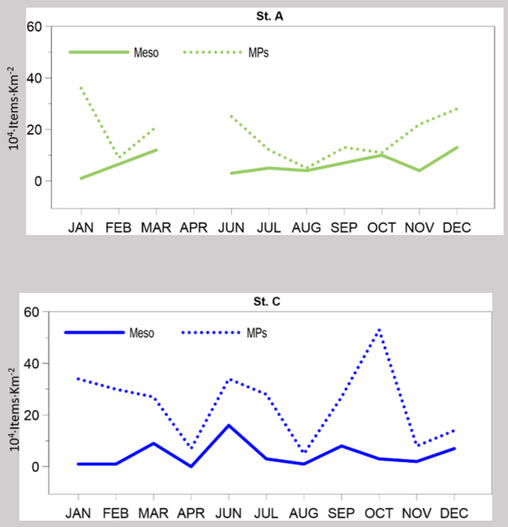
For microplastics the mean concentration across all sites was 20.1 ± 11.6 (mean ± SD) items·km^{-2}. For mesoplastics the mean was 5.27±4.75 items·km^{-2} (mean ± SD).

No significant differences between the total plastic abundance per month or upwelling/downwelling periods were observed.

However significant montly variability was observed for mesoplastics.

Overall, March, September, and December showed higher mesoplastics concentrations. The rest of the months presented values lower than the mean.

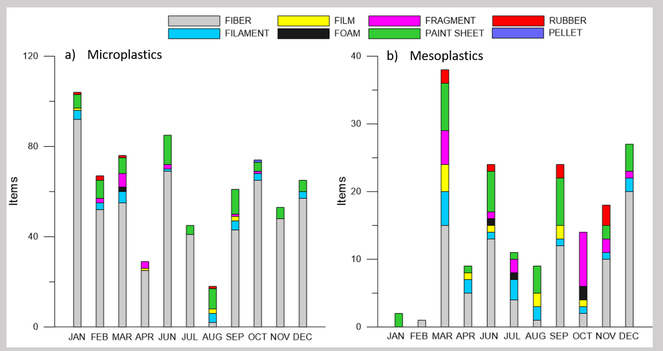
…by sampling station



No gradient was observed in the concentration of MPs or mesoplastics from the inner zone to the outer zone of the Ría.

There is no significant correlation between the concentrations of MPs and mesoplastics between stations (R^2=0.033).

…by plastic shape



Plastic shapes were categorized according to BASEMAN protocol[3] into 8 categories: fibers, filaments, fragments, films, paint sheets, foams, pellets, and rubbers.

The main microplastics shape was fibers (81%), followed by paint sheets (11%). Filaments were present in 4% and fragments in 2.5%. The rest of the shapes were present in <1% (films, rubbers, foams, and pellets). Regarding the shape characterization of mesoplastics, fibers were the predominant shape (47%), followed by paint sheet (19%), filaments (11%), and fragments (10%). The rest of the shapes were present in less than 10%, as films (6%), rubbers (5%), and foams (2%).

Conclusions

- There is a high seasonal variability in both MPs and mesoplastic in seawater in Ría de Vigo.
- Sampling stations were subject to similar anthropogenic influences.
- The abundance of microplastics was greater than that of mesoplastics, and it has been shown that pollution by mesoplastics cannot be estimated through the microplastics abundances.

References:

1. Tsang, Y.Y.,Mak, C.W., Liebich, C., Lam, S.W., Sze, E.T.P., Chan, K.M., 2020. Spatial and temporal variations of coastal microplastic pollution in Hong Kong. Mar. Pollut. Bull. 161, 111765.
2. Olga Carretero, Jesús Gago, Ana Virginia Filgueiras, Lucía Viñas. The seasonal cycle of micro and meso-plastics in surface waters in a coastal environment (Ría de Vigo, NWSpain). Science of the Total Environment 803 (2022) 150021.
3 Gago, J., Filgueiras, A., Pedrotti, M.L., Caetano, M., Firas, J., 2019. Standardised protocol for monitoring microplastics in seawater. JPI-Oceans BASEMAN Project, p. 96

Acknowledgements:

This work was supported by the IEO through the 'RADIALES-20 project', 'CleanAtlantic' (EAPA_46/2016) project 'Tackling Marine Litter in the Atlantic Area' from the Interreg Atlantic Area Call (EAPA_46/ 2016) and ANDROMEDA project (JPI Ocean-PCI2020 112047, IP JG). JG work was also funded by ESMARES-D2 project supported by Spanish Minister of Ecological Transition. A pre-doctoral fellowship from the Galician Innovation Agency (Gain, IN606A-2018/029) funded O.C.

MICRO 2022 ATLAS EDITION