PELAGOS PLASTIC FREE

Integrated actions to reduce plastic debris in the Pelagos Sanctuary

Final report 09/12/2019







Azioni integrate per ridurre l'inquinamento da plastica nel Santuario Pelagos

Pelagos Plastic Free project - Final report

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ADMINISTRATIVE DETAILS

Pelagos Plastic Free project – Mid-term report

Study required and financed by Permanent Secretariat of the Pelagos Agreement Tour Odéon B1 - 36, avenue de l'Annonciade MC - 98000 Monaco

Project leader: Legambiente ONLUS With the participation of: Expédition MED Reference of the project: Convention No. 2018-02 Photography credits: Legambiente onlus, Expédition MED

> *This report should be quoted as:* Pelagos Plastic Free project – Final report *Authors:* Ballerini T., Di Vito S., Dominici M., Dumontet B., Grasso P., Turiani E., Nardicchia S. *Date: 29/11/2019 Title of project:* **Pelagos Plastic Free** *Pelagos Secretariat Convention No. 2018-02*

Covering period: 16/10/2018 - 30/09/2019



NARRATIVE PART

Context of the project

The PELAGOS PLASTIC FREE project aims at tackling the problem of marine plastic pollution through an integrated approach that considers governance, science and scientific literacy.

The project acts on three main axes. The first one consists in sharing knowledge about plastic pollution and the associated risks, and to promote the best practices to manage urban waste together with coastal municipalities in order to enhance their governance capacity. The second axe is related to the scientific research part and is based on the study of the microbial communities living on plastics and microplastics at sea, as well of the sources and origins of plastic debris in the Pelagos Sanctuary, thus allowing to identify overlooked potential risks for marine mammals, especially for filter feeders fin whales. The third one is to put in place outreach and education events that will help to develop awareness and promote engagement by different groups of stakeholders in the resolution of the plastic problem at sea.

Activities carried out during the reporting period

Project management

The general management of the project has been guaranteed by a Coordination Committee made up of both the Legambiente and Expedition Med representatives, both for the technical part and for the financial part. The Coordination Committee, chaired by the Project Manager, had regularly Skype sessions to take stock of the progress of the project, to check for any difficulties and to discuss possible solutions. Three different working groups, one for every area of intervention, have guaranteed the operation of the project: governance, scientific research and awareness raising group. Every group was composed of the Legambiente and Expédition MED experts.

Communication and dissemination activities

See Annex I for the total press review of the project.

Information package

A coordinated logo (Figure 1) and a visual identity have been created and made available to the consortium.



Figure 1 Pelagos Plastic Free logo



Promotional item have been also produced in the first period of the project implementation, in particular: aluminium water bottle (Figure 2), cotton bags, cotton hats, block notes, car garbage bags, produced by Expédition MED, and reusable bags for grocery shopping and storage of fruit and vegetable donated by NaturaSì to the project. Marine flags were also produced, in order to promote the project during the summer navigation campaigns of Expédition Med and Legambiente.



Figure 2 Aluminuim water bottle

In the second period of the project other 400 aluminium water bottle were produced.

a) Web site and social media

A **website** was created (<u>http://www.pelagosplasticfree.eu/</u>) in Italian and French languages and an Instagram account was opened (<u>https://www.instagram.com/pelagosplasticfree/</u>). Nevertheless, information about project's activities circulated also within the websites and the social network of the two partner associations.

The average number of unique visitors from the beginning to the end of the project was 70 per month, with peaks of even 240 unique monthly visitors, which totaled around 2,500 in total over 18 months. During the period of activity of the project the frequency of shared news was at least two per month, for a total of 44 news items. The site will continue to be updated at least once a month for the next two years.

Regarding social media the frequency is at least one post a week, both on the dedicated profile of Instagram and on Legambiente's Facebook and Twitter (legambiente lab). The most successful posts were those posted on the @legambiente lab Facebook platform, which achieved 30% above-average performance.

The Instagram dedicated account has reached 317 followers and on 50 posts the interaction average is around 10%.

b) Information and dissemination materials

A short brochure (see Mid-term Report) (in Italian and French languages), explaining the project and the objective for the general public was created and printed in 5000 copies in Italian (3000 copies) and in French languages (2000 copies). Partners are handing out the brochure during the project activities.

An informative brochure **(see Annex II)** was produced in Italian language and printed in 10000 copies. A French version has been made under request of Pelagos Secretariat and made available for print



and broadcast. The brochure explain the impacts of the plastic waste dispersed into the sea, the consequences on the marine environment and the importance of the Pelagos Sanctuary area. Good habits are suggested and encouraged, with a list of ten action with a merit score to measure self-commitment.

Even not foreseen, also the manual of environmental education, developed in Italian language, used in 3.4 action has been printed (200 copies) and has been distributed to educators and teachers.

c) Media relations

A **launch press conference** was organized in Genova on May 14th and was devoted to present the project. A press kit containing the press release, the project summary, information about project's partners and logos, photographic and video material and video interviews was distributed to the participants through a flash drive. All the contents are available at <u>this link</u>.

d) Replicability

The final conference (Figure 3) took place in Genova on September 20th, within the 59th Genoa International Boat Show (19-24 September) and in cooperation with the Italian marine industry association (UCINA), a non-profit organization for the development and promotion of the boating sector. Representatives of local administrations of Pelagos Sanctuary who subscribed the guidelines has been invited to participate.

As scheduled in the program, the conference has been introduced and coordinated by Sebastiano Venneri, National Chief of Sea office of Legambiente, followed by speakers as: Costanza Favilli, Executive Secretary of the Permanent Secretariat of the Sanctuaire Pelagos; Santo Grammatico, President of Legambiente Liguria; Fausto Ferruzza, president of Legambiente Toscana; Tosca Ballerini, scientific coordinator of Expédition Med and of the Pelagos Plastic Free project; Erik Zettler, of the Royal Netherlands Institute for Sea Research; Agostino Agostinelli, Federparchi – Europarc Italy; Fabrizia Pecunia, Vice President of Cinque Terre National Park; Saverio Cecchi, UCINA president. Stefano Ciafani, the National President of Legambiente, closed the conference.

During the final conference main project results about the three axes of action (governance, raising awareness and scientific research) by the Legambiente and Expédition Med's speakers has been presented. There has also been talk about the problem related to marine litter in the Pelagos Sanctuary and of the necessity to put in place strategies for improve a virtuous management of urban waste.

A decalogue "my boat is plastic free", in Italian language, dedicated to sailors and boaters has been presented also as we all have to do our part for talking litter dispersion in the marine environment.

Among the participant, also students from the Nautical Institute of Genova were present.

See **Annex III** for the Save the Date, the program, and the list of participants of the final conference.





Figure 3 Final conference of Pelagos Plastic Free project held in Genova within the 59th Genoa International Boat Show

Other events

Pelagos Plastic free project was presented also during the 4th national workshop held in Capalbio (Grosseto) on March 22nd and 23th 2019. An initiative for sharing good practices of coastal towns promoted by Legambiente and the "Comunità delle Vele" (the Community of Sails). Together with the Italian Touring Club and Federparchi, in fact, since 2014 Legambiente has organized confrontation tables to share problems and solutions to improve and make sustainable the management of



coastal tourism, rewarding with "Sails" the most virtuous realities.



Pelgos Plastic free project was presented also at SEIF - Sea Essence International Festival, from 28 to 30 June 2019, the Elban festival dedicated to the preservation and enhancement of the essence and beauty of the sea. In this occasion, the first results of the analyses conducted in the Cetacean Sanctuary waters have been presented. In addition, some Legambiente

campaigns focusing on the sea have been illustrated, such as MedSeaLitter and A Vele Spiegate



projects and, again by Legambiente, the memorandum of understanding for "an Elba Island without plastic", with virtuous examples of Italian municipalities involved in the fight against disposable plastic and with the assignment of the "Pelagos Award".

Preliminary results of the Pelagos Plastic Free project were shown at the conference "Déchets en mer" held the **10th of August 2019** in the Nautical Society of Marseille. Bruno Dumontet and Tosca Ballerini participated.

Participation at scientific conferences: during the <u>International Conference</u> <u>on Microplastic Pollution in the Mediterranean Sea</u>, held in Capri (Napoli) **from 15 to 18 of September 2019**, main results on Pelagos Plastic Free



project have been presented from Tosca Ballerini, the scientific coordinator of Expédition Med and of the project (Figure 4). The title of the oral presentation was "*The Pelagos Plastic Free Project: plastic marine debris abundance, plastic-associated microbial community composition, and sources of beached waste in the Pelagos Sanctuary*". In the **Annex IV** the abstract presented.



Figure 4 A lot of interest for Pelagos Plastic Free project scientific results from the science world at µMED conference 2019.

Preliminary results of the Pelagos Plastic Free project were shown at the conference "Déchets en mer" held the **7th of October 2019** at CNPRS (Centre Nautique Provençal de la Recherche Scientifique). The Best practices to deal with plastic waste were presented, as well as the Chart of best practices to be signed by city majors. There was much interested in this chart, and people from the audience asked more information, as they wanted to replicate it their municipalities around Marseille. Tosca Ballerini participated.



Specific project activities

After the first months of implementation, projects activities continues in the following months. In the next session of this report, activities of the three focuses have been reported in the specific objective section.

Objective 1: Enhance the governance capacity of coastal municipalities

1.1 Study on best practices for the prevention of plastic waste at sea and in coastal zones

This first task aimed at collecting the best practices at national and international level adopted by local authorities in order to prevent the problem of waste in the seas.

Legambiente carried out this first activity. The document reporting the best practices (see **Annex V**), in Italian language and translated in English language, is the result of a desk research and contacts with Legambiente's local groups and report a selection of the best practices developed by municipalities, in order to counteract the waste production and leakage and the marine litter phenomenon. The best practices study and the document were useful in the running of the workshop. The best practices were divided by prompt measures, long-term measures, measures put in place by bathing facilities and beach resorts, best practices adopted in islands, and other foreign measures. The document report is composed by over 77 best practices.

Indicator:

• n. of best practices collected: 77

1.2. Workshops on solutions to reduce waste at sea in areas of intervention

This action aimed at organizing a cycle of 12 workshops (9 in Italy e 3 in France) in order to explain to the stakeholders, and to allow the sharing of experiences, solutions to reduce the plastic waste in the sea and in coastal areas.

In the first project period, 7 workshops have been organized and in the following months other initiatives have been organized, maintaining the aim to share and transfer knowledge about marine litter issue and possible enforcement action to reduce input of waste at sea. Opportunities offered by conference and meetings organized by other entities have been taken to speak about the project and about the best practices.



A short summary of the workshop carried out, is reported, in chronological order, in the following table 1:

Table 1 Workshops on solutions to reduce waste at sea

	Date	Location	Nation	No. of participants	Notes	
	First project period, from June to September 2018 (from mid-term report)					
1	22/06/2018	Chiavari (Genova)	Italy	12	Held by Legambiente within its campaign Goletta Verde	
2	25/06/2018	Marciana Marina (Livorno, Elba Island)	Italy	11	Held by Legambiente within its campaign Goletta Verde	
3	06/07/2018	Bonifacio	France	5	Held by Expédition MED within its scientific campaign	
4	27/07/2018	Nice	France	51	Held by Expédition MED within its scientific campaign	
5	16/08/2018	Rispescia (Grosseto)	Italy	19	Held by Legambiente within the festival Festambiente organized by Legambiente	
6	06/09/2018	Livorno	Italy	16	Held by Legambiente	
7	14/09/2018	Viareggio (Lucca)	Italy	10	Held by Legambiente	
	Second project period, from November 2018 to September 2019					
8	19/11/2018	Portoferraio (Livorno)*	Italy	-	Held by Legambiente within the conference "Isole da salvare: azioni concrete per un arcipelago senza plastica"	
9	31/01/2019	Pisa	Italy	45	Held by Legambiente	
10	26/02/2019	Savona	Italy	21	Held by Legambiente	
11	27/02/2019	Manarola (La Spezia)	Italy	11	Held by Legambiente	
12	30/04/2019	San Giuliano Terme (Pisa)**	Italy	30	Legambiente, within the event organized by the Municipality of San Giuliano Terme	
13	17/05/2019	Calenzano (Firenze)*	Italy	20	Held by Legambiente, within the Passo Passo Festival of Calenzano	
14	27/05/2019	Vecchiano (Pisa)	Italy	13	Held by Legambiente	
15	19/07/2019	St Laurent du Var (Nice)	France	39	Held by Expédition MED	
	* No signatu	re sheets				
	** Event organized by San Giuliano Terme Municipality for the signing ceremony of the					
	Partnership Charter for the Pelagos Sanctuary. No signature sheets					



The workshops organized under Pelagos Plastic Free project (see figure 5) allowed an interesting debate among associations, institutions and, often, ordinary citizens. At institutional level, Legambiente and Expédition MED met different actors: Mayors and Deputy Mayors, Regional and National Park Managers, Natural Park Managers, Maritime Natural Area Managers, Directors of the Port, Port Authorities, Carabinieri, Forest Rangers, but also students, researchers and financial police.

During the workshops, at the opening Pelagos Plastic Free project has been presented, giving an overview on the purpose, resources and the different tasks pursued (management, scientific research and raising awareness). Then, some space has been given to the guests and this has allowed them to share their own experiences and situation related to marine litter issue. Furthermore, workshops have been useful to understand and collect best practices already carried out in some municipalities or protected area on one side, to giving opportunity to be inspired by others' experiences. Brochure and gadget of the project have been made available for guests.



Figure 5: up, on the left, the Workshop in Saint Laurent du Var, on the right the Save the Date of the workshop held in Marciana Marina. On the bottom, on the left the workshop in Pisa, on the right the Save the Date of the workshop held in Calenzano within the Passo Passo Festival and in the centre the Save the Date of the Isole da Salvare conference.

Indicator:

• n. of participants: more than 300 for 15 workshop. The project envisaged 10 people for each workshop at least.



1.3 Guidelines to prevent plastic waste

The outcomes emerged from workshop are the basis on which we draw the guidelines for the prevention of plastic waste at sea and along the coastal zones. Guidelines have been translated in French. Both, Italian and French version, are reported in **Annex VI**.

Mayors (Figure 6), deputy mayors, environmental councillors and other councillors, councillor for tourism, municipal officials, and so on have signed guidelines during workshops and other meetings.

For Liguria region 22 Mou have been signed:

- Majors of Alassio (Sv), Bogliasco (Ge), Costarainera (Im), Savona, Vado Ligure (Sv), Ventimiglia (Im), Vernazza (Sp);



Figure 6 Mayor of Savona signing the guidelines

- Environmental Councillor of Albisola Superiore (Sv), Finale Ligure (Sv), Genova, La Spezia, Loano (Sv), Pietra Ligure (Sv);
- Urban Planning and Environment Councillor of Ceriale (Sv);
- Municipal Councillors of Alassio (Sv), Laigueglia (Sv), Riomaggiore (Sp), Taggia (Im) and Varazze (Sv);
- Tourist office official of Diano Marina (Im);
- Head of Environmental Services of Bordighera (Im) and the Head of Technical Office of Loano (Sv).

For Tuscany region 12 Mou have been signed:

- Majors of Capalbio (Gr), Cecina (Li), Vecchiano (Pi); Majors of Portoferraio, Marciana and Marciana Marina of Elba Island (Livorno);
- Vice-Mayor of Castiglione della Pescaia (Gr);
- Environmental Councillor of Firenze;
- Tourist Councillor of Capalbio (Gr);
- President of Federparchi, Giampiero Sammuri.

San Giuliano Terme (Pi) and Scarlino (Gr) Municipalities adopted the guidelines proposed by Pelagos Plastic Free project with a formal municipal act. In particular, San Giuliano Terme subscribed the guidelines during the signing ceremony of the Partnership Charter for the Pelagos Sanctuary.

Indicator:

• n. of signed MoU: 32 in total.



Objective 2: Increasing scientific knowledge on the Plastisphere and on the origins and sources of plastic debris.

The actions foreseen within this objective, in particular subtasks 2.1, 2.2 and 2.3, have been carried forward by partner Expédition MED and the following description is a short summary of the full Report delivered by Expédition MED to Legambiente. <u>Full information are available consulting the Reports attached provided by Expédition MED (Annex VII)</u>.

Legambiente has been the supervisor for subtasks 2.1, 2.2 and 2.3 and developed subtask 2.4.

The following image (figure 7) represent the map of sampling sites during the survey at sea carried out by Expédition MED in the Pelagos Plastic Free project.



Figure 7. Map of sampling sites during the survey at sea carried out by Expédition MED in the Pelagos Plastic Free project. Red stars indicate sampling stations with manta trawl; green diamonds indicate sampling site for seawater; black symbols indicate sampling sites for plastic items in port; blue pentagons indicate sampling sites for plastic items in rivers. (by Expédition MED).



Study of the Plastisphere in the Pelagos Sanctuary

→ The data in this part of the report are still unpublished; therefore, it is important to keep this document confidential.

From July 2019 the laboratory analyses of the samples collected during the cruise were concluded. The analysis of DNA sequences extracted from the microbial biofilm on the plastic fragments has been finished. Due to the large amount of sequences (millions) retrieved from the plastic fragments, it is necessary to carry out complex bioinformatic analyses to compare the different microbial communities present on each plastic fragment studied.

2.1 Abundance of microplastics assessed during the Pelagos Plastic Free project

Average microplastic (MP) composition was 88 215 MPs/km2. Microplastics (fragments smaller than 5 mm) represented, on average 80% of the total fragments collected with manta nets, followed by mesoplastics (fragments between 5 mm – 2.5 cm) (19%) and macroplastics (fragments larger than 2.5 cm) (15%).

In the Figure 8 is shown the microplastic abundance from manta trawl samples collected during the Pelagos Plastic Free project. Highest concentrations were recorded South of Menton, West of Elba Island, E/SE of Bastia, North East of Capraia, and North of M. Marina. Lowest concentrations were recorded North East of Giglio Island, South of Nice, North East of Porto Santo Stefano. The majority of plastic fragments collected with the manta net were Polyethylene (49%), followed by Polypropylene (PP, 24%), and Polystyrene (PS/PE, 11%).



Figure 8 Microplastic abundance from manta trawl samples collected during the Pelagos Plastic Free project.



2.2 Microbes on plastic as observed with Scanning Electron Microscope

Images of plastic fragments were taken with the Scanning Electron microscope, considering the whole fragments and different levels of zoom. The plastic type of the polymers was determined through spectroscopy. On the images is possible to see biofilm on the surface of the plastic as well as filaments (fungi, algae) and to resolve individual bacteria and diatoms (see Figure 9 for an example).



Figure 9 Sample EM18-004 off Corsica. Whole fragment showing pitted surface and biofilm; close up of biofilm, and zooming in further showing individual diatoms and bacteria. Sample EM18-042 S of Nice. Biofilm and filamentous fungi or algae; close up of filaments, and zooming in further showing individual bacteria on eroded surface. DNA analyses identified the presence of dinoflagellate genus Gonyaulax (some members cause HABs or "red tides") on these samples. This unicellular algae contributed 2.7% of sample EM18-42 (this is relatively high).

2.3. The plastisphere of the Pelagos Sanctuary

DNA analyses showed that microbial communities in the Pelagos Sanctuary are often dominated by phototrophs including cyanobacteria and diatoms. There are large differences in the genus that compose the microbial communities on the different plastic samples, as shown by the different colors in the pie charts in Figure 10 in which each colour represents a different type of bacteria. There are some common dominant groups including cyanobacteria: Pleurocapsa (yellow), Rivularia (beige) and Phormidium (purple), but there is also a lot diversity between samples. Pink is Alteromonas – a known bacterial biofilm former. Blue is a chloroplast from a photosynthetic eukaryote.





Figure 10 Pie charts representing total bacterial community on pieces of polyethylene collected from various parts of the Pelagos sanctuary.

2.4. Differences in bacterial communities in different environments

The analysis of the DNA sequences shows that community composition varies according to the environment from which the plastic fragment comes from. Data show that there are clear differences between communities on plastic and in the surrounding water, as well as from communities in river water.

These differences can be visualized by a Principal coordinate analysis (Fig. 10). This is a type of multivariate analysis were each colored dot represents the total microbial community of a single sample. In the Figure 10 dots that are close together have similar microbial communities; those that are far apart have different microbial communities. Each colored dot represents the total microbial community of a single sample. Ellipses were drawn by hand, but demonstrate how the microbial communities on ocean plastic, river and port plastic (presumably most plastic in the port came from the rivers) are different from each other, and from the surrounding water.





Figure 10 Principal coordinate analysis. Each coloured dot represents the total microbial community of a single sample.

2.5. Potential pathogen organisms

There is a lot of concern recently about plastic transporting potentially harmful microbes.

In these analyses the DNA amplicon sequencing, a very sensitive technique, has been used and sequences related to many potential pathogens, including some that affect marine mammals have been picked up. However, with this survey technique, it is not possible to establish the exact species and strain and know whether the detected organisms were actually harmful. In addition, most were at very low levels (<<1% of bacterial community) so these data suggests that at present plastic-associated pathogens do NOT represent a serious threat to marine mammal health.

The most abundant and widespread microbes of concern were dinoflagellate phytoplankton, that can cause Harmful Algal Blooms (HABs), and the bacterial genus *Vibrio sp*.

Gonyaulax sp., Karenia sp., and Pseudo-nitzschia sp. can all cause harmful algal blooms and produce toxins that can accumulate up the food chain to impact fish, birds, and marine mammals. Potential HAB species occurred on many pieces of plastic, and in some cases represented relatively high proportions of the total microbial community (1-9%).



Plastic may facilitate the **spread** of these potentially harmful microbes to other environments, because plastic lasts longer than most other substrates. However, at this time the risk to marine mammals due to ingestion of harmful microbes on plastic seems low.

Vibrio sp. are common, naturally occurring marine bacteria, and most are harmless. However, some types of *Vibrio* can cause disease and opportunistic infections in many marine animals (including mammals). *Vibrio sp.* was detected on most of the plastic pieces, and in some cases, they represented fairly high proportions of the total bacterial population (2-25%) (Figure 11). Therefore, there are some cases where plastic harbors present a relatively high population of *Vibrio*, but in general, marine mammals probably ingest more *Vibrio sp.* associated with plankton than plastic.

We think that for a baleen whale the *Vibrio* present on plastic fragments are probably not a problem, however for a smaller organism (such as fish or sea shells) eating plastic one at a time, if the *Vibrio* present on the plastic are harmful, then they could be a problem.

Occasional high occurrence of *Vibrio* has been reported before in the literature. *Vibrio* are known to be associated with warmer water. Since the samples from the Pelagos Plastic Free project are taken in summer, it is not surprising to find high abundance.

In conclusion, more science is needed to understand the impacts of plastic marine debris, but we cannot wait to know more before taking action to prevent further plastic pollution.



Figure 11 Proportion of total bacterial community made up of Vibrio. Vibrio were present on most pieces, but only made up >1% of the community on 3 pieces.



Indicators 2.1 Monitoring of Plastisphere in the Pelagos Sanctuary:

- n. of sampling stations: 39 sampling stations; 40 samples for the study of the Plastisphere;
 39 samples for the estimation of the plastic fragments floating at the surface of the water;
 4 samples of sea water
- map of distribution of sampling stations: see Figure 7
- Report of activity: see Annex VII
- Participation at scientific conferences: <u>International Conference on Microplastic Pollution</u> <u>in the Mediterranean Sea</u>, held in Capri (Napoli) from 15 to 18 of September 2019. See page 6 of this report.
- Publication in scientific peer- reviewed journals: in the future. A first draft of a scientific paper with the running title *"Bacterial and eukaryotic microbial communities associated with microplastic in the Mediterranean, including the Pelagos Sanctuary"* is underway with submission forecasted before the end of the year 2019.
- outreach and education: meeting with Vele Spiegate at Isola d'Elba (see Figure 5) + presentation of the project Pelagos Plastic Free in Marseille the 10/08/2018 at the end of the Expédition MED cruise (that lasted two weeks more than the Pelagos Plastic Free project)
- n. of Citizen Scientists trained: 29 citizen scientists were trained during the 4 weeks of the survey at sea.

Indicators 2.2 Study of the Plastisphere in rivers and ports:

- Number of samples collected: 14 samples from rivers and 15 samples from ports; 3 samples of water filtrations
- Report of the field activities: see Annex VII
- n. of citizen scientists trained: 10 people trained



2.3 Monitoring of floating marine litter

This action aims at quantifying floating marine litter in the Tyrrhenian part of the Pelagos Sanctuary. The protocol developed by the project MEDSEALITTER and officially adopted by the Italian Agency for the Protection of the Environment for the monitoring activities related to the Marine Strategy Directive, was used. Opportunistic observations of cetacean distribution have been carried out with the sighting protocol developed by Oceanomare Delphis, partner of Expédition MED since 2017. Expédition Med has provided data about the Floating Marine Litter observed, given below.

The number of objects identified during the 10 transects varied between 38 and 884, for an average number of 225 (Table 2).

Artificial polymers represented, on average, the 66% of the objects identified during a transect (min 10%, max 97%); organic material (mainly posidonia leaves), represented on average 27% of the objects observed during a transect (min 2%, max 65%).

Small wood items (< 1 cm) were particularly high (200 fragments) in transect 6, probably due to a sinking log as they were never observed again in such high quantities in all the other transects.

Transect	Artificial polymers	Wood	organic material	Total
1	39	8	17	64
2	227	2	4	233
3	95	16	95	206
4	50	0	17	67
5	310	11	123	444
6	91	222	571	884
7	71	0	12	83
8	29	4	5	38
9	76	9	72	157
10	113	1	5	119
	229.5			

Table 2 Total number of floating marine litter observed.

Indicators:

- n. of transects: 10 transects.
- Map of the transects: see figure 7.
- Opportunistic sightings of cetaceans: 22 observations of cetaceans. These data are shared with the larger marine mammal community by Oceanomare Delphis. Data on 7 observations of fin whales have been shared with Jean-Noël Druon of EC – Joint Research Centre to feed into his habitat model.
- N. of citizen scientists involved in the monitoring: 29 eco-volunteers trained



2.4 Citizen Science campaign to monitor distribution and type of plastic waste on the area of the Pelagos Sanctuary and analysis of the contamination of waste

The task is to study the presence of waste on the shore beach through a citizen science campaign that involve volunteers in monitoring beach litter. This activity foreseen the application of a common protocol that permit to collect data on quantities and types of litter, into a given area, and estimate the sources of these objects. The protocol, utilized by Legambiente since 2014, has been developed in cooperation with the European Environmental Agency.

In total 16 beaches have been monitored in summer 2018 and 2019, 14 in Tuscany region and 2 in Ligurian region. Volunteers counted 13.192 items over a 27.300 sqm area, a mean of 825 items every 100 linear metres of beach with a range of values between 173 and 1.844 items/100 m. The list of the monitored beach with some data are shown below in the Table 3.

Date	Region	Province	Municipality	Beach name	Area (sqm)	tot Items	Plastic (%)
26/04/18	Tuscany	Livorno	Livorno	Ardenza 3 ponti	2700	1177	64%
09/05/18	Tuscany	Grosseto	Grosseto	Collelungo	700	173	93%
24/01/18	Tuscany	Grosseto	Grosseto	Giannella	1000	514	92%
29/06/18	Tuscany	Livorno	Marciana Marina	Le Sprizze	1100	251	76%
19/08/18	Tuscany	Livorno	Porto azzurro	Laghetto	1000	182	84%
22/03/19	Tuscany	Pisa	Vecchiano	La Bufalina	5500	1512	95%
28/02/19	Tuscany	Grosseto	Grosseto	Marina di Alberese	2700	288	91%
12/04/19	Tuscany	Pisa	Vecchiano	La Bufalina	3000	1381	94%
10/05/19	Tuscany	Grosseto	Capalbio	Chiarone	1800	821	98%
12/07/19	Tuscany	Pisa	Pisa	Gombo	1000	830	95%
31/07/19	Tuscany	Pisa	Pisa	Gombo	1000	993	92%
31/07/19	Tuscany	Pisa	Pisa	Gombo	1000	466	96%
06/08/19	Tuscany	Pisa	Pisa	Gombo	1000	834	96%
06/08/19	Tuscany	Pisa	Pisa	Gombo	1000	1107	98%
28/07/19	Liguria	La Spezia	Monterosso al Mare	Fegina	1500	819	79%
16/08/19	Liguria	La Spezia	Riomaggiore	Fossola	1300	1844	64%

Table 3 Data on beach litter monitoring



Poor management of urban waste is the main cause of the dispersion of waste (34%), followed by the lack of purification of the wastewater, which is

responsible for 7% of the objects monitored.

Fishing and aquaculture activities are responsible for the 1% of monitored waste: nets, lines, bait boxes; not only professional but also amateur fishing. However, most of the waste is not attributable to specific actions or activities (58%).

Waste smoke related, as cigarette butts, lighters, packets of cigarettes and their packaging, are the main representative (43%) of waste from poor urban management, followed by food packaging (see pie chart in Figure 8). Also significant are the percentages of building construction material abandoned (18%) and plastic bags (10%).





Five top most abundant debris: 66% of the waste recorded is represented by the following 5 items (Table 4).

	% on the total	Tot items	ITEM	Average every 100 m
1	27,1%	3572	Plastic fragments (2.5- 50 cm)	210
2	13,3%	1756	Polystyrene fragments (2.5-50 cm)	103
3	11,0%	1452	Cigarette buts	85
4	8,9%	1174	Caps, lids, plastic rings	69
5	5,9%	776	Cotton buds	46

Tabella 4 TOP 5 Items most abundant

Indicators:

- n. of participants involved: almost 100
- n. of data collected and submitted to Marine Litter Watch: 16 monitored beaches.



Objective 3: Increase stakeholders' awareness (including fishermen, tourists, local communities, sailors, divers)

In this part of the report activities related to the objective 3 are reported. Please note that often initiatives of clean up, beach litter monitoring and raising awareness-dedicated days involved all kind of stakeholders and were held at the same time.

1.1 Fishermen awareness campaign

→ Annex VIII

The action aims at raising awareness between fishermen. During the project, aquafarmers have been involved too, since in Italy the problem of marine litter has consequences also on this sector. Therefore, the informative meetings on the impact of plastic waste on sealife and cetaceans were organized in this perspective.

The meetings and the clean-up, related to **the campaign Clean up Pelagos**, took place in Liguria and Tuscany region during the project (Figure 9). In Genova on April 12th 2019, in Lerici (La Spezia) on May 14th 2019, in Vecchiano on May 27th 2019 within the meeting "Azioni integrate per un mare da amare", in Bocca di Serchio on June 16th 2019 with a clean-up of Penisola dei Gabbiani and in La Spezia on August 12th 2019, within the stop of Goletta Verde, Legambiente's itinerant Campaign. A further clean-up day was made on August 20 2019 in the Marine Protected area of 5 Terre.



Figure 9 on the left the meeting with aquafarmers in La Spezia. On the centre (down) a moment of the Clean-up day organized in Bocca di Serchio. On the right and the centre (up) a moment of the Clean-up organized in the Marine Protected area of 5 Terre.

During the meetings, a Memorandum of Understanding (MOU) has been presented and signed by fishermen associations and aquafarmers.



The MOU require to fishermen:

- To do not disperse any type of disused fishing equipment or consumables used at sea during the fish processing phases.
- To do not throw anything outboard especially cigarette butts, drenched in toxic substances, or chewing gum.
- To differentiate the waste produced on board, taking them ashore to dispose of them in an appropriate collector (plastic bottles, food wrappers, cans, etc.).
- To raise awareness about the problem and to make other fishermen aware of the prevention and correct disposal of waste.
- To cooperate with projects to reduce the presence of waste at sea, such as the Pelagos Plastic Free project or the Prismamed project, promoted by the Liguria region.
- In addition, to administration:
- To follow the guidelines for proper waste management, promoted by the Pelagos Plastic Free.
- To cooperate with fishermen to promote "fishing for litter" activities, facilitating the transfer of collected waste to land.
- To start marine waste collection initiatives during the closing of the fishing season.
- To promote awareness-raising activities about marine litter issue with all the stakeholders.
- To cooperate with projects to reduce the presence of waste at sea, such as the Pelagos Plastic Free project or the Prismamed project, promoted by the Liguria region.

Indicators:

- n. of participants: more than 30.
- n. of signed MoU: 19 signatures in total. 10 In Toscana, from Vecchiano Bocca di Serchio; 9 Mou signed by mussels farmers from la Spezia.
- n. of participants involved: in the campaign Clean up Pelagos.

1.2 Tourist awareness campaign

This task aimed at involving tourist and citizen in order to raise awareness about the project themes. In addition to the initiatives reported in the Mid-term report, other clean-up days took places within the project. February, 3 2019 in Mola wetland beach in Elba Island and, again, on 25th and 26th of May in Mola wetland beach in Elba Island, on 26th of May in Sestri Levante (Ge) (Figure 10), on June 8, 2019 in Palmaria island, 28th of July in Monterosso al Mare (Sp), on 16th of August 2019 in Riomaggiore (Sp) with volunteers of voluntary camp in 5 Terre National Park, on 20th of August in Vernazza (Sp), on 14th of September 2019 in Calambrone (Pi) within the initiative *"La Caretta caretta nel Santuario Pelagos"*.





Figure 10. Clean up day in Sestri Levante (on the left) and Palmaria (on the right)

During the Pelagos Plastic Free project, the moving exhibition "Océans et mers plastifiés" was finalized by Expédition Med to include a section specifically dedicated to the Mediterranean Sea. The exhibition, tailored for schools and citizens, give basic information of the plastic pollution crisis, its impacts on marine organisms and highlights possible sustainable solutions.

During the summer, and while at St. Laurent du Var, networking activity was carried out with the City of Nice. The exhibition is shown at the Maison de l'environnement de Nice from 17 September to 17 December 2019.

Indicators:

- n. of visitors to the itinerant exhibition: the exhibition is shown at the Mason de l'environnement de Nice from 17 September to 17 December 2019. More than 5000 visitors (school group and general public) are foreseen.
- n. of participants reached by information materials: at least 13000 people
- n. of participants involved in the beach cleaning operations for each protected area and in each summer season. Tuscan Archipelago, Elba Island, 2018 → 20 people, 2019 → 40 people; Maremma Natural Park, 2018 → 30 people, 2019 → 70 people; Cinque Terre National Park, 2018 →20 people, 2019 → 46 people.

1.3 Scuba divers awareness campaign

\rightarrow Annex IX

This action aimed to actively involve SCUBA divers in the project. The diving centers in the project area has been contacted, The Pelagos Plastic Free project partners developed a "Vademecum for a plastic free diver" in Italian language, distributed to all the contacts.

A Memorandum of Understanding was developed and signatures were collected and diving were involved in Operation Clean Seafloors. In particular, this last action took place on 25th of May 2019 in Le Grazie (Sp) involving almost 60 people, on 6th of July 2019 in Rapallo (Ge) (Figure 11), with 20 people (included operators of 5 Terre National Park) and on 26th of September in Giglio Island. ESA diving, Tartasub Maremma association and International Diving of Giglio Island signed the MOU.





Figure 11 Operation Clean Seafloors in Rapallo (Ge).

Indicators:

- n. of signed MoU: 5
- n. of divers reached (by the diving training courses): almost 50
- n. of participants involved: over 100

1.4 School awareness campaign

\rightarrow Annex X

This task aimed at implementing an education programme about project themes in the local schools. During the first month of the project, an environmental education manual in Italian language (Figure 12) has been created focused on the theme of plastic waste at sea, thanks to the net of environmental educator of Legambiente led by the Schools and Education National office of Legambiente. Regarding the 3 training courses (Table 5 and Figure 13) for teachers Schools and Educators organized the classes.

Date	Location	No. of participants
01/12/2018 9:00 - 18:30	Elba Island. Portoferraio (LI), Tuscan Archipelago National Park headquarters	17
28/02/2019 14:30 - 18:30	Environmental Education Centre of Legambiente, Rispescia (GR)	21
07/03/2019 14:30 - 18:30	Aquarium and Talamone Sea Turtles Recovery Center	30
09/04/2019 14:30 - 18:30	Legambiente Liguria Headquarters, Genova	38

Table 5 training courses for teachers and environmental educators



Azioni integrate per ridure l'inquinamento da plastica nel Santuario Pelagos

Students and teachers have been then invited to join clean-up activities, named **Pelagos Plastic free days**. This campaign took place, with clean up and beach litter monitoring activities: on 22nd of March, in Marina di Vecchiano, involving almost 40 people (2 school classes), on 10th of May in Capalbio, beach of Chiarone, involving almost 30 people (2 school classes), and on 5th of June 2019 in Cecina with almost 50 students (2 school classes).

Indicators:

- n. of teachers involved: 85, including environmental educators
- n. of students involved: more than 120, in the Pelagos Plastic free days



Figure 12 Education manual for teachers and environmental educators



Figure 13 Pictures from the training courses



Difficulties encountered and measures taken to overcome problems

Objective 1. [ADD IN ANY]

Objective 2. [ADD IN ANY]

<u>Objective 3.</u> In Elba Island fishermen are not organized in cooperatives and works alone. It has been very difficult to get in contact with them and organize initiatives of Clean Up. It is undeniable, however, that the Pelagos Plastic Free project has been very useful and important to lay the foundation for a first approach and for future collaboration.

Changes introduced in the implementation (if any)

Preparatory activities

Objective 1. [ADD IN ANY]

Objective 2. [ADD IN ANY]

Objective 3. [ADD IN ANY]



Achievements/ Results

- Proposals

Not at the moment

- Synthetic explanatory report (a short article with the most important outcomes to

be published on the website)

Governance, scientific research and communication: this is the innovative and integrated approach of the PELAGOS PLASTIC FREE PROJECT in fighting marine plastic pollution in the Pelagos Sanctuary. The project, implemented by Legambiente and Expédition Med, started in April 2018 and lasted 18 months.

Over this period, different specific objectives have been reached for each of the three main macro areas of intervention listed below:

1) To enhance the governance capacity of coastal municipalities;

2) To increase scientific knowledge on the Plastisphere and on the origins and sources of plastic debris;

3) To develop awareness and promote engagement by different groups of stakeholders through outreach and education events.

Regarding the governance, Legambiente as first step collected and analyzed best practices to counteract the marine litter phenomenon. A first collection of the best practices, has been discussed during all the workshops held with local institutions in order to share knowledge on this topic and promote the uptake, and where possible the upscale, of these practices within the coastal municipalities that overlook the Pelagos Sanctuary. Starting from these best practices, local administrators wrote and adopted special guidelines to reduce plastic waste in their territory reducing in this way the impact on sealife and in particular on marine mammals.

As concerns the scientific research, the activities have been mainly pursued by Expédition Med. At first, the survey at sea took place aboard the research vessel Ainez from 30 June to 29 July 2018. During the cruise, which involved biologists, oceanographers, a marine mammal specialist, and video maker, volunteers, they were collected samples of water once a week and samples of floating plastic debris from 39 trawls and in total a selection of 40 different type of plastic fragments. The study of the Plastisphere took place also at ports and river in order to monitor the microbial communities that live on plastics that could potentially arrive at sea from land. Besides, to monitor floating litter, two surveys areas were considered. In total 216 floating objects were registered, while the presence of waste on the shore beach was assessed through the organization of beach litter monitoring activities. For now five beaches in Tuscany region were monitored by Legambiente and its volunteers, who counted 2297 items over a 6500 sqm area, a mean of 460 items every 100 m of beaches. Data will be send to the European Environmental Agency to enrich the Marine Litter Watch programme.



The third macro area of the project regards the objective of increasing awareness of different types of stakeholders, including fishermen, sailors, divers, tourists, students, local communities etc. Thanks to the project, many people have been involved in different kind of events: in this way they have become aware of the problem of marine pollution caused by plastic and its effects on sealife and consequently they have become aware of the need to change their behaviour by adopting more sustainable lifestyles.