Evaluation of the uncertainty of microplastics quantification in sediments: A bottom-up assessment

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The concern with the contamination of the environment with micro(plastics) is very trending nowadays due to the fact that this material is ubiquitous.

Plastic production reached over 368 million tonnes worldwide and 57.9 million tonnes in Europe in 2019 [1,2] due to its wide application. Actual statistics point that more than 60% of the global composition of marine litter is plastic and about 1.15 to 2.41 million tons of plastic are dumped into oceans every year from rivers [3,4].

The awareness of this threat to the environment and human health attracted the scientific community to the monitoring of microplastics contamination in several aquatic systems and matrices, namely, surface water, column water, seafloor sediment, and beaches.

The monitoring of the level and trends of the contamination by microplastics is essential to determine the relevance and potential sources of this contamination necessary to define strategies to reduce it. The contamination is classified regarding microplastics' physical-chemical properties. The impact of microplastics in open ocean, rivers, estuarine areas, and coastal regions compartments is only possible to understand if this contamination is characterized adequately and objectively.

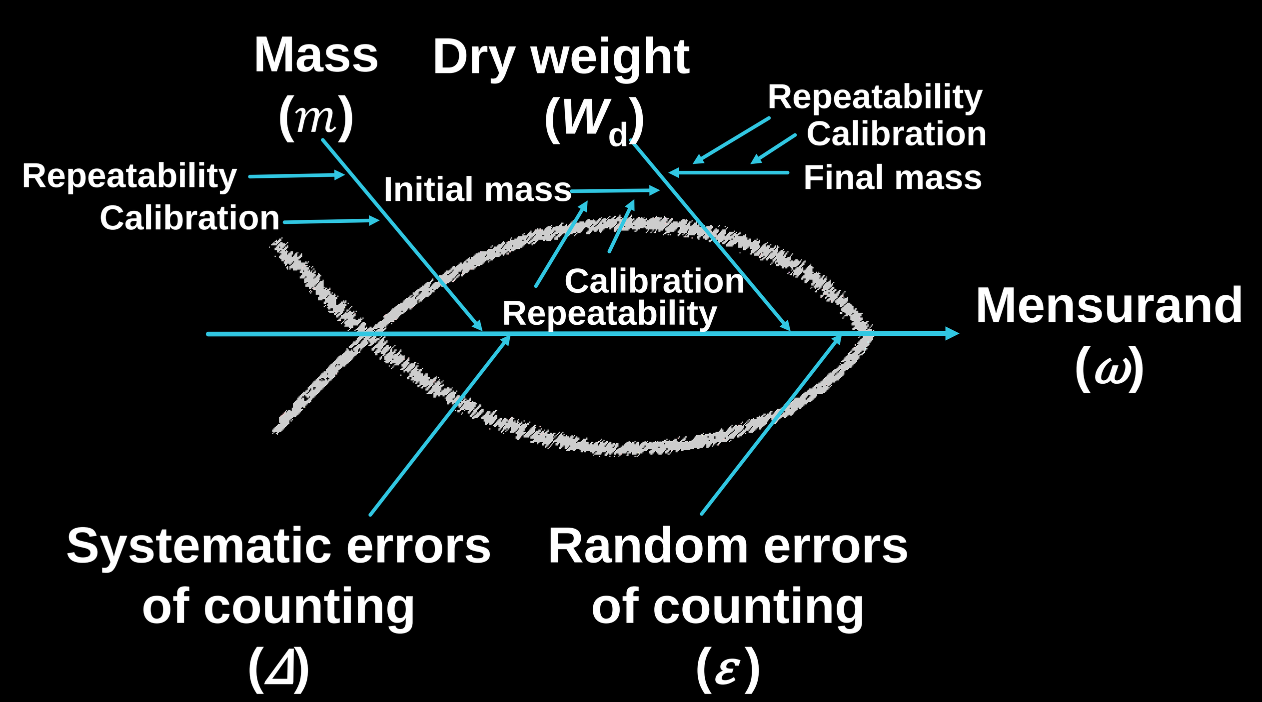
1 Measurand definition

"T, PP or PET with size ranging between 50 µm and 5 mm per dry mass of sediment"

T: Microplastics isolated by a saturated NaCl solution, despite their propertiesphysical chemical
PP: Microfragments of polypropylene
PET: Microplastics of polyethylene terephtalate

2 Uncertainty sources identification

Bottom-up approach



3 Uncertainty sources quantification & combination

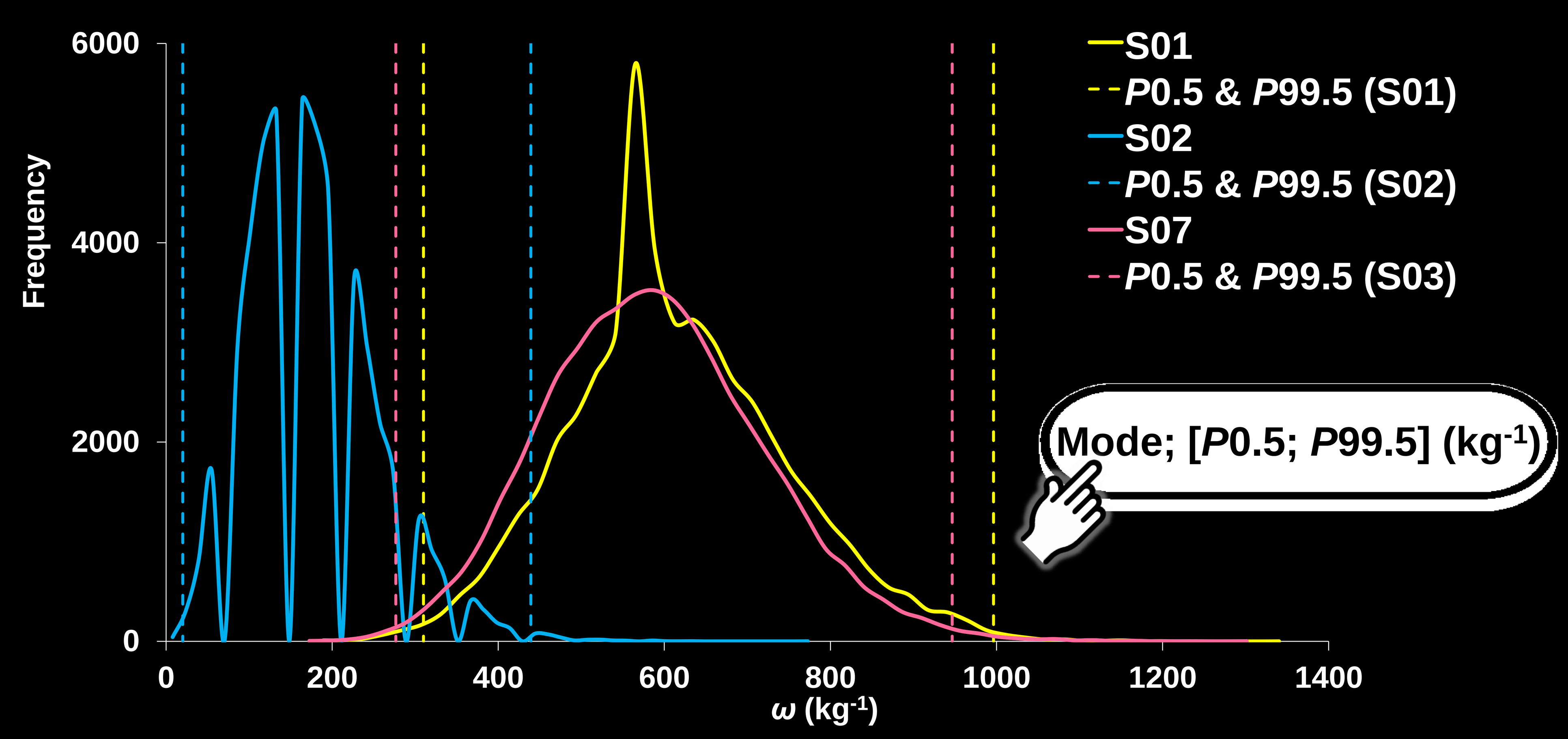
Monte Carlo method

$$\omega = \frac{C + \varepsilon + \Delta}{m\, W_d}$$

Select distribution:

- **Rectangular** | u_m, u_{W_d}
- ***t*-Student** | u_m, u_{W_d}
- **Poisson-Lognormal** | Δ, ε

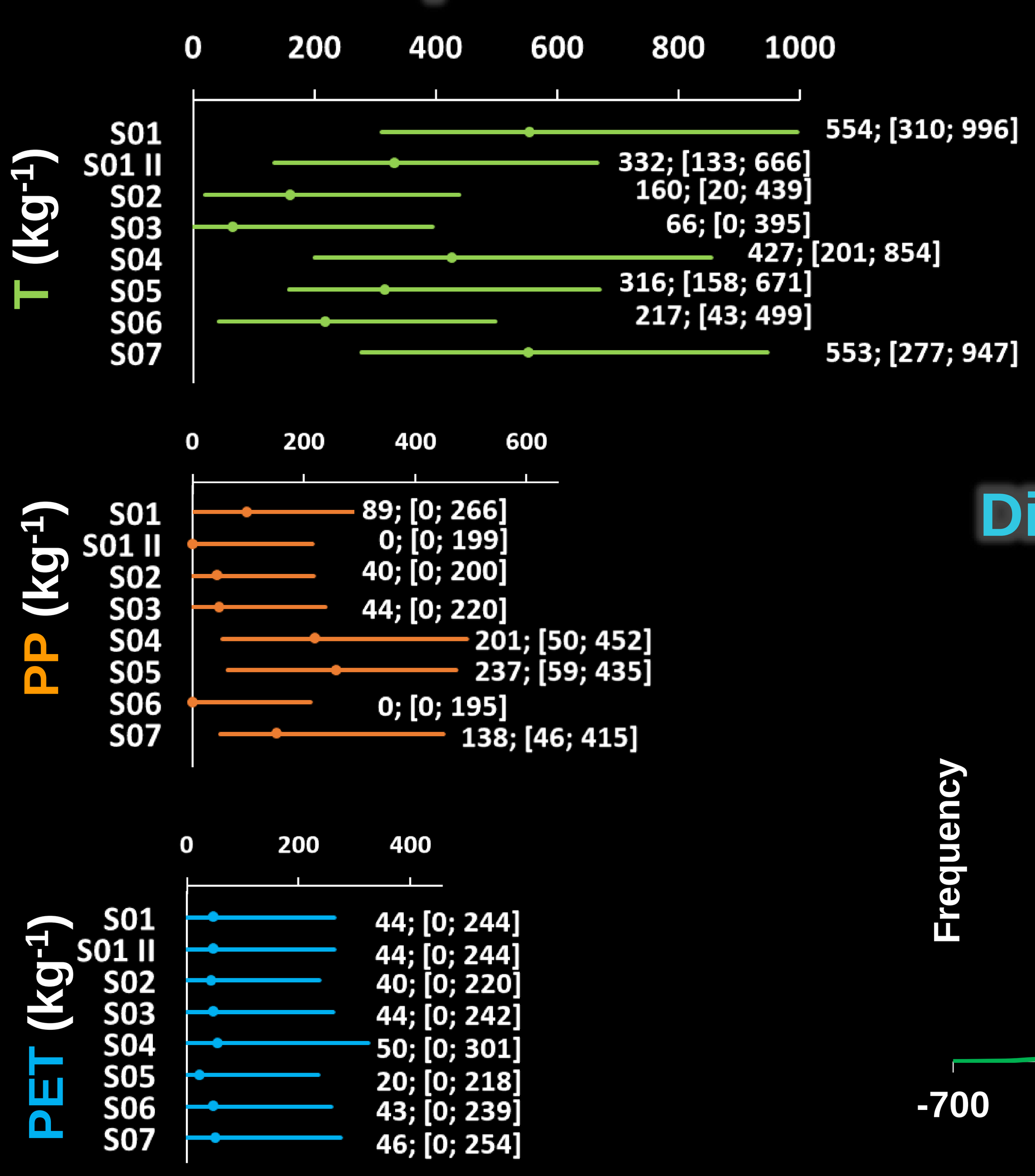
Probability density distributions:



Mode; [P0.5; P99.5] (kg^{-1})

4 Results

Sediment samples from Mira river:



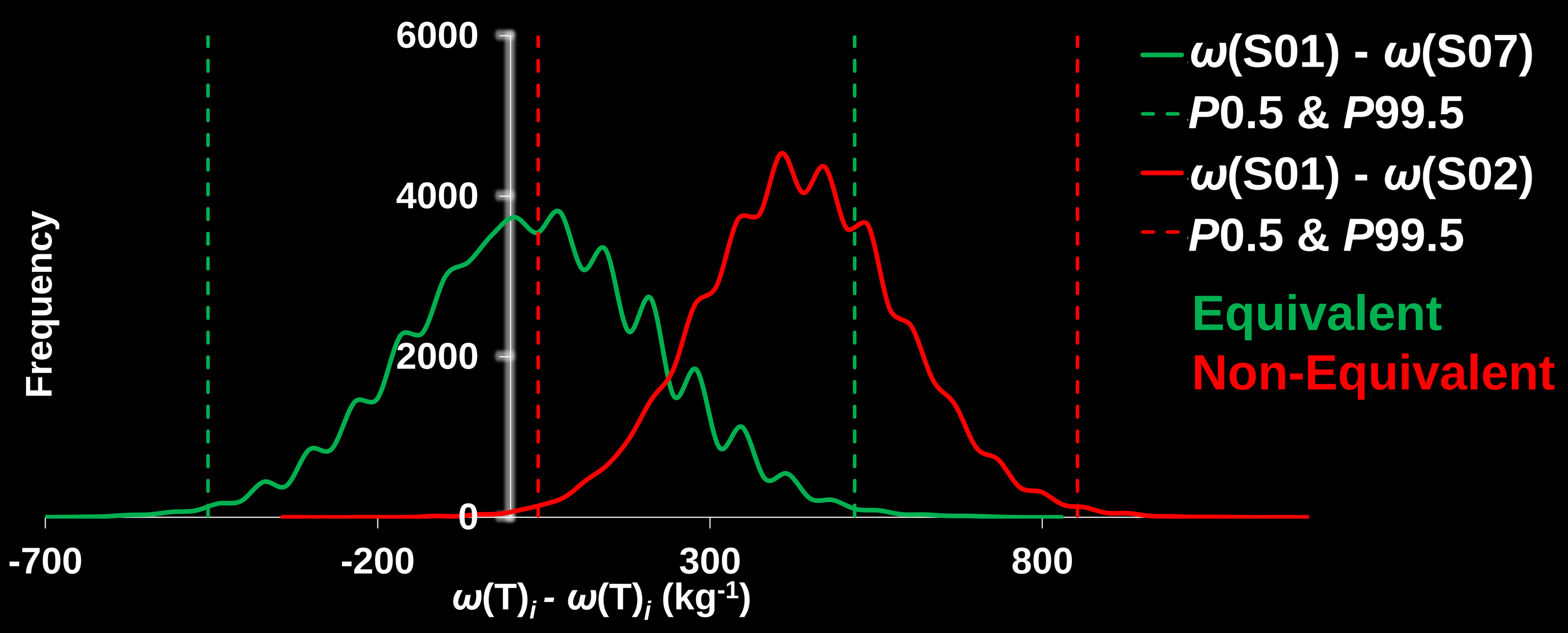
Objective comparison 95% c.l.

- Samples from same campaign
- Samples of same coordinates
- Mean contamination observed in campaigns

Criterion

$P0.5 < 0 < P99.5$

Difference distributions:



5 Main conclusions

- Methodology successfully applied to the determination of T, PP, PET in dry mass of sediment.
- Estimation of the measurement uncertainty by the Bottom-up approach by combining components with different distributions.
- Monte Carlo method used to combine the different distributions.
- First objective comparison of the contamination levels of the various samples.

Acknowledgments:
This work was supported by Universidade de Lisboa through a PhD Scholarship 2018, Instituto Hidrográfico through the MONIAQUA research program, the Operational Program Mar2020 through project "AQUIMAR – Caracterização geral de áreas aquícolas para estabelecimento de culturas marinhas" (MAR2020 nº MAR-02.01.01-FEAMP- 0107), Fundação para a Ciência e Tecnologia (FCT) through projects UIDB/00100/2020 and UIDP/00100/2020, and Institute of Molecular Sciences through project LA/P/0056/2020.

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