Monitoring, simulation, and dissemination: the European SPlasH! project strategy to face up the microplastic problem in commercial port environment

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Introduction

The European SPlasH! "Stop to plastics in H_2O!" project is one of the many projects that have been devised in recent years for the study, monitoring and management of microplastics (MPs) in marine environments, but it is the only one (at its start in 2018) targeting the port environment. The project is a collaboration between the University of Genoa (IT), the University of Toulon (FR) and the European Research Institute (IT), and it was divided into three different activity categories: monitoring, simulation, and dissemination (**Fig. 2**). The aim of the project was to provide stakeholders with useful information for the implementation of measures and actions to reduce the impact of plastics on port and outside waters.

Fig. 1: Area of the Interreg ITA-FR Maritime 2014-2020 programme (in blue).

The project monitoring plan included 4 campaigns (from 2018 to 2019) in the ports of Genoa, Toulon and Olbia (**Fig. 1**) for the sampling of sediments, surface waters, surface MPs and fish. Sediment, water samples and fish stomatal content underwent density separation, organic matter digestion and microfiltration.

A series of laboratory experiments was performed with the aim of measuring MP trajectories under different wave conditions and according to different MP characteristics. Marine circulation and MP dispersion process were studied. The FLOW module of DELFT3D was used to simulate the multidimensional hydrodynamics. The evolution of the horizontal velocity generated on the surface of the domain and the evolution of the MP concentration were obtained.

Dissemination activities with schools took place and different communication tools were used.

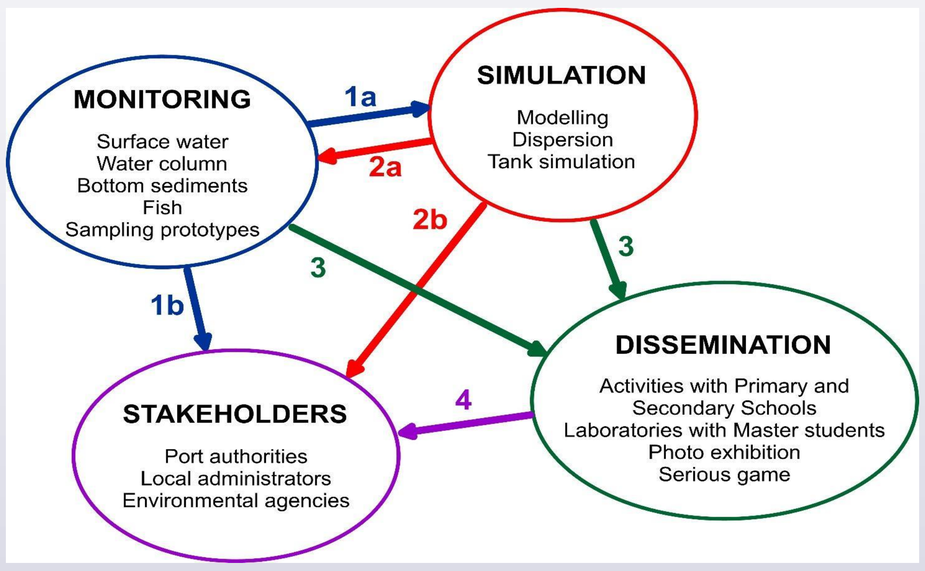

Fig. 2: The strategy of the SPlasH! project to face up the MP problem in commercial port environment. Colours represent the different activity categories addressed by the project; numbers indicate the time order in which the activities were carried out within the project.

Results & Discussion

Items extracted from the samples have been classified by shape, color and dimension by optical analysis, revealing a prevalence of filament and fragment shapes and dimensions of 63-500 µm. The polymeric composition of the MPs in water samples was more heterogeneous than in sediments (**Fig. 3**) and the MP composition was more diverse and abundant in samples taken in Genoa than in Toulon, for both matrices. Prevalent presence of polyester was highlighted in water, while sediment samples showed a major content of polypropylene particles in both sites. These results agree with the greater complexity (in terms of port activities, morphology of the basin, presence of rivers, marine traffic, etc.) of the Port of Genoa compared to the one of Toulon.

All scenarios obtained from the simulation of MP dispersion in the Port of Genoa show a mass spillage from the port area, even if with relatively low MP concentration. However, the worst scenarios are those in which there is a northern wind that invariably tends to lead to an increase in the amount of material released from the port, resulting in significant dispersion in the surrounding area **(Fig. 4).**

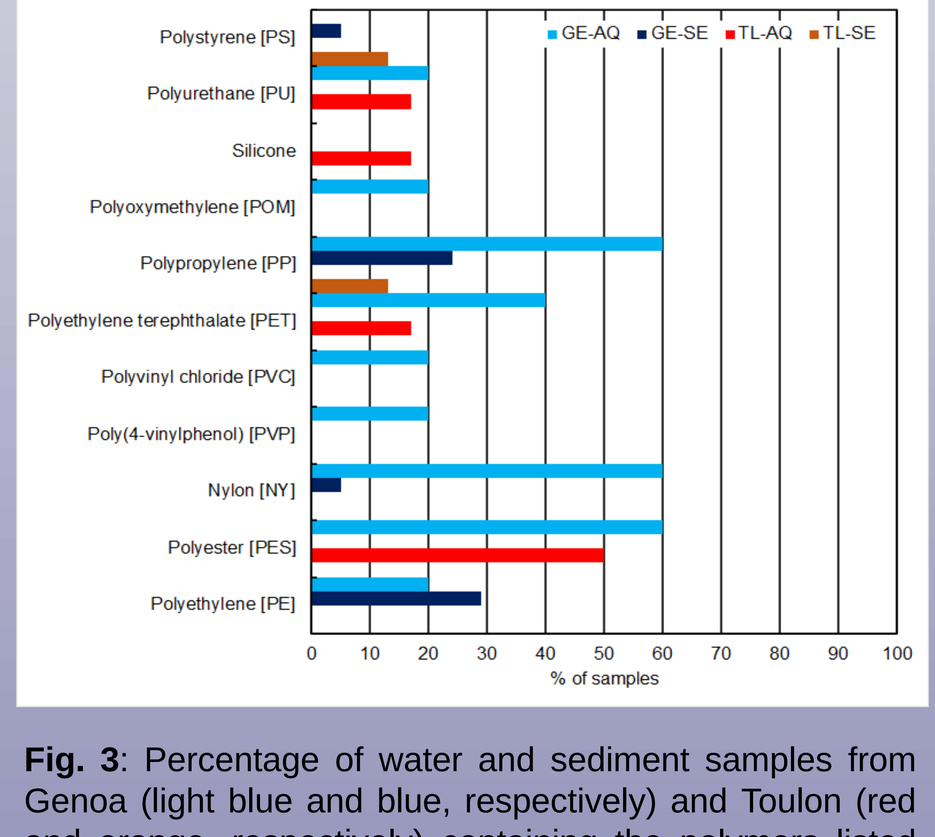

Fig. 3: Percentage of water and sediment samples from Genoa (light blue and blue, respectively) and Toulon (red and orange, respectively) containing the polymers listed on the y-axis.

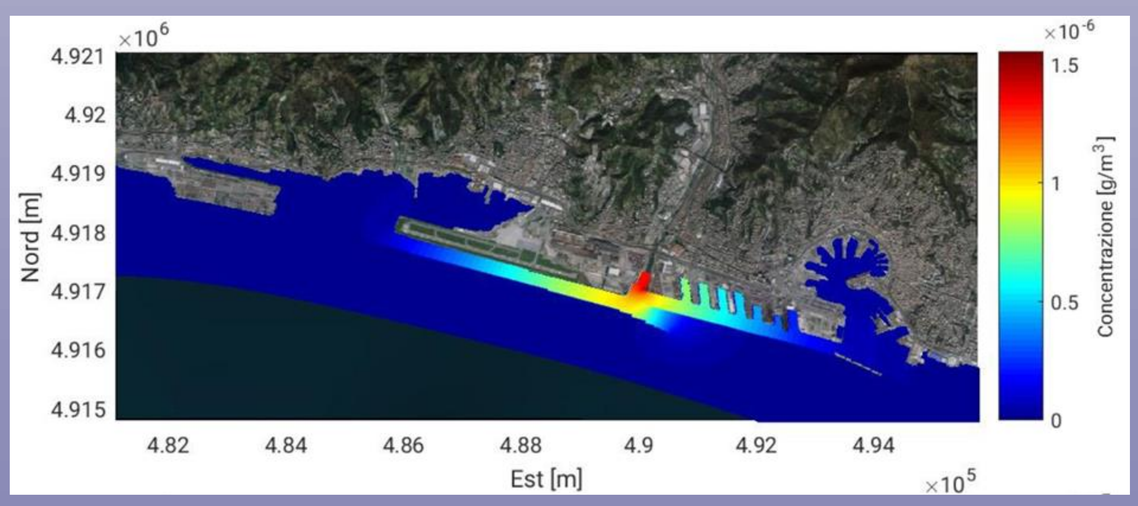

Fig. 4: Evolution of the maximum concentration of tracer released in the inner part of the Port of Genoa, with N wind.

The dissemination activity involved a total of 21 schools, 954 classes, and 1806 students from schools of different grades. The field activities made it possible to collect and catalogue 50 kg of plastic, 456 cigarette butts, 283 cotton buds. In order to broaden the vision of the problem of plastic pollution, a social game (**Fig. 5**) has been created and put on the net in 3 languages: Italian, French and English for its maximum dissemination.

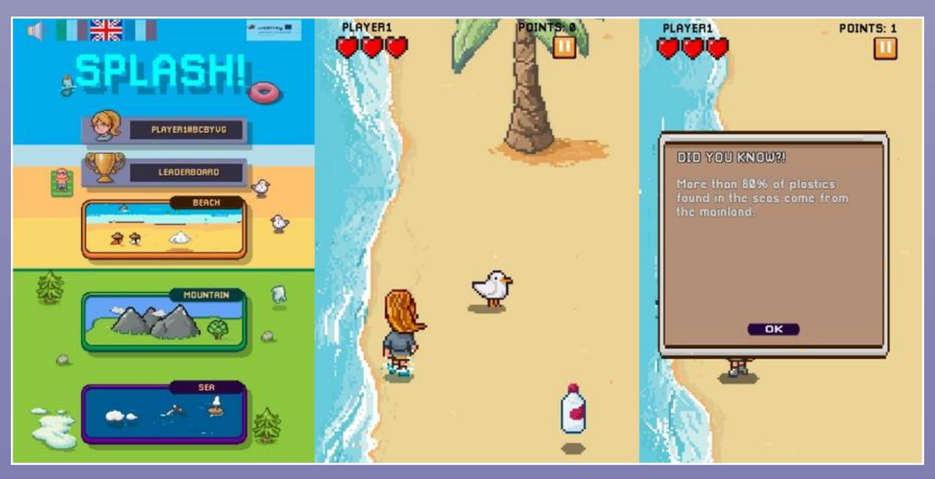

Fig. 5: The SPlasH! Social game.

Conclusions

The Project “SPlasH!” has been useful to better understand MPs contamination in port areas, and the results, combined with the use of dispersion models, can be exploited by Port Authorities to improve the management of this emerging environmental issue. Further sampling campaigns will be held to increase knowledge and awareness on this environmental threat during the next SPlasH & Co Project.

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