

NETWAP

NETwork of small "in situ" WAsTe Prevention and management initiatives

Priority Axis: ENVIRONMENT AND CULTURAL HERITAGE

Specific Objective 3.3 - Improve the environmental quality conditions of the sea and coastal area by use of sustainable and innovative technologies and approaches

Deliverable 3.4:1 Definition of a common framework methodology for waste management in small communities – Annex VI Vademecum for optimisation of marine litter prevention of beached waste production and management issues

WP3: Data analysis, baseline elaboration and methodology definition on organic waste and plastic management

Activity 3.4 Organic waste and plastic management methodology for small communities

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Introduction

Environmental protection in seaside resorts cannot be separated from sustainable land management. Particular attention must be paid to the sustainable development and to the reconciliation of fishing, tourism and the environmental conservation. This need takes on a specific meaning in the case of the smaller islands. Here the ecosystems are fragile and can be altered by significant seasonal tourist flows. With this contribution we want to offer a simple, flexible and shareable tool for stakeholders in order to promote good practices aimed at preventing waste production.

The objective of the present report is the implementation and adoption of a best practice focused on prevention of urban waste production. Marine litter is increased during Anthropocene. As a consequence beach cleaning is becoming an emerging issue on environmental management because mixing of different material can increase waste production and loss of natural resources (sand and vegetal biomasses in particular).

With the present report we have implemented a simple procedure to coordinate manual cleaning operation by both volunteers and municipal company in order to allow recycling of waste collected on beaches and coastal areas. A great deal of this waste are plastics; in particular, plastic nets used by aquaculture are an emerging and increasing component. Unfortunately these plastics, being collected in the beaches, are classified with an EWC (European Waste Catalogue) 20.03.03 of “cleaning street residues” and as such, they are landfilled without any possibility of recovery.

The activities introduced by the NETWAP project provide fundamental elements for the resolution of recurrent problems in coastal areas, increasingly afflicted by the emergency of marine litter. The growing problem of marine litter has exacerbated the impact on local communities and the environment on a global scale and, in particular, in the Mediterranean Sea. The increasing number of wastes washed ashore during storm surges or near the mouths of rivers, favors the spread of bad management practices, such as mixing and disposal.

The main purpose is to provide highly replicable case studies, so as to provide Public Administrations, in particular those of small islands and coastal areas, with experiences, technical and scientific knowledge, indications but also, hopefully, practical and effective tools for the management and resolution of common problems.

ENEA's experience, accumulated over the last decades, starting from the local scale to the national one, has allowed to reach the definition of models and systems for analysis. In this way it is possible to

implement remediation and policy interventions at central and regional level. The holistic and systemic approach adopted in the interventions on the territory allows to define, plan and implement territorial projects based on criteria of environmental and economic sustainability, also in order to develop strategies to support tourism that, alone, contributes to more than 10 % of the national GDP.

General framework and background information

World Plastic Production

World plastic production is over 368 Mt/year; about half of it is used only once and recycling is less than 5 %. The packaging sector generate the largest production (**Figure 1**). The majority are disposable products and they become waste within a year after distribution on the market or after a single use.

In Europe, the recycling rate of waste plastics reached 31% for the first time in 2016, overcoming the disposal into landfill (27%). However, it is important to highlight that only a part of the collected plastics are reintroduced into the market. Polymers with an established recycling market are few and composed by polyethylene (PE), polypropylene (PP) and polyethylene terephthalate (PET) among packaging and polymethyl methacrylate (PMMA) among electrical and electronic waste (WEEE).

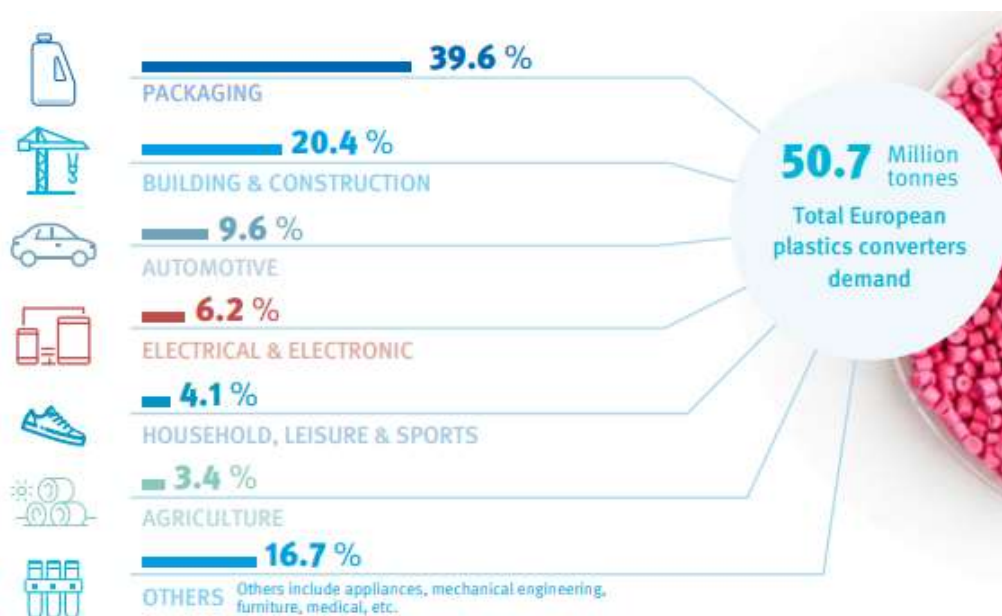


Figure 1. Distribution of the plastics market by sectors (Plastics-The Facts, 2020).

Demand of recycled plastics is strongly related to the properties of materials, closely dependent on the price of oil which influences the cost of the raw material. In Europe, during 2014, about 13% of the total volume of packaging plastics allocated to recycling (44%), entered the European market, while 30% were exported with no information about its final destination.

Nowadays, the recent ban on the plastic waste import by the Chinese government has deeply affected the recycling market, especially for those fractions with a low quality and an unstable market such as polypropylene (PP), plastic films, polyolefin blends for packaging or acrylonitrile butadiene styrene (ABS) and styrenic polymers from WEEE. As a consequence, in 2017, the price of small films in Italy collapsed to the symbolic price of 2 €/ton.

At the same time, saturation of incineration plants is causing a worrying and increasing storage of plastic waste into unauthorised deposit. In Italy, for example, there has been an emergency due to more than 300 fires in 2017-2018 of these saturated plastic deposits. Due to the lack of available land and the high cost for the society, landfill is an unsustainable solution. So, it is mandatory to focus on the suitable and complementary alternative to traditional recycling methods.

Marine litter¹

Monitoring programme, carried out for the implementation of the Marine Strategy, revealed distribution and quantity of marine litter on the sea surface, seabed and beaches. Preliminary data suggest that waste distribution is not yet completely exhaustive but it can be roughly estimated as follow:

- 3-600 items per 100 m of beach;
- 1-1,000 items per km² of floating waste (depending on the distance from river mouths);
- <1,000 per km² on the seabed;
- 90-200,000/km² of microplastics (and their transfer to the food chain, is still not homogeneous).

¹ Data of Italian Institute for Environmental Protection and Research (ISPRA) submitted to the European Commission under the Marine Strategy framework activities such as EU project DEFISHGEAR, MEDSEALITTER; ML-REPAIR, INDICIT.

The amount of waste potentially present in the areas of interest is reported by the European Commission's Decision 2017/848/EU.

It is well known that micro-plastics are capable of transporting and spreading different kinds of pollutants with them. Recently, research projects carried out by National Research Council (CNR) and *Legambiente* association characterised the bacterial colonies that populate the biofilm attached to micro-plastics. A correlation was highlighted between the state of degradation of polymers and the bacterial population.

Materials and methods

Summary of the methodological approach

The following actions have been carried out during the NETWAP Project:

- 1) ENEA implemented a beach cleaning procedure.
- 2) The draft of proposal has been shared with all partners of NETWAP Project in order to be reviewed and discussed with possible common implementations.
- 3) Guidelines for beached marine litter have been implemented and approved among all project partners and stakeholders involved in the project. An example of good practices, useful for the prevention of waste production in the coastal marine environment, has been disseminated through presentation and webinar of 27th May 2021.

Results and discussion

Best practice for prevention of waste production and marine litter management

The following procedure and general considerations on the nature and management of materials found along the coasts have been defined and shared among the NETWAP project partners. This paragraph illustrates the main concepts and operational steps to prevent waste production. The materials found on

beaches have their own path, according to their composition and nature. Considering that, it is necessary to specify that the majority of beached debris are deposited along the coasts during sea storms. The main categories of marine litter are plastics, glass, metal, paper, fabric, rubber and wood. The largest amount of marine litter consists of disposable plastics. Just in the case of some Mediterranean coastal areas these plastics appear locally mixed with vegetable biomass. Paper and cardboard tend to decompose rapidly in contact with water. Wastes with higher specific weight/heavier fractions (tires, metal, and other non-floating bulky materials) sink to the bottom and are rarely present on the beach.

1. Vegetable biomasses (wood, reed canes, seagrass wrack) should be prioritized to be retained on the beach to promote the ecological beach model (according to the circular issued by the Italian Ministry of Environment MATTM 8388/2019). Keeping them in place promotes colonization of pioneer species and vegetation cover, increasing natural capital (Rotini et al., 2020²). As second option, they should be moved to the backshore to protect the foot of the dune from wind, waves and storm surges
2. Waste should be removed periodically, thus insuring a clean environment that supports the conservation of ecosystems and pristine decorum of the coastal landscape. Waste of anthropogenic origin (plastics etc.) should always be collected before displacement of vegetable biomasses. Waste collection should be carried out manually by operators (volunteers or staff of companies responsible for collection), directly along the shores (both sandy and rocky). If the piles of marine biomass result in a large amount, waste separation can also be assisted by specific mechanical equipment.
3. Mechanized beach cleaning operation brings about the mixing of the waste with natural resources which in turn leads to the increase of urban waste production and prevent the sustainable use of beached vegetable biomass.
4. The mechanized cleaning of beaches should be regulated distinguishing natural and anthropized beaches, where roads, cliffs, sea-walls are extraneous elements; in these cases small temporary construction sites or the use of crawlers or wheeled vehicles would be useful for the separation

² Rotini, A., Chiesa, S., Manfra, L., Borrello, P., Piermarini, R., Silvestri, C., et al. (2020). Effectiveness of the “ecological beach” model: Beneficial management of posidonia beach casts and banquette. WATER, 12(11), 3238

of waste, beached biomass and sediment. This approach should be implemented in a manner that does not increase the anthropic pressure on the ecosystem.

5. In situ human use of beached plant biomass and sediment must not favor exploitation of natural resources but can generate many social, economic and environmental advantages. Therefore, due to the specifics of locations, a “case by case” approach should be undertaken for the assessment of sustainable management in accordance to National legislation. If the legislation is non-existent we propose it should be defined as soon as possible.
6. The collection of waste from coastal areas should be carried out manually in order to separate different types of plastics as well and increase the separate collection of plastics. Therefore, it is suggested to collect 3 categories of materials:
 - a. Nets used for mussel farming may be mechanically recycled according to the experimental treatment specifications outlined in the “Mechanical recycling of mussels net” (D5.1.3 and D5.1.4), briefly summarized/illustrated in Box 1; this category has an EWC 20 01 39 code;
 - b. Other plastics, usually mixed and deteriorated, cannot be mechanically recycled, but must be treated according to the schematic description in Box 2 with pyrolysis “Chemical recycling of plastic marine litter”, see D5.1.3 and D5.1.4); for their management also this category has an EWC 20 01 39 code;
 - c. The remaining material will be classified as “residues from street and beach cleaning” with EWC code 20 03 03
7. Complementary services can include selective waste collection along the coast. Coordination of periodic cleaning actions operated by volunteers, associations and the services provided by local authorities that periodically collect and transport waste should be promoted. All events that involve volunteers should also include and promote the value of informal and non-formal education which can be implemented through these events.
8. During the cleaning events, volunteers and workers can drop off the material to “green islands” specifically distributed along the beach during the summer months (Figure 2), in order to avoid problems of EWC code attribution to the collected waste. Alternatively, operators can deliver the collected material to the nearest collection point or beach resort. Both the options

described above could increase the percentage of separate/recycling collection of non-domestic users.

9. Volunteers should be trained to collect the different fractions of waste and separate them. If necessary, they may perform some preparation work such as washing or separation from the sand. Sediments must not be removed from the beach.

All sandy material and vegetable biomasses that should be recovered during the treatment must be separated, preserved and they are a common asset owned by the community and not by the management body of the treatment plant. Therefore, at the end of the process, they must be returned to the beaches with no cost for the public administration and without additional income for the owner of the treatment plant.



Figure 2. Bins of "green islands" or "recycling banks" on the beach.

Concluding remarks

Many concluding remarks can be made on the base of the procedure implemented within the framework of NETWAP project. Most of them are reported as follow:

- The cleaning of coastal areas could be affected by actions of separate waste collection in analogy to the separate collection applied to domestic and non-domestic users;
- Two different kinds of plastics should be collected during beach cleaning and their treatment should follow the processing chain described in BOX 1 (*Mechanical recycling: collection, washing, extrusion tests of mussels net*) and Box 2 (*Chemical recycling: mineral oil from the heterogeneous and deteriorated plastic fraction*) of the present report;
- Management of beached vegetal biomasses should be rapidly adopted by European countries according to the model of ecological beaches described in BOX 3 (*ecological beach model*);
- Extra cost of these waste separation services should be covered by contribution of the central governments or subtracted from the burden of state concessions;
- Tax credits, reduction of the state fee, rewards in the scores of tenders or environmental certification (such as blue flag), or non-refundable other incentives should be foreseen for those operators who separate the waste collected along the coast and manage the beached vegetable biomass instead of disposing them;
- To promote an ecological transition across Europe, specific regulatory action should be implemented and rapidly adopted by EU countries in order to reduce marine litter and waste production derived from beach cleaning operation.

BOX 1

BOX FOR MECHANICAL RECYCLING: COLLECTION, WASHING, EXTRUSION TESTS OF MUSSELS NET



BOX 2

BOX FOR CHEMICAL RECYCLING: MINERAL OIL FROM THE HETEROGENEOUS AND DETERORATED PLASTIC FRACTION



BOX 3

BOX FOR MANAGEMENT OF VEGETAL BIOMASSES AND ECOLOGICAL BEACH MODEL

