

Pump-underway ship intake: an opportunity for Marine Strategy Framework Directive (MSFD) monitoring needs. First observations of microplastics on oceanic and coastal waters off the Canary Islands (Subtropical NE Atlantic)

Tania Montoto-Martinez^{*1}, Jose Joaquin Hernandez-Brito², Maria Dolores Gelado-Caballero¹

*Corresponding author: tania.montoto@ulpgc.es

¹ Research group on Environmental Technologies, Management and Biogeochemistry. University of Las Palmas de Gran Canaria (ULPGC)

² Oceanic Platform of the Canary Islands (PLOCAN)

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Abstract

Broad scale sampling methods for microplastic monitoring in open ocean waters is a current challenge in oceanography. Large amount of samples is required to understand distribution, abundance and fate of these particles in the environment. The underway water system of research vessels (RVs) has been approached for microplastic sampling in some studies up to date (Desforges et al., 2014; Enders et al., 2015; Kanhai et al., 2017; Lusher et al., 2014; Setala et al., 2016). In this study, we present a sampling methodology founded on the design of a microplastic sampling device connected to the pump-underway ship intake system as an opportunity for oceanic monitoring needs concerning microplastic abundance and distribution (Figure 1).

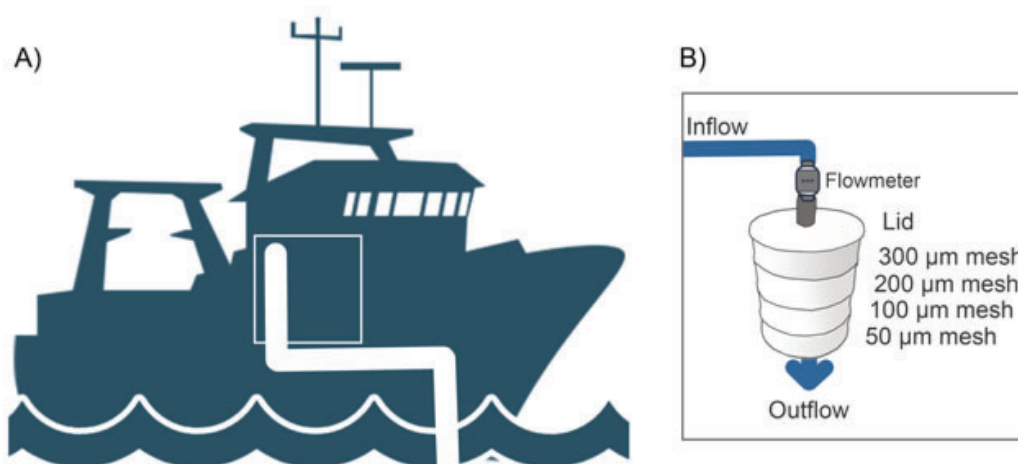


Figure 1: Sampling set up diagram, showing (a) the pump-underway system of the RV; and (b) the filtering device diagram.

This methodology provides four main advantages: (1) the sampling device is fully made with standard materials, cost-effective and affordable, and it can be self-mounted by the researchers without additional skilled personnel or equipment on-board; (2) it can be employed to report data

taking advantage of oceanographic campaigns without interfering their regular vessel activities; (3) it is highly versatile and reduces the time needed to recover each sample; (4) it is suitable to sample microplastic particles (both fibres and fragments) down to 50 μm . As preliminary field application results and first reported data from the Canary Islands oceanic and coastal waters, we investigated microplastics (0.05 – 1 mm) sampled from subsurface waters (- 4 m depth) using the pump-underway system of RV Ángeles Alvariño in the Subtropical NE Atlantic. Sampling was performed in three consecutive oceanographic campaigns over a year, repeating the same procedure, retrieving water while on navigation and while on coastal and oceanic stations. Microplastic particles ($> 50 \mu\text{m}$) were found in the total stations and transects sampled (Figure 2). Fibres (64.42%) were predominant over fragments (35.58%), being the concentration values over the data reported in other areas in the Atlantic.

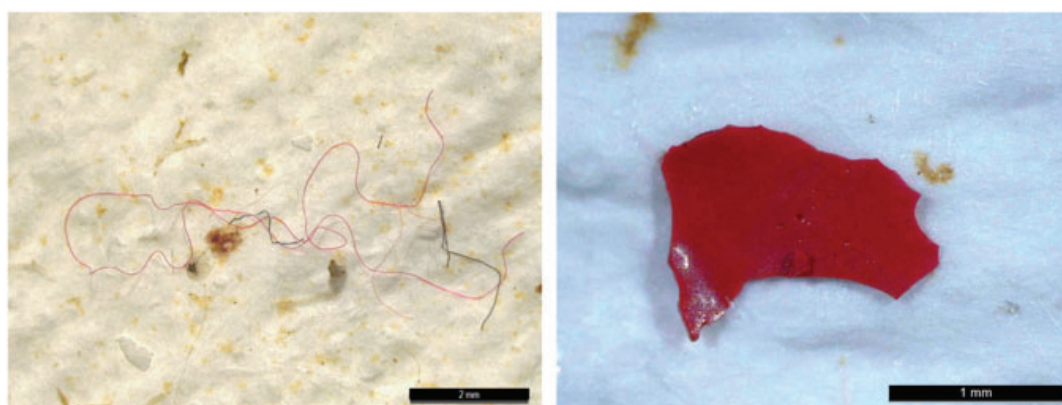


Figure 2: Pictures showing the typical microplastic particles found: (a) a specially long red fibre, and (b) a red microplastic fragment, showing characteristics for microplastic identification such as irregular edges.

The pump-underway system represents an opportunity as a sampling method to increase monitoring efforts and increase reported data for the implementation of the Marine Strategy Framework Directive (MSFD). More research is needed in order to assess the method efficiency and to develop proper strategies to address the threat that microplastics pose to the marine environment and ecosystems.

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