



# Impact of Marine litter on Italian fisheries and potential consequences on human health

**Project coordinator: Prof. M. Cristina Fossi**

**Research group members:** Cristina Panti, Matteo Baini, Silvia Casini, Matteo Galli, Dario Giani  
Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente, Università di Siena

## 1. State of art

Marine litter is one of the environmental issue raising most concern worldwide. In the Mediterranean Sea the effects of Marine litter on marine organisms and the possible consequences on the trophic chains have been little investigated compared to other marine ecosystems (eg Pacific Ocean), although recent data show that the Mediterranean is one of the most exposed seas to this emerging threat (UNEP/MAP, 2015). Several studies have shown that plastics represent 60-80% of marine litter (Misfud et al., 2013).

The effects of plastic debris, and in particular microplastics (plastic fragments smaller than 5 mm), on the marine edible species, in the commercial fisheries, as well as on human health, are still largely unknown and represent an important issue to be explored in the Mediterranean area.

In a study carried out by Rochman et al (2015) in the United States, anthropogenic debris (essentially microplastic) were found in 25% of edible fish species and in 67% of all species examined. Furthermore, the presence of microplastics has been reported in 33% of the sampled mussel species. A similar research carried out in Belgium (Van Cauwenberghe, 2014) reveals that the edible mussel species *M. edulis* contained on average  $0.36 \pm 0.07$  g<sup>-1</sup> of microplastics (wet weight). As a result, in this research, the annual exposure for shellfish consumers at European level has been estimated of around 11,000 microplastics annually.

This project represents an important step to increase the available knowledge about the impact of marine litter, in particular microplastics, on Mediterranean fish species, the related impact on fisheries, the consequences on edible and commercial species and the possible consequences on human health.

## 2. Project overview

The specific activities proposed by University of Siena (UNISI) within the project are:

- Monitoring and characterization of micro and macro-plastics on the surface and in the water column in the study area (the pilot areas will be identified in the North Tyrrhenian Sea and other areas of comparison). This survey will make it possible to identify the different types and sources of anthropogenic contamination in order to guide future mitigation actions.

- Determination of the presence of macro - meso and micro - plastics in fish species, crustaceans and mussels for human consumption in different study areas. The activities will be carried out in collaboration with local fisheries.
- Evaluation of the effects of plastic debris in the different edible species, previously identified as the most exposed to the marine litter contamination. In these species will be evaluated both the levels of plastics additives and the biomarkers responses to identify possible negative effects on fish stocks.

### 3. Student training

The project will be carried out by a young researcher within his/her PhD program. The PhD student will collaborate in the planning and implementation of the sampling and subsequent laboratory analysis of the analyzed species, which is fundamental for the achievement of the project objectives. During the period of the project, the student will have the opportunity to increase the skills on the sampling and laboratory procedure related to the detection of marine litter and microplastics and their effects on biodiversity. The six months will allow to the students to be trained and to increase the ability to work on the scientific field and enhance the communication skills. In addition, to applying the knowledge learned in the academic field, the student will develop and acquire new technical skills necessary for the performance of the project activities. There will also be a training period abroad with one of the research group partners of the Plastic Busters MPAs project (e.g. IFREMER, Hellenic Centre for Marine Research, Centro Oceanográfico de Baleares del Instituto Español de Oceanografía). At the end of the planned activities, he will be responsible for drafting the scientific report in which the results achieved and any scientific publications deriving from the project results will be reported. The results will be also presented at scientific conferences and disseminates to a wider general public.

For the development of the project, the student must have documented experience on the issue of marine litter and knowledge of the methods used to evaluate the impact on marine species. The student must also have the ability to collect organs and tissues of marine organisms and have acquired analytical, microscopic and molecular techniques for the evaluation of ecotoxicological state, as well as a good knowledge of instruments for the infrared spectroscopy analysis (eg. ATR-FT-IR).

Furthermore, the student should be available to spend a period of training abroad will be planned in order to increase the skills of the student.

### 4. Duration (months): 6

### 5. The research group

The research group coordinated by Prof. M.C. Fossi has played a key role in investigate the emerging theme of Marine Litter, in particular microplastics, from 2010, including the European Marine Strategy Framework Directive (D10 -MSFD). Since 2013, the University of Siena research group has been the scientific coordinator of the "Plastic Busters" project born in the framework of the United Nations project Sustainable Development and Solution Network-Mediterranean and declared as UN-SDSN Med *Flagship Project*. The Project has also received the unanimous endorsement by the *Union for the Mediterranean (UfM)*, and achieved the prestigious UfM label in February 2016 ([http://ufmsecretariat.org/plastic-busters-for-a-mediterranean-free-from litter/](http://ufmsecretariat.org/plastic-busters-for-a-mediterranean-free-from-litter/)).

The Plastic Busters MPAs project made up of 15 European partners (<https://plasticbustersmpas.interreg-med.eu/>), born from the Plastic Busters (SDSN) receive funding under the European Interreg-Mediterranean. The project will bring together the main experts at Mediterranean levels on the topic of marine litter, policy makers and stakeholders involved in the issue.

The activities of Plastic Busters MPAs has been followed on SkyTG24 Italy in the awareness campaign “Un mare da salvare.” (<https://tg24.sky.it/ambiente/sky-un-mare-da-salvare.html>) and participated to several national TV programs (Linea Blu, Presa Diretta, Petrolio, ecc), The results of the projects and studies carried out in the last decade have been also published in several national and international newspapers and magazines (La Repubblica, Il Corriere della Sera, The independent, BBC press, La Stampa, Sette, ecc.).

The UNISI research group has also coordinated numerous national projects (Ministry of Environment, Tuscany Region) on the impact of plastics and microplastics on Mediterranean risk species (cetaceans and sea turtles) Plastic Busters MPAs is also on Twitter (<https://twitter.com/plasticbusters?lang=bg>), Facebook and a website (<http://plasticbusters.unisi.it/>).

## 6. Research group International partnership:

- IFREMER Institut français de recherche pour l'exploitation de la mer,
- HCMR Hellenic Centre for Marine Research,
- SOCIB Balearic Island Coastal Observing and Forecasting System,
- ISPRA , The Institute for Environmental Protection and Research,
- Biochemistry and Environmental Toxicology, Higher Institute of Agronomy, University of Sousse (TN),
- IWRS, Institute for Water of the Republic of Slovenia (SI),
- CNR, Consiglio Nazionale delle Ricerche,
- Consorzio Lamma (IT),
- ISOTECH – Environmental Research and Consultancy Cyprus

## 7. Research group main publications on the topic of the project

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*Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente*

*Università di Siena*

*Via P.A. Mattioli, 4*

*53100 Siena, Italia*

*email: [fossi@unisi.it](mailto:fossi@unisi.it)*

*Tel: +39 0577 232913*

*<http://plasticbusters.unisi.it/>*

*Siena 25/09/2018*