Università Politecnica delle Marche
Dottorato di Ricerca in Science della Vita e dell'Ambiente

PCSI – Plastic Crime Scene Investigation.
The Citizen Science Approach to Microplastic Monitoring

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PhD Student: Raffaella Bullo

Tutor: Prof.ssa Silvia Bianchelli (UNIVPM)

Tutor: Prof. Silvestro Greco (SZN)
Tutor: Dr.ssa Claudia Gili (SZN)

Curriculum Biologia ed Ecologia Marina

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Abstract

The issue of plastic pollution in oceans has gained significant public attention, largely thanks to extensive scientific knowledge advancement and media coverage. While society is indeed becoming aware of this problem, the focus has predominantly centered on the visibility of macroplastics. In contrast, the public issue of microplastics remains relatively underrated, and there is much work to be done in this regard for several reasons. Microplastic impact has indeed emerged as a critical scientific concern due to its effect on the environment, ecosystems, and marine biodiversity. However, public awareness of microplastic pollution remains low, particularly regarding risk perception. This could be attributed to a lack of information provided to the public by both the scientific community and the media. Conversely, recent studies have shown that raising awareness about microplastics and visually demonstrating the extent of pollution could increase public knowledge and influence their perception of the associated risks.

"PCSI - Plastic Crime Scene Investigation" project is dedicated to assessing a methodology for the quality-quantitative analysis of microplastics in seawater surfaces and beaches through a Citizen Science approach, allowing the gathering of a large volume of data, engaging civil society actively in scientific research endeavors and offer a robust data set that can be used and compared with the other scientific, environmental agencies and governance bodies.

To make the sea-surface sampling and monitoring activities more inclusive, a prototype was developed, tested, calibrated and validated against the Manta Trawl Net, the instrument used by researcher centers under the EU Marine Strategy Directive Framework protocols (descriptor 10).

After calibration, the prototype called *Kythara* was used to assess the microplastic abundance and composition (i.e., characterization of plastic compounds) in 6 areas along the Roman coast, 3

protected (Oasi di Macchiagrande, Tenuta Presidenziale di Castelporziano, Secche di Tor Paterno) and 3 not protected areas (Isola Sacra, Tevere Mouth, Ostia), in summer 2022.

Along the beaches, parallel activities to monitor little plastics sanded were designed under the gamification guidelines to build a scientific approach in Citizen Scientists. These activities involved ca. 700 students and ca. 70 teachers, plus ca. 30 people from the general public in the field, and ca. 30 people as digital unit through social media interactions.

Since public attention has been highly stimulated from the beginning, a systematic communication plan was developed to involve citizens, politicians, local administrations, and stakeholders to create a solid local network of cooperation in scientific research. This has been achieved through the participation to ca. 20 public events, included the 3-days Tevereday, involving the Roma Municipality, as well as the building of several collaborations with different stakeholder segments (e.g., academic, municipal and regional policy, private companies, economic operators, NGOs, etc.) and mass media coverage.

Overall, the results of the project demonstrated that: i) prototypes projected and validated by scientific teams can be effective in collecting scientific data; ii) data collected through Citizen Science can be solid and useful for scientific purposes, iii) social awareness on scientific themes can be raised when the Citizen Science is based on solid research dedicated projects and iv) Citizen Science can embrace all the society components, from the scientific, to the policy, public, private entities, educational and artistic sectors, to face the present and future environmental challenges.

Citizen Science is a scientific approach that is not lesser in worth or cost-effectiveness. It demands a significant upfront investment in data quality. Despite the associated expenses and efforts, the benefits of Citizen Science are nowadays of paramount importance. It plays an imperative role in increasing collective awareness, developing knowledge, and advancing scientific research, all of which are essential for facing contemporary urgent environmental challenges. To achieve the primary goals of promoting scientific accuracy, engaging citizens, and influencing policy decisions, Citizen Science projects must adhere to scientific and regulatory standards, but also courageously embark on

new paths of scientific innovation. Failure to guarantee data quality and integration across scientific programs may impede the effectiveness of Citizen Science proposals. However, by confirming new processes and new methods, Citizen Science can sustain high scientific rigor while making scientific data more accessible to all, thereby promoting science democratization and environmental justice.