Monitoring macro & micro plastic in Pelagos Sanctuary: a citizenscience successful approach

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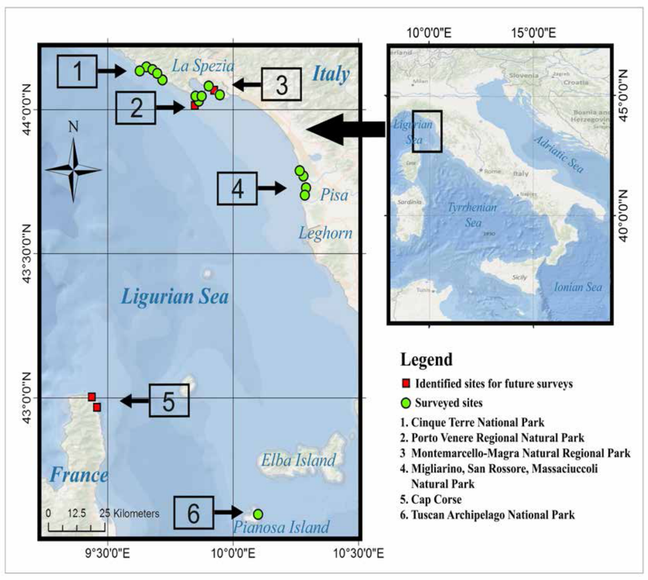
1. Introduction

SEACleaner and SEACleaner II are two coastal monitoring programmes dedicated to the collection, classification and analysis of marine litter in five coastal areas in Tuscany and Liguria, located inside the macroarea of the Pelagos Sanctuary. The projects took place in the years 2013 to 2017, thanks to a common goal pursued by the involved institutions: combining scientific research, "on field" didactic activities, dissemination of results and raising public awareness of the problems of our coastal areas due to pollution from marine waste, in particular plastic. Citizens are seen as an active part of the monitoring and data collection process, participating in field research activities for scientific, informative, didactic and of public awareness purposes.
Results are made public through specific scientific articles but also through dissemination conferences, magazine and network reports.



SEACleaner Monitored Areas: Cinque Terre beaches – Area 1, included in Cinque Terre National Park and its MPA; Palmaria island - Area 2, included in Porto Venere Natural Regional Park and its MPA; Lerici beach - Area 3, near Montemarcello-Magra Regional Natural Park; San Rossore restricted area - Area 4, included in Migliarino-San Rossore-Massaciuccoli Regional Natural Park; Talamone beach, included in Cap Corse Park - Area5; Pianosa island - Area 6, included in Tuscan Archipelago National Park and Secche della Meloria MPA. SEAClenaner II surveyed area is restricted to specific MPAs with high protection degree. (Pianosa Island in Tuscan archipelago; San Rossore Park, near Pisa), to some neighboring urban beaches, and to Cap Corse Park beach, in order to compare situations that differ for paramethers as anthropization, tourist exploitation, cleaning beach actions etc

2. The dealed problem

Recent investigations [1, 2] assess high densities of Antropogenic Marine Debries (AMDs) in between the Tyrrhenian and Ligurian Sea, with concentrations of macro and micro floating marine litter comparable with the values found in Pacific Ocean. The problem of AMDs accumulation at sea and along coastline is becoming increasingly important within the Marine Strategy Framework Directive (MSFD), but there is still not enough data regarding macrodebries, microdebries and the principal pollution sources of them along our coasts. These data are instead important, in order to establish the degree of Environmental Status of Italian coastal areas and to make comparison with bio-indicators of coastal flora and fauna and their biodiversity index.

One of the monitored site (San Rossore beach), in a high protection degree Marine Protected Area. The absense of tourism does dot implicate absense of pollution. Performed cleaning actions are very scarce, and marine litter accumulate and fragmentate, with very negative consequence.

*In SEACleanerII project, follow up of SEACleaner, the network has been extendend to ENEA - UTMAR of La Spezia.
This new project is focused on microplastic, which represent a major problem for cetaceus living in this macroarea.*

3. Methodologies

Each monitored Area include several Sites, i.e. beaches selected in order to monitor and estimate contribution of urban, riverine or marine inputs to coastal litter pollution [3]. Beaches have been classified following Ariza et al. [4] as:
- Urban (U) beaches located in residential and touristic areas.
- Urbanized (Uz) beaches, close to urban centres and may be visited by tourists but with a lower human presence compared to the previous ones.
- Natural (N) beaches with low human impact. Most of them are located in the most restricted sub-areas ("A Zone" - high degree of protection and prohibition for boating activities) in MPAs.

The monitoring protocol is made up by a Survey Datasheet for cataloguing AMD and its Users' Manual/Guidelines result of the integration of direct observations with all guidelines and methodological instructions identified by UNEP/IOC [5], MSFD 2013 [3], OSPAR 2010 [7] and NOAA 2013 (see Merlino et al. 2015 [7] and Giovacchini et. al 2018 [8] for more details).

Collection of data is due trought repeated campaigns at the same georeferenced stations, with seasonal time lapse. Items are collected starting, for each site, from the seaside line to the beginning of the back dune vegetation (or other constraints), selecting one or more sampling units 100 meters long. For microplastic 9 station are selected in each site, with tree replicas each one, using a 1mm metal sieve.

4. Volunteers and students involvement

For data collection, catalogation and counting, many volunteers have been involved. In this kind of citizenscience approach, a previous preparation phase is necessary, in order to explain to people how to perform surveys, how to use the Monitoring Guide and to follow correctly the survey protocol. In SEACleaner project we pay particular attention in high school students' involvement, by means of "relate-learning" stages. The purpose is triple:

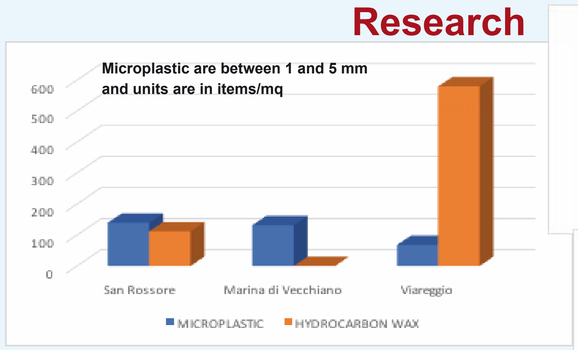
1) To make the youngsters more aware of these environmental issues and, with them, their upcoming adults (parents, relatives).

2) Attracting young people to science in an active, fun and passionate way.

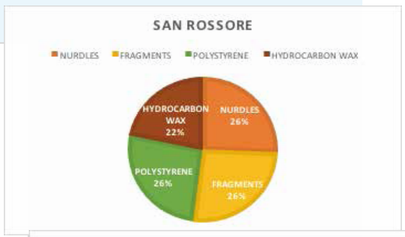
3) Acquire more scientifically valid data thanks to the large number of surveys executable with the participation of the School Institutes

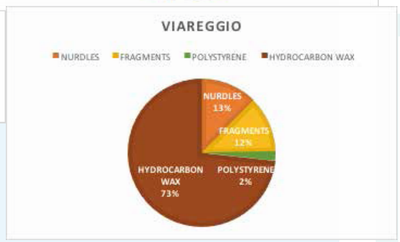
Results

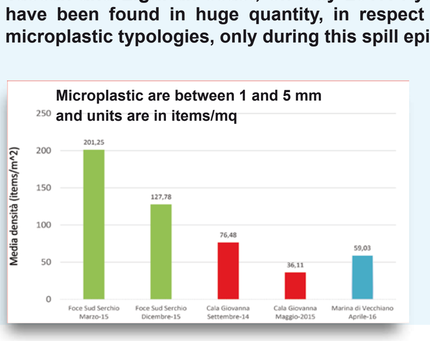
Research



Collection and elaboration of data about microplastic in Marine Protected Areas during the hydrocarbon wax spill, in Tuscan and Ligurian coast, on July 2017. Hydrocarbon wax have been found in huge quantity, in respect to "standard" microplastic typologies, only during this spill episode.

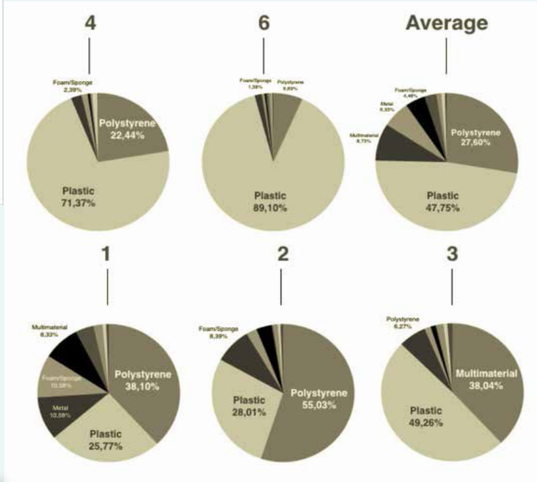






Data have been collected during 2016 and 2017 in different location caracterized by a different degree of urbanization/protection. Microlitter density seems to be highter in MPA with no turistic access (San Rossore) in respect to Natual beach with even a low turistic frequentation. (Cala Giovanna-Pianosa and Marina di Vecchiano). Value of 2016 and 2017 for the monitored areas are consistent with ARPAT value 2014.

Research



Macro AMDs typology distribution (Pie Charts) and density (Bar graph) for the monitored Areas inside Pelagos Sanctuary.

Area 1 : 5Terre National Park
Area 2: Portovenere Regional Park
Area 3: Montemarcello Magra Regional Park
Area 4: San Rossore Regional Park
Area 6: Arcipelago Toscano Nazional Park.

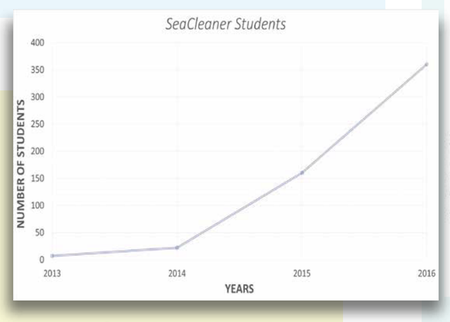
Results of Macrolitter monitoring performed with a citizenscience approch, and the involvement of volunteers and students, for 5 years, lead to recollect data usefull to assess environmental parameters (as GES status, AMD density, and AMDs tipology predominance in 5 National and Regional parks [7], [8], [9], [10], [11].

Public Awareness

Public awareness activities have been realized, to share the Marine Litter problem as much as possible: The documentary "MARINE RUBBISH. A challenge to share" (EU Finaltial support - Marie Curie Action 2014/2015) have been showed during several Nationa/Internationa Environmental Film Festival and at the "10th of Researchers Night", in Bruxell, September 2015 [13]. SEACleaner LOGO and website (work in progress) have been realized also thanks to high students involved in it.

Education

Twenty-five schools attended the activities proposed by SEACleaner and SEACleanerII in the last 5 years.
Students participating in such scientific experiences come up with a knowledge of what is the field-proven scientific method and a wealth of experience that leads them to better apply their knowledge and acquire skills that are hardly obtainable in the classroom. Additionally, this is often accompanied by increased confidence in their abilities (non-formal learning and emotion-based learning).



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