

## SHORT TERM SCIENTIFIC MISSION (STSM)

### Scientific Report

# PlasticWatch – Citizen Science to monitor macro and microlitter in freshwater environments

by **Luisa Galgani**

**Action Number:**

CA15212 - 38896

**Grantee Name:**

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**Institution**

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**STSM Title:**

PlasticWatch

**STSM start and end date:**

26/11/2017 to 03/12/2017

**Host**

Dr. Gitte Kragh

**Host Institution:**

Earthwatch Oxford, UK

## Brief Summary

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**Research Interest:** Anthropogenic impacts on aquatic ecosystems: plastic pollution

### Summary of research completed in STSM:

The STSM PlasticWatch has been directed to individuate the best research methodologies for microplastics monitoring in freshwater systems through citizen science projects. This work has been achieved by a cooperation between the University of Siena, Italy, and Earthwatch Institute, UK, which are constantly in contact for implementation and progress. Earthwatch has a long history of successful citizen science initiatives, among these the international platform FreshWater Watch. FreshWater Watch is Earthwatch's global citizen science project to investigate the health of the world's freshwater ecosystems on a scale never seen before. It spans over several cities, countries, in urban and rural ecosystem, across 6 continents, for a total of 18000 datasets acquired up to now. At present, more than 2500 ecosystems are being monitored and more than 8000 citizens have been trained in water research. Within this initiative, and building on it a new protocol, the STSM PlasticWatch has been focused on setting up the necessary tools, protocols, and online management system to include microplastics among the other parameters already monitored (including macro litter). This way, through FreshWater Watch network, essential information on the abundance of microplastics in freshwater systems will be achieved, making it possible to individuate local point sources and act consequently, by informing stakeholders and policy makers. Additionally, the acquired data on microplastics presence and abundance in freshwater systems will add the missing information to the global inventory of marine microplastics already being developed by other NGOs, contributing to tackling the microplastics problem from its source to its end into our oceans.

### Synthesis and application [of research?]:

PlasticWatch has been directed towards the identification and enhancement of good practices that can be applied to citizen science projects in different areas, through engagement, online learning tools, participants' feedback. This STSM aimed at harmonizing existing methods and protocols across different research institutes and NGOs, for a comparable, global database on microplastic pollution in world's aquatic ecosystems, achieved through citizen science. This activity highlights the opportunity of using citizen science data in an area, such as plastic pollution of inland waters and marine ecosystems, that need development for future research activity.

### Wider benefit of the STSM to the participant:

Dr. Galgani has recently incorporated citizen science into her central research activities focused on anthropogenic impacts on aquatic ecosystems, in particular plastic pollution, both as macrolitter and microplastics. With this STSM, the applicant had the possibility to expand her cooperation network and share ideas while learning important aspects of the management, communication, online learning and feedback and social aspects needed in citizen science projects. By joining a leading institute in citizen science research, Dr. Galgani has improved her understanding of the potential impacts of citizen science in societal challenges and policy, while widening the base of participation by developing methods and increasing visibility also at a local level.

Many environmental scientists have a limited capacity to address citizens to promote a sustainable future. The microplastic challenge is growing in importance, with threats that are becoming more

visible for citizens to understand, mitigate and stop. Much of the effort can be addressed from the point of view of informed consumers through improved decision making around household management, product purchasing and waste management. A bottom-up approach rather than a top-down behaviour based on informed stewardship, in order to close the gap from researchers and stakeholders in the urging threat of plastic contaminants.

### **Key Outputs / The main results obtained / etc.:**

Within the STSM, we have explored methods for monitoring microplastics, according to existing, standardized and recognized protocols and the feasibility of incorporating these approaches into the FreshWater Watch platform or other Earthwatch initiatives. The procedure includes monitoring methodology, online learning in multiple languages, online database for standard freshwater quality parameters, like nutrients and turbidity. The data on microlitter, collected by citizen science projects, may add freshwater information to the existing data on marine microplastic pollution, by cross-linking the initiatives and collaborating with the NGOs that are developing the databases. Adding the microplastic protocol to the parameters and to the database would certainly benefit other NGOs looking at marine pollution, and would benefit local communities in tacking the sources of microplastics before they reach our seas.

The training and sampling has been tested and will be tested again with a group of chosen volunteers and afterwards, adjustments will be made based on participants' feedbacks. The outcomes serve as a basis for all stakeholders involved and to inform policy makers on sources of plastic and microplastic pollution, helping build together mitigation strategies and improving the local community's understanding and awareness of ways to prevent and stop such pollution.

Outcomes so far:

- From the scientific point of view: this STSM has served as the basis to foster collaboration between research and citizen science, in order to add missing information on microplastics abundance in freshwater systems on a global scale, making these data comparable to data collected for marine environments;
- The information added will make it possible to understand local point sources of microplastics, and address local stakeholders and policy makers in promoting a change;
- With this bottom-up approach, behavioral change will be easier to achieve through creating awareness at a local and global scale availing of an already existing network of motivated volunteers, sensitive to environmental issues.
- The applicant had the opportunity to understand and develop skills to properly address and plan citizen science initiatives by learning with a leading institute in this emerging field of research.

**Short quote: Protecting marine systems while promoting public local stewardship of aquatic resources**

## STSM Report

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### Purpose of the STSM

Earthwatch is a non-profit environmental organization focused on engaging people worldwide in scientific field research and education, to promote the understanding and action necessary for a sustainable environment. Earthwatch aims at connecting everyday people with the world's top scientists to conduct vital field research, by combining volunteer opportunities for individuals with long-term citizen-science initiatives like the FreshWater Watch project, where volunteers reduce their water-footprints and investigate the health of their local freshwater ecosystems. The STSM PlasticWatch was meant and conceived to contribute to the setting up of a new protocol for microplastics monitoring in freshwater systems through citizen science projects. This objective involves a close cooperation between the University of Siena, Italy, and Earthwatch Institute, UK. Earthwatch has a long history of successful citizen science initiatives, among these the international platform FreshWater Watch. FreshWater Watch is Earthwatch's global citizen science project to investigate the health of the world's freshwater ecosystems on every continent. It spans over several cities, countries, in urban and rural ecosystem, across 6 continents, for a total of 19000 datasets acquired up to now. At present, more than 2500 ecosystems are being monitored and more than 8000 citizens have been trained in water research. Being already part of the FreshWater Watch initiative, with this STSM was meant to merge the already existing project in Italy through volunteers with microplastics research in agreement to a protocol to be set up together with EarthWatch, which is currently working on that issue. The STSM aimed at promoting collaboration and sharing of ideas, thus setting up the necessary tools, protocols, and online management system to include microplastics among the other parameters already monitored by citizen scientists (including macro litter), that could be implemented in worldwide projects. This way, through FreshWater Watch network, or other Earthwatch initiatives, essential information on the abundance of microplastics in freshwater systems will be achieved, making it possible to individuate local point sources and act consequently, by informing stakeholders and policy makers. The data on microlitter, collected by citizen science projects, may add freshwater information to the existing data on marine microplastic pollution, by cross-linking the initiatives and collaborating with the NGOs that are developing the marine databases. Besides promoting at a collaboration between the home and the host institute, this STSM also aimed at establishing a wider cooperation network in the field of citizen science projects monitoring plastic pollution, with the goal of getting information on plastic and microplastic concentration in worldwide aquatic ecosystems. This will be achieved by linking already active NGOs and citizen science projects focused on the health of aquatic environments. All this effort shall be directed towards exploring ways to integrate data and knowledge gathered through different citizen science initiatives while suggesting methods for interoperability, participants' feedbacks and quality control of acquired data.

### Description of the work carried out during the STSM

Prior to the stay at Earthwatch Institute, Dr. Luisa Galgani has performed a test sampling on microplastics with volunteers of the FreshWater Watch project POSEIDOMM along the Pesa river, Tuscany, Italy. The test sampling has been useful to discuss with the citizens volunteers the feasibility of sampling and possible alternatives that are being explored right now.

During the STSM at Earthwatch (UK), the applicant has worked together with Earthwatch scientists being first introduced to Earthwatch citizen science projects, engagement, learning and school programmes and local water blitzes.

At Earthwatch, we have worked together to identify potential sources of microplastics and which information already gathered by citizen scientists shall be collated to be included on a monitoring programme (e.g. ecosystem conditions, land-use, biochemical data, point sources) and third party datasets (e.g. discharge points, regional land-use data, hydrological mapping). It has been evident that an increased understanding of the distribution of microplastics can be achieved through the

combination of focused and distributed citizen science approaches: local scale Blitzes (in collaboration with local partners and businesses) and regular monitoring by committed and trained Earthwatchers. The engagement approach has been discussed to address both committed volunteers and new audiences through short commitment activities and engaging learning approaches. The topics discussed during the STSM meant to build a successful microplastics freshwater monitoring, have been the following:

- 1) Impact, Monitoring and Evaluation of projects: from the starting idea to a successful continuation of citizen science initiatives
- 2) Platform implementation, data management and mapping: a new ArcGIS online map has been set up for the Italian FreshWater Watch POSEIDOMM project, to better visualize spatial data and water quality. Within this map, the next step will be including macro and microlitter.
- 3) Engagement and Science: introduction from EarthWatch scientists to practices for successful engagement of volunteers while maintaining a good scientific quality, and discussion on how to individuate the best engagement and science activities for the microplastics initiative on freshwater habitats.
- 4) Participation to the final project report from Freshwater Habitat Trust and Thames Water organized on November 29th, 2017.
- 5) Education and Learning: how to set up a school programme, online learning, engage and motivate teachers, families, and corporates. Individuation of actions to be implemented at various levels of engagement and in different environments (home, office, school, communities).

All these activities performed by the applicant during the STSM have contributed to a proposal on a Microplastics Citizen Science, submitted to EarthWatch board for evaluation on December 1st, 2017. Discussion of methods, (water filtration, microplastic retention, identification and enumeration protocols), strategic monitoring sites, frequency, and pollution point sources. As a follow up, from the home institute (University of Siena) we aim at submitting a proposal for the European calls on marine litter.

### Description of the main results obtained

The STSM itself has ended with the scientific stay at Earthwatch, which has been very productive in building a collaborative partnership between the institute and the University of Siena while working on a common initiative. Main result of the activity at Earthwatch has been the proposal submitted to Earthwatch board for evaluation on December 1st, 2017, which will be discussed and implemented in the next weeks. However, results that will be implemented in Italy by the University of Siena, beyond the present STSM are the following:

- Online map self-actualizing with latest citizen science data <https://arcg.is/4CLG9>
- Water blitz and series of 4 movies on climate change, water resources and plastic pollution – in progress, started on March 20th 2018 and going until Earth Day 2018 (April 22, focused on Plastic pollution). In collaboration with the local administration, local associations and volunteers (Italy).
- Microplastics sampling protocol implementation – will be tested with volunteers of the POSEIDOMM project of the applicant Dr. Luisa Galgani, and students, who will look at river sediments for their Master theses at the University of Siena. In the light of the proposal submitted, we will carry out a pilot study to test the feasibility of the new microplastics protocol with a limited number of participants. The pilot study will consist in training, field sampling day followed by feedback/discussion. Microplastics will be sampled from water, sediments or both and the feasibility of the two methods will be tested.



- Discussion and establishment of a communication plan as an integral part of a successful citizen science project, with appropriate approaches for the recruitment and long term engagement of new participants across Europe.

### **FUTURE COLLABORATIONS (if applicable)**

During the STSM we have explored multiple approaches for recruitment and engagement of participants. As University of Siena, we have participated to the 6th International Marine Debris Conference presenting results on citizen science projects and future collaborations with Earthwatch in microplastics monitoring. For the moment, we keep the discussion and the collaboration open for the actual proposal Earthwatch scientists are preparing for a new citizen science microplastics initiative. We will collaborate within our FreshWater Watch group of volunteers in Italy by applying methods, participant learning, feedback, engagement and data gathering tools, while testing sampling protocols and individuation of microplastics in the laboratory with students of the Master in Chemistry course at the University. Networking and collaborations with other institutes looking at microplastics will be explored and included.

In this phase, the central stakeholders are new conscious communities, general public, teachers and educators, small and large businesses and regulatory agencies.

### **Foreseen publications/articles resulting from the STSM (if applicable)**

Short communication or Notes article in Marine Pollution Bulletin special edition from 6th International Marine Debris Conference, results from citizen science project in collaboration with Earthwatch (open for submission March 23 – June 23, 2018). Title to be discussed.