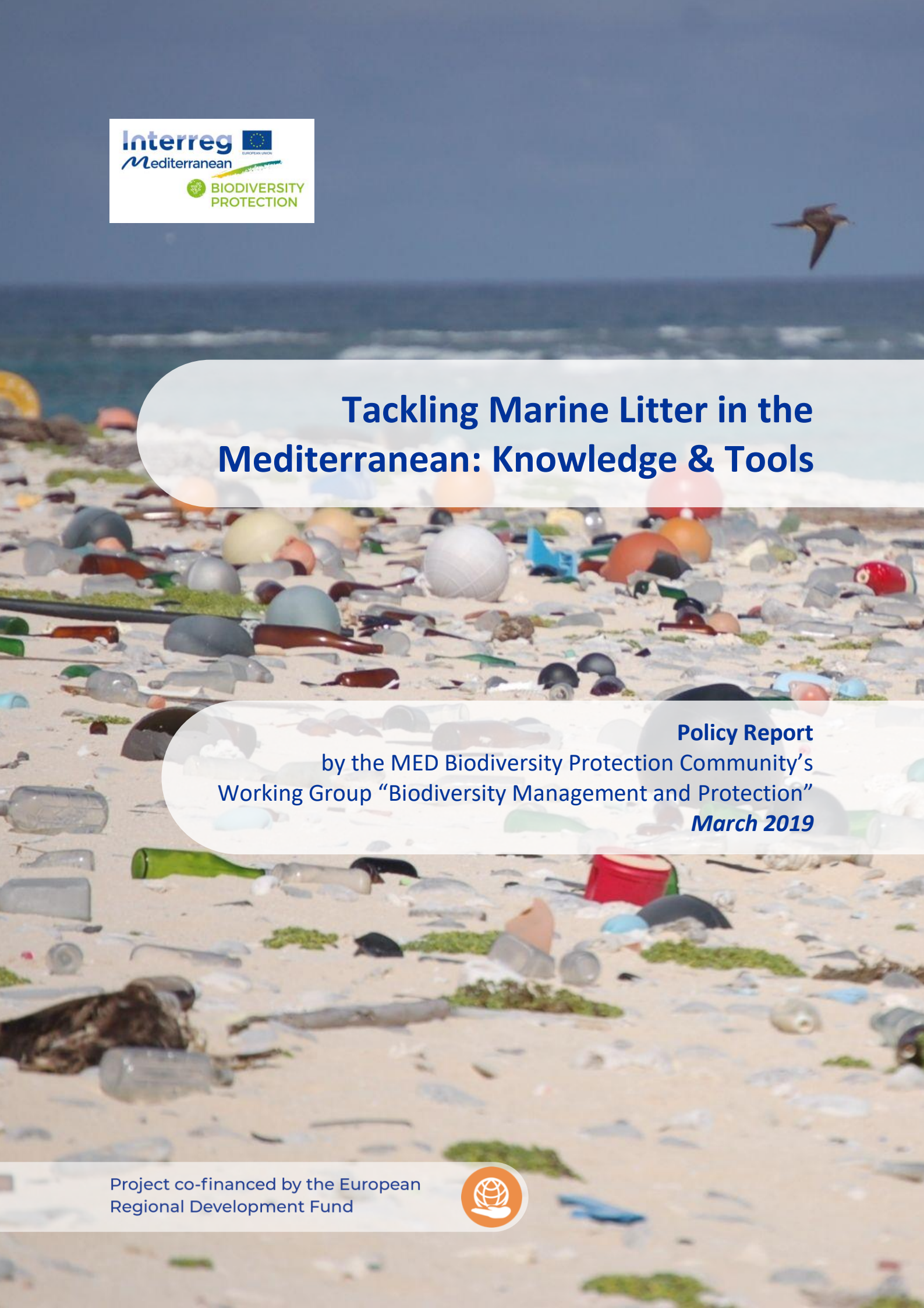

Tackling Marine Litter in the Mediterranean: Knowledge & Tools

Policy Report

by the MED Biodiversity Protection Community's Working Group "Biodiversity Management and Protection"

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Executive Summary

The Biodiversity Protection Community has been established for the purpose of engaging nature conservation stakeholders in the Mediterranean region, by acting as a mainstreaming instrument to communicate and capitalise on the efforts carried out by the Interreg MED Community of projects, with a special focus on Marine Protected Areas (MPAs) as sentinels for monitoring environmental impacts in the Mediterranean Sea.

This report aims to synthesise and showcase the contribution of the Biodiversity Protection Community projects and other Interreg MED projects on the development and/or refinement of marine litter assessment and management tools, giving special emphasis to the tools that can be applied in Mediterranean MPAs. Moreover, it identifies current gaps in knowledge and management, advancing recommendations for further action for both EU and Mediterranean policymakers, governance mechanisms and funding instruments.

The Challenge: Marine Litter in the Mediterranean

The Mediterranean Sea is one of the areas that is most affected by marine litter in the world. Although several legal and policy frameworks have been established to tackle this important issue, several problems still exist in relation to marine litter assessment and management at the Mediterranean scale. These problems include: the need for increased, long-term information on marine litter and its impacts on biodiversity, human activities and well-being; the need for harmonised monitoring protocols; the need to empower local managers, especially in Marine Protected Areas (MPAs) with the necessary tools and knowledge to tackle marine litter; the need for clearly defined baselines and reduction targets to measure trends and progress; and the need to ensure effective cross-border cooperation and coordination, especially with non-EU countries, in the implementation of existing policies.

The Community contribution to address marine litter: Main findings

Section 2 of the report showcases the following results and the achievements of the Biodiversity Protection Community projects on marine litter assessment and management.

Increased knowledge of the presence of marine litter on beaches, floating on the surface, and in biota

- Plastic constitutes more than 80% of marine litter in all compartments, especially packaging, bags, wrappers, and fisheries-related objects.
- Marine litter on beaches accumulates more rapidly during the warmer seasons (spring and summer).
- There is a higher presence of floating litter during the warmer seasons, especially in the Ligurian Sea, Sardinian-Balearic basin, and Central Tyrrhenian Sea.
- Marine litter in the Mediterranean comes mainly from the largest coastal cities, rivers, and the most congested shipping lanes. The modelling of how floating marine litter drifts in the entire Mediterranean indicates that the most contaminated areas are the Cilician sub-basin, the Catalan Sea, the Po River Delta area, and the Venice Lagoon.

- Boomerang Effect: the modelling of how floating marine litter drifts shows that the plastic pollution of almost every country is mainly caused by its own terrestrial sources.
- Marine litter was found in the stomach of 78% of the marine turtles and of 46% of the fish sampled.
- There is a high spatial overlap between the presence of marine litter and marine species (cetaceans and sea turtles), especially in spring and summer, and in the Sardinian-Sicily Channel and in the Adriatic Sea.

Refining current assessment protocols and methods

- An enhancement of the existing protocols for monitoring floating macro-litter and ingested marine litter has been developed and tested. It includes a study of the main limitations, benefits, and opportunities to reduce the costs of existing monitoring techniques. This enhanced protocol has been included in the review of the EU-JRC Guidance for monitoring marine litter in 2019.

Testing innovative tools to support marine litter assessment

- The use of drones and other Unmanned Aerial Vehicles (UAVs) has been shown to be a promising and cost-effective tool for marine litter monitoring, especially for hotspot areas and for local management purposes.
- The geo-spatial tools developed by the Community are a useful means for MPA managers to visualise and analyse the results of marine litter monitoring. In addition, the Biodiversity Protection Platform can be easily used to visualise existing knowledge, and ensure access and sharing of data and information on marine litter at the Mediterranean scale.
- Modelling tools have proved to be useful in understanding the fate of marine litter throughout the Mediterranean.
- The new indicator developed (the Marine Litter Beach Accumulation Index), and the investigation into the use of animal forests as indicators of entanglement can contribute towards establishing clearer baselines and reduction targets in the framework of both the EU MSFD (Marine Strategy Framework Directive) and the UNEP/MAP Integrated Monitoring and Assessment Programme (IMAP).

Tools and measures for MPA managers

- A comprehensive list of best practice measures to fight marine litter in Mediterranean MPAs has been compiled.
- Recommendations have been formulated on how to increase coordination between MPAs and other maritime sectors, centred on policy lobbying, waste reduction, and raising awareness.
- A Decision-Making Tool was developed to help managers identify the most effective measures to tackle marine litter in their MPAs.
- Nine pioneering MPAs have developed MPA-specific Marine Litter Action Plans.
- These Action Plans form the backbone of a Joint Plan for Action that sets the baseline for a common urgent response by all other Mediterranean MPAs.

Recommendations for further action at the EU policy level

The following recommendations are advanced in Section 3 for action at the EU and Mediterranean levels:

Marine litter data and information

- ⇨ Further support the creation of a long-term knowledge base and information series that cover the whole Mediterranean basin;
- ⇨ Support research to close current knowledge gaps on marine litter fluxes, on the impacts of marine litter on maritime socio-economic sectors, on the impacts of marine litter on biota and on human health, on the occurrence of Abandoned, Lost or otherwise Discarded Fishing Gear (ALDFG), and on the degradation mechanisms for marine litter in the environment (including "biodegradable" materials with enhanced degradation properties).

In this regard, in order to further capitalise on the efforts of the Community projects, we recommend reinforcing and consolidating the Community participatory science initiatives (Marine Litter Watch Month and floating litter monitoring through sailing vessels), as well as strengthening the collaboration of the scientific community with MPA managers, Mediterranean NGOs, and local communities, also in other Mediterranean MPAs. Moreover, we recommend promoting the use of drones, wave gliders and other UAVs for marine litter data collection, especially in MPAs. Finally, we recommend ensuring that the Mediterranean marine litter knowledge base hosted in the Biodiversity Protection Knowledge Platform is regularly maintained and updated, and permanently linked to the UNEP/MAP Regional Cooperation Platform on Marine Litter.

Refining and Improving Assessment Protocols

- ⇨ Fostering the adoption of the enhanced protocols for floating macro-litter and ingested litter, proposed by MEDSEALITTER and included into the revision of the EU-JRC Guidance on monitoring marine litter in 2019, at Mediterranean scale; and
- ⇨ Further support the development of new Mediterranean-wide monitoring protocols for micro-litter, for the entanglement of marine species, for the effect of litter colonisation by small marine species, and for deep-sea areas.

Knowledge and tools for local managers

- ⇨ Further support local authorities, MPA managers, and local communities with effective instruments to monitor and manage marine litter, by improving their administrative coordination, capacity building, and technical support, and prioritising upstream solutions in keeping with the waste management hierarchy.

In this regard, in order to further capitalise on the efforts of the Community projects, we recommend sharing the management tools developed for the pilot MPA managers with other Mediterranean MPAs in both EU and non-EU countries, by using existing networks of Mediterranean MPAs (namely MedPAN) and the UNEP/MAP network. Moreover, we recommend increasing the human and technical resources and capacity of MPA managers to address marine litter, by training the personnel on using the geospatial tools developed by the Community projects. Finally, we recommend ensuring that funding mechanisms require the development of geospatial tools that are user-friendly and can be easily used in an effective way by MPA managers.

Clearly defined baselines and targets

⇨ Further support scientific research towards a clear definition of baseline values and of reduction targets against which to measure progress in tackling marine litter.

In this regard, we recommend considering the use of the new Marine Litter Beach Accumulation Index, and further investigating the use of animal forests as indicators of entanglement, so as to establish clearer baselines and reduction targets in the context of both the EU MSFD and the UNEP/MAP IMAP.

Cross-border cooperation (especially with non-EU countries)

⇨ Further support cross-border cooperation and coordination in the Mediterranean, by sharing the knowledge and tools developed by the Interreg MED community for marine litter, especially with partners from non-EU countries.

In this regard, in order to further capitalise on the efforts of the Community projects, we recommend sharing the management tools developed by the pilot MPA managers with other Mediterranean MPAs in both EU and non-EU countries, by using existing networks of Mediterranean MPAs (namely MedPAN) and the UNEP/MAP network. Moreover, we recommend considering the extension of the horizontal approach used to develop and implement the Biodiversity Protection Community, to include other lines of EU funding for the Mediterranean (e.g. other Interreg, LIFE, European Fisheries Fund (EFF)) as an instrument to streamline best practices and recommendations into management and policy instruments.

Cross-sector coordination

⇨ Further support the coordination between marine conservation and maritime socio-economic sectors, by including the Ecosystem-Based Management principles into other policies (especially in the Circular Economy Package and the Plastics Strategy), and by fostering a coordinated approach between MPAs, coastal and marine resource managers, and other maritime sectors.

Sea-based sources of marine litter

⇨ Ensure a wider coverage of potential sources of marine litter, by supporting projects that address sea-based sources of marine litter like shipping, fishing, offshore installations, or dumping of refuse at sea.

Involve local stakeholders and civil society

⇨ Further strengthen the connection of future projects with society at the local level, by implementing actions that aim to raise the awareness of local communities and involve local authorities in developing participatory science initiatives on marine litter monitoring and assessment.

Sustainability of achievements

⇨ Guarantee the sustainability of the Community's achievements, by ensuring the creation of a permanent link between the Community outcomes and the existing Mediterranean-wide knowledge platforms on marine litter in order to foster accessibility to available resources, the transferability of the knowledge and tools generated, and the replicability of the solutions tested.

In this regard, in order to further capitalise on the efforts of the Community projects, we recommend ensuring that the Mediterranean marine litter knowledge base hosted in the Biodiversity Protection Knowledge Platform is regularly maintained and updated, and permanently linked to the UNEP/MAP Regional Cooperation Platform on Marine Litter.

Overall, the efforts of the Biodiversity Protection Community featured by PANACeA have contributed to the state-of-the art science, practice, and policy to tackle marine litter in the Mediterranean. Their detailed results can be found in this report. Some of these projects concluded their activities in 2018, while other projects will continue throughout 2019. Their results and achievements support the continued, collaborative effort within the Interreg MED Biodiversity Protection Community to streamline management for enhanced nature conservation in the Mediterranean.

1. The Challenge

1.1 Marine litter in the Mediterranean

The Mediterranean Sea is one of the most important biodiversity hotspots in the world. It represents less than 1% of the global ocean surface, but hosts almost 20% of global marine biodiversity[1], of which almost a third is endemic[2]. Many of the Mediterranean marine habitats and species are rare and/or threatened by the increasing pressure generated by human activities. Pollution discharges (including marine litter), intensive fishing activities, maritime transport, and climate change are the main factors causing habitat destruction, eutrophication, and the introduction of non-native species.

To date, more than 1,200 Marine Protected Areas (MPAs) and other forms of protected areas have been designated in the Mediterranean to protect endangered and threatened habitats and species, including the associated ecosystem services and cultural values. They cover a total of 179,798 km^2, corresponding to about 7% of its surface area[3]. This share is far below the Aichi Target 11 of 10% of coastal and marine waters to be protected by 2020[4], and is likely to be even lower if we consider that designation often remains 'on paper', with no real protection and management in place for more than half of Mediterranean MPAs.

Despite these efforts, the Mediterranean Sea is one of the areas that is most affected by marine litter in the world[5]. Its unique semi-enclosed nature makes the Mediterranean Sea a concentrating basin for marine litter, with amounts that are estimated to be comparable to those observed in the five oceanic subtropical gyres[6]. Marine litter in the Mediterranean is largely composed of plastics (70-90% of the total in all compartments)[7]. It originates mainly from land-based sources like tourism and recreational activities, poor waste management practices, discharges of untreated municipal waste, and industrial outfalls. Rivers are an important pathway through which a considerable quantity of marine litter enters into the coastal and marine environment. Additionally, sea-based activities such as maritime transport, fisheries, and aquaculture can heavily contribute to the inputs of litter in specific contexts, especially

[1] Gabrié et al., 2012.
[2] EEA, 2015.
[3] See the MedPan website: http://medpan.org/marine-protected-areas/mediterranean-mpas/.
[4] The Aichi Biodiversity Targets have been established in the context of the United Nations Convention on Biological Diversity.
[5] Morris 1980; Barnes et al. 2009; Lebreton et al. 2012; UNEP, 2015; UNEP, 2017.
[6] Mansui et al., 2015; Zambianchi et al., 2017. For model simulations, see: Lebreton et al., 2011; Maximenko et al., 2012; Liubartseva et al., 2018. For in situ observations, see: Cózar et al., 2015; Arcangeli et al., 2018.
[7] UNEP, 2015; UNEP, 2017.

through direct discharge of waste and through Abandoned, Lost, or otherwise Discarded Fishing Gear (ALDFG).

Marine litter is a major threat to living marine organisms. Over 260 species, including invertebrates, turtles, fishes, seabirds, and mammals, have been reported to ingest or become entangled in plastic debris worldwide[8]. Moreover, marine litter may be colonised by micro-organisms, and be used as a transport vector for non-native and invasive species.

In parallel, there are increasing concerns among scientists, policymakers, and society about the impacts of marine litter not only on economic sectors[9], but also on human health, livelihood, and well-being[10].

1.2 The State of Play: Policy Action to Date

In order to tackle the challenge of marine litter, several legal and policy frameworks have been developed at the global, European Union (EU), and Mediterranean level. General obligations and requirements to fight marine litter have been set at the global level, either through formal international agreements, like Annex V of the MARPOL Convention[11], the London Protocol (1996)[12], and the Stockholm Convention on Persistent Organic Pollutants (POPs)[13], or with non-binding or voluntary initiatives like the Honolulu Strategy and the Global Partnership on Marine Litter (GPML).
At the European Union (EU) level, the main law setting specific environmental objectives for marine litter is the **Marine Strategy Framework Directive** (MSFD; 2008/56/EC), which aims to achieve the Good Environmental Status (GES) of European marine waters by 2020. The achievement of GES is articulated along 11 qualitative descriptors. Descriptor 10 focuses on marine litter; it requires Member States to ensure that "properties and quantities of marine litter do not cause harm to the coastal and marine environment". To this end, monitoring programmes must be established by Member States, and articulated along four indicators (see Table 1). A Technical Group on Marine Litter (TG ML) has been created to support the implementation and review of the MSFD in this respect; it serves mainly as a forum for information exchange and discussion, providing guidance and advice, and fostering the adoption of harmonised monitoring protocols.

In parallel, the EU **Circular Economy Package** and Action Plan set the target for reducing marine litter 30% by 2020 for the ten most common types of litter found on beaches, as well as for fishing gear found at sea. At the same time, the **Plastics Strategy** sets ambitious targets for reducing plastic pollution, whereby all plastic packaging on the EU market will be recyclable by 2030, the consumption of single-use plastics will be reduced, and the intentional use of microplastics will be restricted. Along

[8] Derraik, 2002; Ivar Do Sul and Costa, 2014.
[9] Mouat et al., 2010.
[10] Thompson et al., 2009.
[11] Annex V of the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) on the prevention of pollution by garbage from ships (1998) prohibits the disposal into the sea of all plastics, and regulates the distances from the coast at which other types of waste can be disposed of into the sea. It requires each party to ensure the provision of facilities at ports and terminals for the reception of garbage. In this context, the Mediterranean Sea has been designated as a Special Area, where the disposal of garbage at sea is prohibited and adequate port reception facilities for garbage should be established.
[12] The "London Protocol" (1996; entered into force in 2006) to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention, 1975), prohibits the dumping of waste into the sea, requiring ships to hold a permit to dump waste listed in Annex 1 (e.g., dredged material, sewage sludge, organic material, and bulky items).
[13] The Stockholm Convention on Persistent Organic Pollutants (POPs) establishes the reduction or elimination of the release of unintentionally produced POPs, such as those released by plastic materials as they degrade.

this line, the **Plastic Bags Directive** was adopted to decrease the number of plastic bags produced and marketed in the EU[14].

Table 1 Correspondence and overlaps between the marine litter-related indicators of MSFD and IMAP. As specified in Decision (EU) 2017/848

EU MSFD	UNEP/MAP IMAP
D10C1 – Primary* **The composition, amount and spatial distribution of litter on the coastline, in the surface layer of the water column, and on the seabed, are at levels that do not cause harm to the coastal and marine environment.**	Common Indicator 22 Trends in the amount of litter washed ashore and/or deposited on coastlines, including analysis of its composition, spatial distribution and, where possible, source
D10C2 – Primary* **The composition, amount and spatial distribution of micro-litter on the coastline, in the surface layer of the water column, and in seabed sediment, are at levels that do not cause harm to the coastal and marine environment**	Common Indicator 23 Trends in the amount of litter in the water column including microplastics and on the seafloor
D10C3 – Secondary* **The amount of litter and micro-litter ingested by marine animals is at a level that does not adversely affect the health of the species concerned**	Candidate Indicator 24 Trends in the amount of litter ingested by or entangling marine organisms
D10C4-Secondary* **The number of individuals of each species which are adversely affected due to litter, such as by entanglement, other types of injury or mortality, or health effects.**	

** Secondary criteria are decided by EU Member States, where necessary, to complement a Primary criterion or when, for a particular criterion, the marine environment is at risk of not achieving or not maintaining a good environmental status.*

Moreover, in 2019 the EU is expected to adopt a **Directive on Single-Use Plastics**, laying down rules to target the ten single-use plastic products that are found most often on Europe's beaches and seas, as well as lost and abandoned fishing gear[15]. The EU legal framework on marine litter is complemented by several other EU laws, whose aim is to foster waste prevention, reduction/reuse/recycling, and regulation of waste discharge and disposal activities[16]. These acts are indirectly relevant to the issue of marine litter, as they include provisions to avoid the generation of waste, or to establish structures and mechanisms to recycle waste, as well as to avoid waste disposal into the environment.

[14] The aim of the Plastic Bags Directive (2015/720/EU) is to lower the annual per capita consumption of lightweight plastic bags to a maximum of 90 bags by 31 December 2019 and 40 bags by 31 December 2025, including the prohibition to provide lightweight carrier bags free of charge at the point of sale of goods or products by 31 December 2018.

[15] According to the proposed Single-Use Plastics Directive, plastics will be banned from products where alternatives are already available and affordable (e.g. cotton buds, cutlery, straws, and balloon sticks), while consumption reduction targets will be set for food containers and drink cups. Extended Producer Responsibility mechanisms will be in place for containers, packets and wrappers, cigarette butts, and fishing gear (among others). Finally, the proposed Directive also sets collection targets, labelling requirements and awareness-raising measures.

[16] The Waste Framework Directive Packaging and Packaging Waste Directive (94/62/EC); the Port Reception Facilities Directive; and the Extended Producer Responsibility (EPR) mechanisms in place for vehicles (End-of-life Vehicles (ELV) Directive), batteries and accumulators, and waste from Electronic and Electrical Equipment.

Finally, at the Mediterranean level, a legally binding **Regional Plan on Marine Litter Management**[17] was adopted in 2013 in the context of the Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean. The Mediterranean is the first Regional Sea Programme to adopt such a legally binding plan on marine litter. The Regional Plan includes policy, legal, institutional, regulatory (including economic incentive instruments), and technical measures to address different aspects of marine litter prevention and management from both land- and sea-based sources. The timeframe for implementing the measures is from 2016 to 2025, with the majority of measures to be implemented by 2020. Moreover, reduction targets for the main marine litter types were adopted in 2016[18].

In parallel, the **UNEP/MAP Integrated Monitoring and Assessment Programme (IMAP)** includes 11 Ecological quality Objectives (EOs) to evaluate the status of the Mediterranean, one of which focuses on marine litter (EO 10). In this respect, three indicators have been included to monitor and assess marine litter in the Mediterranean; they are illustrated in Table 1 and related to the MSFD indicators. Reduction targets have been set for each indicator. Moreover, metadata templates have been developed for litter on the beach, on the surface and on the seafloor.

1.3 Current scientific and management challenges

Notwithstanding these efforts, several scientific and management challenges exist, which should be addressed by scientists, policy- and decision makers, managers (including MPA managers), and other stakeholders.

First, the information on marine litter sources, quantity, and accumulation rates in the Mediterranean is fragmented and spatially restricted to the northern part of the basin[19]. This information is available only at the local level, so that basin-scale conclusions cannot be derived. Moreover, it mostly covers a short period of time, so that long-term assessments are extremely difficult to perform[20]. In addition, there is a lack of knowledge on the impacts of marine litter on marine organisms at the population and community level, as well as the need to further advance the investigation of the impacts of marine litter on maritime socio-economic sectors[21].

A better understanding is also needed of the degradation of litter in the marine environment, including the consideration of "biodegradable" materials with enhanced degradation properties, as there is the concern that they may break down into non-degradable fragments[22]. Finally, there is a lack of consistent basin-wide data on the occurrence of ALDFG in the Mediterranean.

Second, even where these data are present, they are often inconsistent and hardly comparable, especially in relation to different size categories, sampling procedures, and reference values. More specifically, common protocols and standardised methods should be employed to obtain comparable results at the Mediterranean scale[23]. In parallel, further scientific efforts are needed to reach common and standardised sampling and analysis protocols to monitor micro-litter and impacts on biodiversity. Several techniques are currently used to monitor sea surface marine litter, using different units of measurement and reference lists (e.g. visual observations, drones, and satellite imagery). Moreover, no harmonised protocols are currently in place to monitor and assess the entanglement of marine

[17] Decision IG.21/7.
[18] Decision IG.22/10.
[19] Ioakeimidis et al., 2014; UNEP, 2017.
[20] UNEP, 2017.
[21] Galgani, 2011.
[22] CIESM, 2014.
[23] UNEP, 2017.

species in marine litter, while no protocols exist on the effects of litter colonisation by small marine species (e.g. bacteria, amphipods, and filter-feeding crustaceans). In fact, standardised and coherent monitoring of marine litter is needed to assess the effectiveness of the measures taken, as well as to set priorities for further marine protection actions in a cost-effective way[24].

Third, waste management practices in the Mediterranean should be improved[25] based on the principles of the EU waste hierarchy[26], in order to prevent the leakage of litter into the marine environment. More specifically, stronger administrative coordination, increased budget allocation, improved technical capacity, and firmer enforcement should be fostered to achieve this objective.

The challenge of marine litter in the Mediterranean in a nutshell:

- ⇨ Need for increased, long-term information on marine litter and its impacts on biodiversity and humans for the whole Mediterranean
- ⇨ Need for harmonised protocols to monitor and assess certain marine compartments, and the impacts on biodiversity
- ⇨ Need to improve waste management practices in keeping with the waste hierarchy to prevent the leakage of litter into the environment
- ⇨ Need to empower local managers (especially in MPAs) with the necessary tools and knowledge to tackle marine litter
- ⇨ Need for clearly defined baselines and targets to measure trends and progress
- ⇨ Need to ensure effective cross-border cooperation and coordination at the Mediterranean (especially non-EU) scale in the implementation of existing policies

In parallel, Mediterranean MPAs often lack effective means to deal with the problem of marine litter. This problem is exacerbated by the fact that the designation of an MPA is not always accompanied by the creation of an effective management structure. About 58% of Mediterranean MPAs do not have a management structure[27]; where such a management structure is in place, MPA managers suffer mainly from the lack of the necessary human resources, tools, and the knowledge to effectively address the problem of marine litter.

Finally, other important challenges to managing marine litter in the Mediterranean are the lack of clearly defined baselines and reduction targets against which to measure trends and progress, and the need to ensure effective cross-border cooperation and coordination among coastal countries (especially with non-EU countries) in the implementation of existing policies for marine litter.

1.4 The Biodiversity Protection Community: consolidating the findings of Interreg-MED projects on marine litter

The Biodiversity Protection Community has been established for the purpose of engaging nature conservation stakeholders in the Mediterranean, acting as a mainstreaming instrument to

[24] Cheshire et al., 2009; Sheavly, 2007; Galgani et al., 2013a; UNEP, 2015.
[25] UNEP, 2017.
[26] The Waste Framework Directive introduces a hierarchy in waste management, whereby prevention is the best option, followed by re-use, recycling and other forms of recovery, with disposal (e.g. landfill, incineration) as the last resort.
[27] Gabrié et al., 2012.

communicate and capitalise on the efforts of the Interreg MED projects, with a special focus on Marine Protected Areas (MPAs) as sentinels for monitoring environmental impacts in the Mediterranean Sea[28]. Several projects within the Biodiversity Protection Community devote efforts to address the current limitations in scientific knowledge and management practices on marine litter, and particularly to enhance the capacity of MPA managers and other stakeholders to address this pressure (see Infographic). The purpose of this report is to synthesise and showcase the contributions of these projects to the development and/or refinement of marine litter assessment and management tools, placing special emphasis on the tools that can be applied in Mediterranean MPAs. Moreover, current gaps in knowledge and management are identified, and recommendations are advanced for further action at both the EU and Mediterranean level.

Project	Aim	Main partners and Countries innove	Period
ACT4LITTER	Facilitate efforts for tackling marine litter in Mediterranean MPAs through the development of effective and targeted measures	Catalan Waste Agency – UN Environment SCP/RAC (ES)– Lead Partner. MIO-ECSDE (GR) MedPAN (FR) Sant' Anna School of Advanced Studies, Pisa (IT)	Feb2017 Oct2018
AMAre	Develop shared methodologies and geospatial tools to assess multiple stressors, coordinate environmental monitoring, and analyse multiple criteria and stakeholder engagement. Develop concrete pilot actions and coordinated strategies in selected Marine Protected Areas (MPAs) to solve hot spots of conflicts affecting marine biodiversity and the services it provides	National Inter-Universities Consortium for Marine Sciences – CoNISMa (IT) – Lead Partner Euro-Mediterranean Centre on Climate Change - CMCC (IT) French Research Institute for Exploitation of the Sea - IFREMER (FR) Hellenic Centre for Marine Research - HCMR (GR) Management Body of The National Marine Park of Alonissos Northern Sporades (GR) Management Consortium of Torre Guaceto (IT) National Research Council, Institute of Marine Science – CNR-ISMAR (IT) Regional Government of the Balearic Islands. Department of the Environment, Agriculture and Fisheries (ES) Spanish National Research Council (ES) University of Malta (MT)	Nov2016 Oct2019
MEDSEALITTER	Network representative MPAs, scientific organisations and environmental NGOs to develop, test and efficiently apply easy-to-implement and cost-effective protocols	Cinque Terre National Park and Marine Protected Area (IT) – Lead Partner Capo Carbonara MPA (IT) École Pratique des Hautes Études (EPHE) (FR) EcoOcéan Institut (FR) Egadi Islands MPA (IT)	Nov2016 Jul2019

[28] The projects engaged in the "Biodiversity Protection Community" are: ACT4LITTER (marine litter management in MPAs); AMAre (Maritime Spatial Planning and Protected Areas); CONFISH (network of fish stock recovery areas); ECOSUSTAIN (water quality monitoring solutions in protected wetlands); FishMPABlue2 (governance of artisanal fisheries in MPAs); MEDSEALITTER (marine litter impact on biodiversity); MPA-ADAPT (adaptation of MPAs to climate change); POSBEMED (strategy for joint management of Posidonia beaches and dunes); WETNET (wetland governance); PHAROS4MPAs (impacts of economic activities to biodiversity); and Plastic Busters MPAs (marine litter monitoring, impacts on biodiversity, and management in MPAs).

	to monitor and manage floating litter and litter impact on biodiversity	Hellenic Centre for Marine Research - HCMR (GR) ISPRA – Italian national Institute for Environmental Protection and Research (IT) Legambiente (IT) MEDASSET (GR) University of Barcelona (ES) University of Valencia (ES)	
PHAROS4MPAs	Produce recommendations on interactions between MPAs and 9 blue economy sectors related to energy, transport, tourism and fisheries	WWF France (FR) – Lead Partner Consiglio Nazionale delle Ricerche (IT) Institute of the Republic of Slovenia for Nature Conservation (SI) Priority Actions Programme Regional Activity Centre – PAP/RAC (HR) Regional Agency for the Administration of Protected Areas (AL) Regional Development Funds for the North Aegean Region (GR) University of Girona - Institute of Aquatic Ecology at the Faculty of Sciences (ES) WWF Mediterranean (IT)	Feb2018 Aug2019
PLASTIC BUSTERS MPAs	Contribute to maintaining biodiversity and preserving natural ecosystems in pelagic and coastal MPAs by consolidating Mediterranean efforts to curb marine litter	ISPRA – Italian National Institute for Environmental Protection and Research (IT) – Lead partner University of Siena (IT) Albanian Ministry of the Environment-Directorate of Biodiversity and Protected Areas (AL) Catalan Waste Agency - Regional Activity Centre for Sustainable Consumption and Production (ES) Corsican Agency for the Environment (FR) French Research Institute for Exploitation of the Sea – IFREMER (FR) Hellenic Centre for Marine Research - HCMR (GR) Hellenic Ministry of the Environment and Energy, Special Secretariat for Water (GR) Management Agency of Zakynthos National Marine Park (GR) Mediterranean Information Office for the Environment, Culture and Sustainable Development (MIO-ECSDE) (GR) Ministry of Environmental and Nature Protection of Croatia (HR) Regional Government of the Balearic Islands (ES) Spanish Oceanographic Institute (ES) Tuscan Archipelago National Park (IT) University of Split (HR)	Feb2018 Jan2022
BLUEISLANDS*	Properly identify, address and mitigate the effects of the seasonal variation of	Ministry of Agriculture, Rural Development and the Environment (CY) – Lead Partner ACR+ - Association of Cities and Regions for Sustainable Resource Management (BE)	Set2016 Aug2019

	waste generation on Mediterranean islands	Department of the Environment Ea éco-entreprises (FR) INSULEUR - Network of the Insular CCI of the European Union (GR) Municipality of Mallorca, Waste Management Unit (ES) Municipality of Mykonos (GR) Municipality of Rhodes (GR) National Inter-Universities Consortium for Marine Sciences – CoNISMa (IT) Primorje-Gorski Kotar County (SI) Region of Crete (GR) Region of Sardinia (IT) Taormina Etna Consortium (IT) Autonomous University of Barcelona (ES) Wasteserv Malta Ltd. (MT)	

** The project BLUEISLANDS belongs to the Interreg MED "Sustainable Tourism" Community of projects*

2. Our Action

This Section showcases the outcomes and achievements of all Biodiversity Protection Community projects on marine litter monitoring and assessment (Section 2.1) and marine litter management (Section 2.2).

2.1 Progress in marine litter monitoring and assessment

2.1.1 Increased knowledge of marine litter

Several projects focus part of their efforts on monitoring marine litter on beaches, floating litter, and in biota. Their results and achievements are briefly presented below.

2.1.1.1 Beach Litter

Monitoring marine litter stranded on the beach was performed in the context of two projects belonging to the Biodiversity Protection Community (ACT4LITTER and AMAre) and of one project belonging to the Sustainable Tourism Community (BLUEISLANDS). The results of their monitoring activity are summarised in Table 2. Among its scheduled activities, PLASTIC BUSTERS MPAs plans to monitor beach litter in some specific MPAs (to be selected).

Policy relevance!

The results of ACT4LITTER's Marine Litter Watch Month monitoring will feed into the Marine Litter Watch database, managed by the European Environment Agency (EEA), and into the EMODnet database, to support existing and future EU policies on marine litter.

Four editions of the "Marine Litter Watch Month" were organised in the context of ACT4LITTER in winter, spring, summer, and autumn 2018. The purpose of this initiative was not only to gather data on marine litter quantity, distribution, and composition, but also to engage managers in an exercise of participatory science, which would contribute to building skills needed for monitoring marine litter. The winter edition took place from mid-December 2017 to mid-January 2018; it engaged about 20 MPA management bodies, NGOs and other organisations in coastal and marine protected areas in Albania, France, Greece, Italy, Slovenia, Spain, and Turkey. Marine litter was measured and classified in a total of 28 sites in 22 beaches, using the methodology developed by the MSFD TG ML (Vlachogianni, 2019). Overall, the Marine Litter Watch Month proved to be an effective tool for gathering essential marine litter data, providing valuable baseline information on the amounts and the full spectrum of marine litter deposited on the beaches of protected areas in the Mediterranean. Moreover, it served as a useful blueprint for setting up participatory-science campaigns.

ACT4LITTER MLW Ebro Delta by Mariano Cebolla ARXIU PNDE

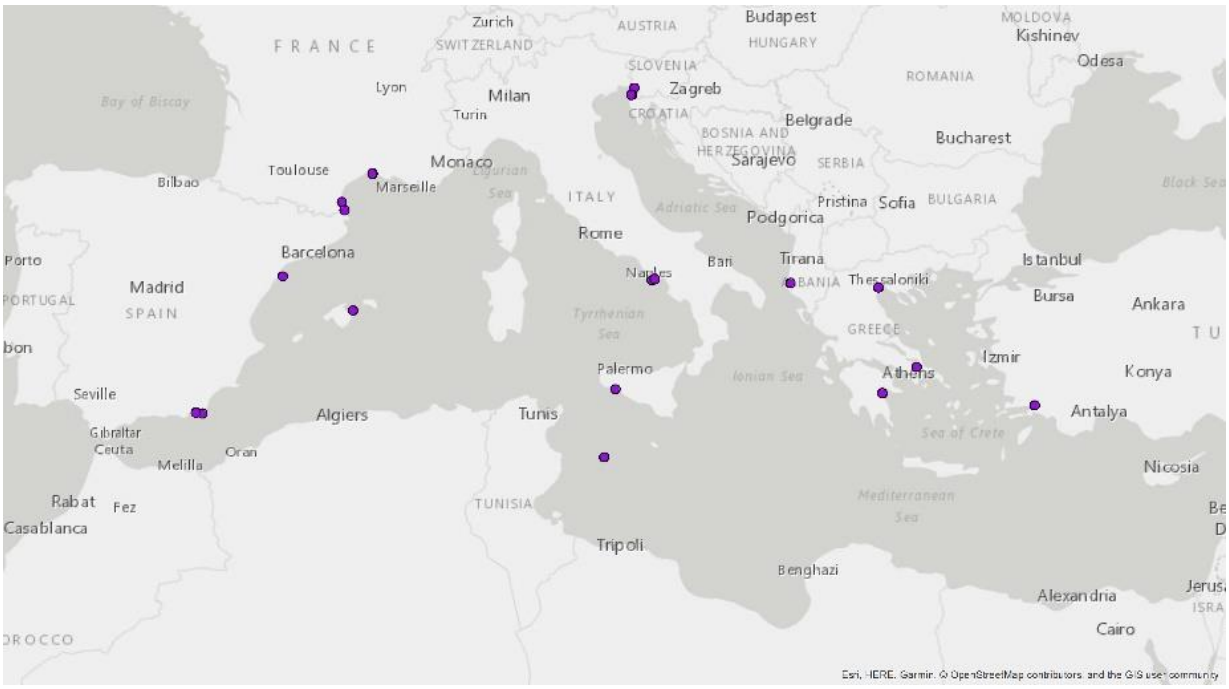
The BLUEISLANDS Project assessed the seasonal variation of marine litter as an effect of tourism through 147 surveys on 24 beaches in 8 Mediterranean islands (Crete, Cyprus, Mallorca, Malta, Mykonos, Rab, Rhodes, and Sicily), during both the low and high seasons. The time elapsed between the survey and the last cleaning activity performed on the beach was taken into account to evaluate the accumulation rate of marine litter (see the Accumulation Index in Section 2.1.3). Overall, the beaches monitored were considered to be moderately clean throughout the year, with a higher accumulation rate during the tourist season.

Although the aim of the AMAre project is to find and develop new tools for monitoring marine litter, the project has collected useful data on marine litter in three beaches along the coast of the North-

East Marine Protected Area of the Maltese Islands[29] during the tool testing activities. A total of 473 images were captured at the two survey sites. Results show that the total number of litter items recorded in the two sites were 30 items and 578 items, respectively.

This high difference can be explained not only by natural factors (like the dynamics of coastal currents and coastal topography), but also by factors related to human activities, like accessibility from land, berthing, and the presence of nearby aquaculture activities.

Figure 1 Map of the sites assessed by the "Marine Litter Watch Month" (ACT4LITTER)



* The names of the sites are the following (from west to east): Cabo de Gata-Níjar Natural Park, Ebro Delta Nature Park, and MPA Levante de Mallorca-Cala Ratjada (SPAIN); Gulf of Lion MPA, Côte Languedocienne Natura 2000, and Espiguette Natura 2000 (FRANCE); Pelagie Islands MPA, Capo San Marco Nature Reserve, Punta Campanella MPA, and Miramare MPA (ITALY); Strunjan Landscape Park (SLOVENIA); Karaburun-Sazan MPA (ALBANIA); Parnon and Moustos wetland, Thermaikos Gulf Protected Areas, and Marathon and Schinias National Park (GREECE); and Gökova Special Environmental Protection Area (TURKEY).

Table 2 Summary of the results of the beach monitoring performed by two Biodiversity Community projects (ACT4LITTER, and AMAre) and by the BLUEISLANDS project.

	ACT4LITTER Marine Litter Watch Month	AMAre Beach monitoring	BLUEISLANDS Beach assessment
Location	Winter edition 2018: 22 beaches and 28 transects in MPAs in Albania, France, Greece, Italy, Slovenia, Spain, and Turkey	3 beaches in 2 sites inside the North-East Marine Protected Area, Malta	24 beaches in 8 islands in Croatia, Cyprus, Greece, Italy, Malta, and Spain
Period	Winter, spring, summer, and autumn 2018	Summer 2017	During both low and high season (2017)

[29] Deidun et al., 2018.

Methodology used	MSFD TG ML	Drones	MSFD TG ML
Litter quantity	Winter edition results: 17,344 items collected Average density: 0.61 items/m^2, 1048 items/100 m	30 items at Qawra Point (regular clean-up); 578 items at Baħar iċ-Ċagħaq (tourist beach)	Higher in the low season (1398 items/survey) than in the high season (1075 items/survey); Higher accumulation rates in high seasons (+117% in average in the low season), especially in beaches used by locals (+135%) and tourists (+162%)
Main types of litter	82% artificial polymer materials: small plastic and polystyrene pieces (21.9%), plastic caps and unidentified lids (5%), mussel nets (5%). On aggregate, single-use plastics accounted for about one fifth (21%) of all the items recorded	Plastic fragments smaller than 25 cm at Qawra Point; Wood at Baħar iċ-Ċagħaq	88.2% artificial polymer materials; 19.4% tourism-related items (cigarette butts, caps/lids, cutlery/trays/straws, and crisp/sweet packets and lolly sticks) All samples analysed were contaminated with microplastics, with fragments and fibres representing more than 95% of the particles on average.
Main sources of litter	27% Shoreline sources, including tourism and recreational activities and poor waste management practices; 10% fisheries and aquaculture	Tourism activities	Tourism activities

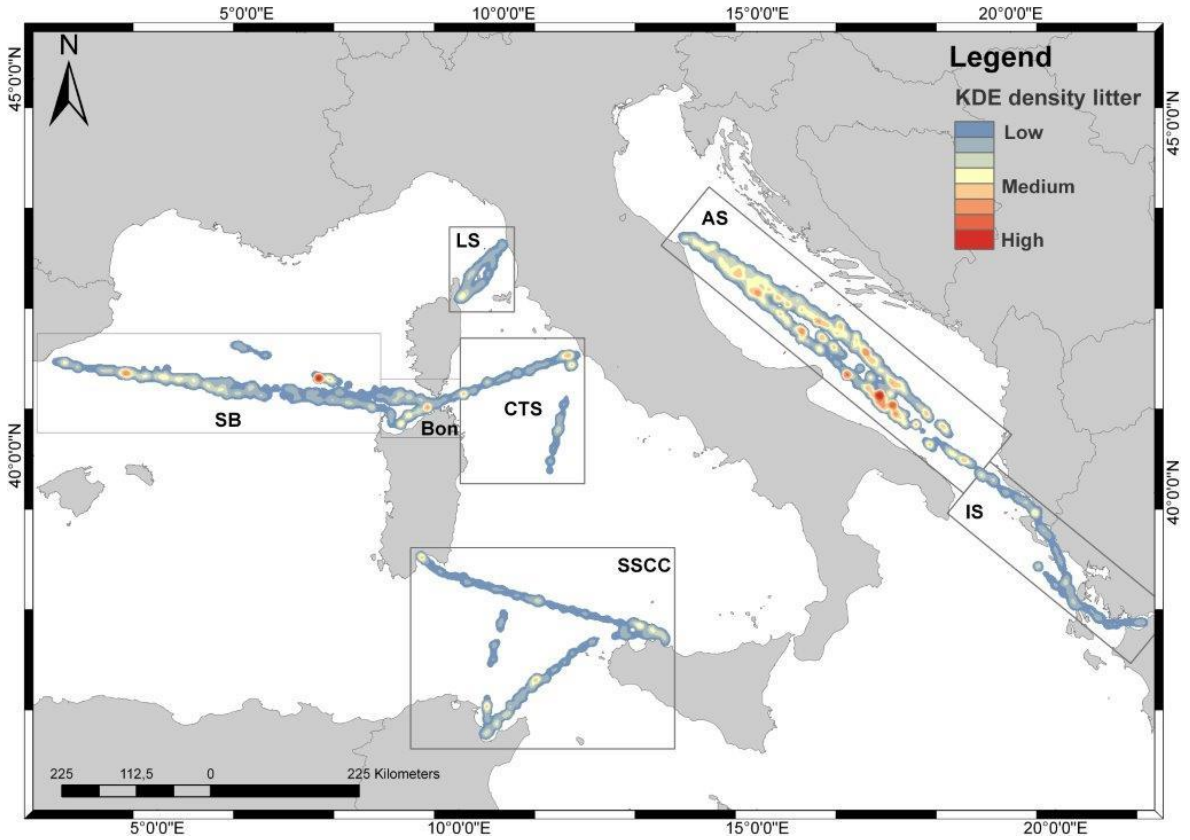
2.1.1.2 Floating Litter

Two major studies have been conducted in the context of MEDSEALITTER to assess floating macro litter in the Mediterranean; they have recently been published in peer-reviewed scientific journals. The first study[30] performed a 3-year continuous survey in the period 2013–2016 along the Barcelona–Civitavecchia transect (Western Mediterranean Sea), with the aim of characterising floating macro-litter composition, sources, and production industries, as well as describing seasonal patterns and major overlaps between accumulations of plastic and cetacean presence, which can be considered an early indication of potential risk exposure. The second study[31] aimed to investigate seasonal trends,

[30] Campana et al., 2018.
[31] Arcangeli et al., 2018.

qualitative composition, and spatial distribution of floating macro litter along five maritime routes connecting Italy to France, Spain, Greece, and Tunisia (see Figure 1).

Figure 2 Map of the transects monitored for floating marine litter in the context of the MEDSEALITTER project.



Source: Arcangeli et al., 2018.

Both studies found an average of 2-5 marine litter items per km^2. More than 80% of marine litter is composed of artificial polymer materials, i.e. plastic bags, wrappings, bottles, tableware, and ***polystyrene boxes used by fishermen. Significant marine litter hotpots have been identified in areas*** near to land, like next to the Tiber river mouth, in the Bonifacio Strait, and close to the port of Tunis. Both studies found a general increase in floating marine litter during spring and summer.

Finally, the presence of microplastics in surface waters was also assessed in the context of the BLUEISLANDS project. Samples were collected in the period July-October 2018 at a total of six beaches along the coasts of Sicily and Cyprus. Results are pending, as the processing of the samples has not started yet at the moment of writing. Similarly, PLASTIC BUSTERS MPAs plan to monitor floating litter in specific MPAs and in the Pelagos Sanctuary.

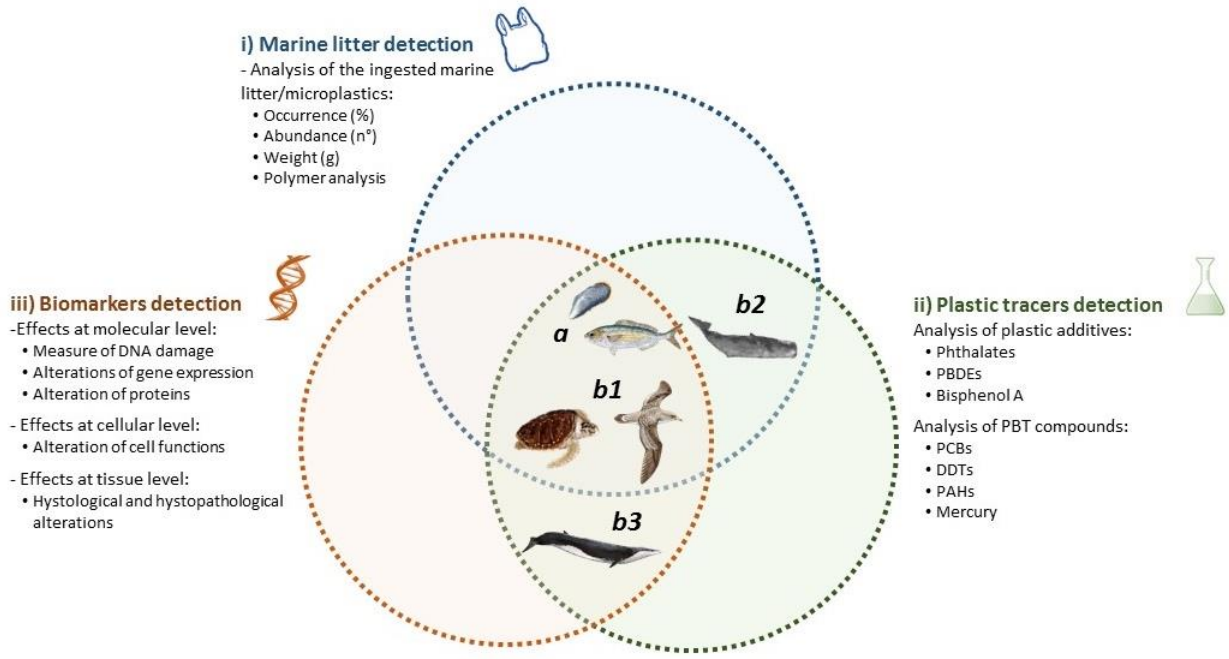
In addition to scientific studies, the MEDSEALITTER project conducted a campaign called "Three families on the sailing boat to talk about marine litter", as an example of engaging citizens in participatory science for marine litter monitoring. Six families sailed across the Tyrrhenian Sea in summer 2018 with the schooner "Mahayana", on board which single-use plastics was banned, to visually monitor floating macro- and micro-litter with the use of a manta trawl. The marine litter, collected through the use of fish landing nets, was later disposed in recycling bins at the port of arrival.

These cruises were used also to test the monitoring protocol for marine macro-litter, developed in an earlier phase of the project.

2.1.1.3 Impacts of Marine Litter on Biota

Marine turtles are one of the species that is most impacted by marine litter, mainly because they confuse debris with food, with possible negative effects on health like dietary dilution and assimilation of contaminants. In some cases, marine litter may block or tear their digestive tracts, resulting in the death of the turtles[32]. For this reason, the MEDSEALITTER project[33] investigated the consumption of marine litter by loggerhead sea turtles (*Caretta caretta*) in the Western Mediterranean, applying the methodology developed for the MSFD. A total of 4423 debris items were found in 121 of the 155 turtles analysed. 'Sheet-like' plastics and 'fragments' of hard plastic, together with 'threadlike' plastic and 'foamed' plastic were the most common items, found in about 69% of the turtles, followed by natural non-food remains (60%) and rubbish. By comparing the results of this study with the period 1995-2005, the authors note a slight decrease in the amount of plastics ingested by loggerhead sea turtles in this region. A possible explanation of this result may derive from the policies related to plastic usage recently applied in the EU.

Figure 3 The methodology for detecting marine litter impacts on biota adopted by the PLASTIC BUSTERS MPAs project



Source: Fossi et al., 2017.

In parallel, the MEDSEALITTER project also analysed the ingestion of plastics by fish. A total of 102 individuals of bogue (*Boops boops*) were sampled in three areas off the Mediterranean coast of Spain (an industrialised area near Barcelona; the Cap de Creus MPA; and an intermediate-polluted area near Blanes). Ingested microplastics were found in 46% of the 102 bogues analysed. The abundance of microplastics ranged from 1.5 to 2.3 items per individual. Polypropylene was the most common polymer type, followed by tetra pack and polystyrene. As expected, Barcelona was the most polluted

[32] For further information, see Bjorndal et al., 1994; Tomas et al., 2002; Lazar and Gracan, 2011; Velez-Rubio et al., 2018.
[33] See the study published by Domenech et al. (2019).

area, with an occurrence of ingested microplastics of 64%, while the frequency in the Cap de Creus MPA and in the Blanes area was around 35%.

PLASTIC BUSTERS MPAs aims to further advance our knowledge of the impacts of marine litter on biota, by investigating litter ingestion (both at different trophic levels and in organisms living in different habitats), entanglement, and the use of litter as a transport vector and habitat. Regarding marine litter ingestion, this project will investigate traces of plastic-related chemicals and their effects on biomarker responses at different biological organisation levels, and develop bioindicators of impact on two main categories of biota: commercially harvested species, and endangered species (stranded, hospitalised and free-ranging organisms) such as sea turtles, sea birds and marine mammals. The methodology proposed is illustrated in Figure 2. Some species have been proposed for coastal and pelagic waters, like the loggerhead sea turtle (*Caretta caretta*) and the sperm whale (*Physeter macrocephalus*); the choice and application of the protocol will capitalise on the experience of MEDSEALITTER, as well as on the work of the INDICIT project and of the MSFD TG ML. Very few studies have investigated the effects of ingestion of marine litter on animal health; PLASTIC BUSTERS MPAs will take a step forward in this direction.

These harmonised methodologies, as well as the methodologies developed for the simultaneous investigation of macro-litter and micro-litter in the water column, are planned to be tested in selected sites. The results will feed into a comprehensive diagnostic analysis of the impacts of marine litter on biodiversity and endangered species in Mediterranean MPAs. The first test of a comprehensive monitoring strategy to evaluate the impact of marine litter on endangered fauna was performed in the summer of 2018 in the Pelagos Sanctuary, by researchers from the University of Siena. Specifically, this study surveyed dolphins and whales as sentinels of the impact of macro-litter and micro-litter.

2.1.1.4 Overlaps between Marine Litter and Biodiversity

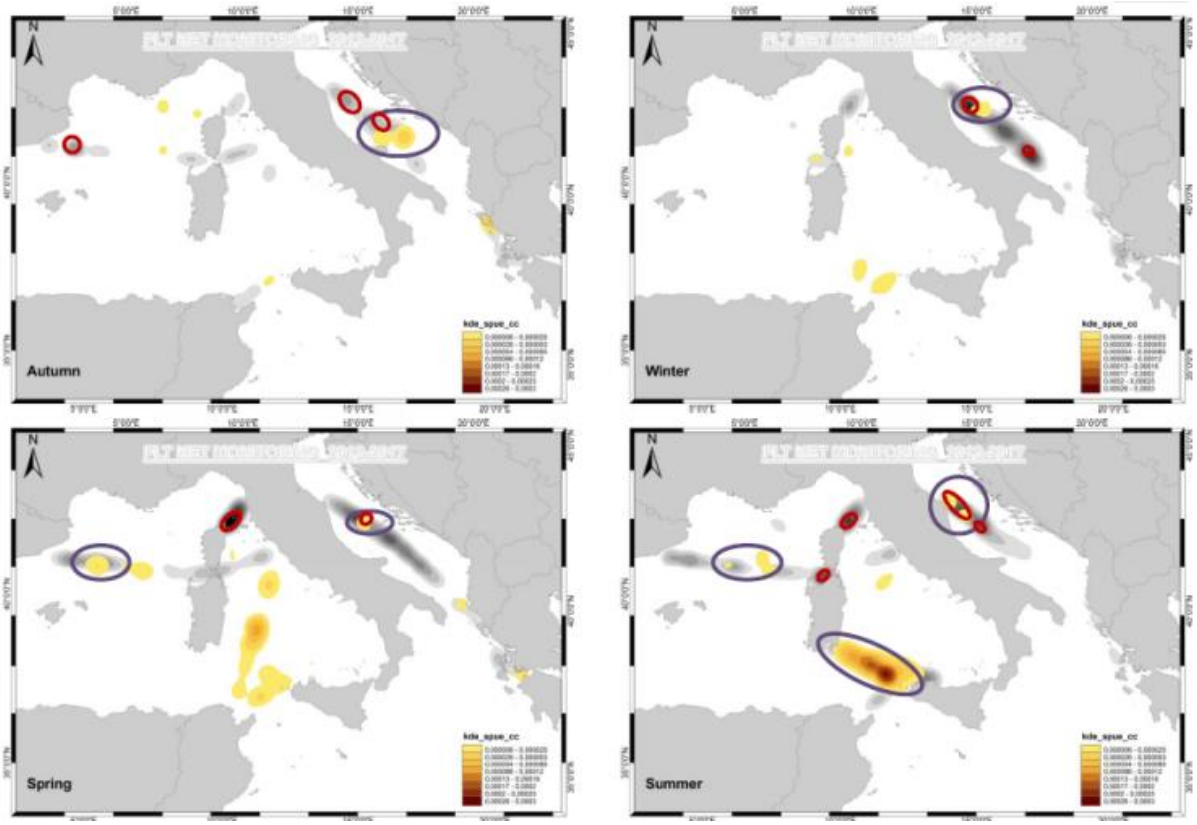
Areas of overlap between marine litter and biodiversity were identified as part of MEDSEALITTER. In this regard, two studies were conducted. In the first[34], focusing on the middle latitudes of the Western Mediterranean Basin, it was found that the overlaps of marine litter with cetaceans are generally high, especially in spring and summer, in the Balearic Islands, the Bonifacio Strait, and the Sardinian Sea, while the lowest overlaps are in autumn and winter in the Balearic Islands and the Bonifacio Strait.

The second study focused on overlaps between floating marine litter and the distribution of loggerhead sea turtles (*Caretta caretta*) along the transects already used to monitor floating marine litter [35] (see Section 2.1.1.2). The results, illustrated in Figure 3, show that the areas with the highest risk to sea turtles from the presence of marine litter are the Sardinian-Sicily Channel (especially during summer) and the Adriatic Sea (during all seasons). This threat is particularly important in the southern Adriatic Sea, which is supposed to be a developmental habitat, and possibly a nursery area for juvenile turtles, even green sea turtles (*Chelonia mydas*). The Sardinian-Balearic Sea is another critical area that requires attention, due to the overlap between litter concentration and the presence of loggerhead turtles, especially during spring and summer.

Marine litter in Mediterranean MPAs will also be modelled in the context of PLASTIC BUSTERS MPAs, with a special focus on investigating the effects of marine litter on biodiversity. Different models for marine litter accumulation will be identified and validated in the testing phase, also in relation to the overlap with species distribution maps. In the next phase the layers will be integrated in a preliminary risk analysis for selected species.

[34] See Campana et al. (2018).
[35] See Arcangeli et al. (2018).

Figure 4 Seasonal spatial overlaps between floating marine litter and loggerhead sea turtle (Caretta caretta) distribution (MEDSEALITTER).



2.1.2 Refining common assessment methodologies

Policy relevance!

The MEDSEALITTER fine tuning and enhancement of existing protocols for monitoring floating and ingested marine litter has been included by the TG ML in the review of the Guidance on Monitoring of Marine Litter in European Seas in 2019.

A protocol for monitoring floating macro litter and litter ingested by biota for both local and wide areas was drafted in the first phase of the MEDSEALITTER project, fine tuning previously developed protocols. The enhanced protocol was tested during summer 2018; the final protocol has been delivered in March 2019. The draft protocol proposes slight modifications to the basic data collection sheet adopted by the TG ML. Recommendations are also advanced on the use of ferries and sailing boats, and on the use of automatic photography from UAVs and manned aircrafts. In relation to the ingestion of marine litter, the modifications to the existing protocols suggested by MEDSEALITTER focus on three groups of species: loggerhead sea turtles (*Caretta caretta*), fish, and polychaeta. As for turtles, the protocol addresses only the necropsy of dead loggerhead sea turtles, slightly modifying the protocol proposed by the TG ML, considering basic and optional parameters proposed to stakeholders according to their logistic and time constraints, and in coordination with another EU-funded project, INDICIT.

The MEDSEALITTER protocols were tested during summer 2018 in representative pilot areas on both local and wide scales to determine the best conditions for monitoring floating macro-litter using different platforms and techniques (visual-automatic detections, aerial surveys, and boat-based

surveys). The results also add information on floating litter amount, composition, and distribution in the different sites sampled in the western Mediterranean Sea.

Table 3 Main limitations, benefits and opportunities to reduce the costs of existing monitoring techniques for floating and ingested marine litter.

Type of litter / impact	Method/Protocol	Limitations	Benefits and opportunities to reduce costs
Floating marine litter (macro)	**Dedicated visual (opportunistic platform, ferries)**	Observations affected by weather/sea conditions; the minimum detectable size of litter is 20 cm	Costs reduced thanks to the agreement with ferry companies to integrate activities into ongoing vessel operations and/or other monitoring programmes (e.g. marine mammals); wide spatial coverage along fixed transects; possibility to have extensive temporal coverage year-round
	Dedicated visual (dedicated platform, sailing/motor boats)	Can be expensive depending on the platform used; affected by weather and sea conditions.	Higher detail of the observations generated; monitoring can be adapted to sampling necessities (specific areas/seasons). Can be coupled to marine fauna monitoring to reduce costs
	Aerial (Visual)	Expensive, unless coupled with existing aerial surveys; sensitive to weather and can detect only large floating items (<30 cm); reduced possibility to discriminate among item categories	Very large coverage area - Coupled aerial surveys e.g. for monitoring cetaceans can reduce costs
	Aerial (Photo)	Expensive, sensitive to weather and sea conditions. Unless automated, the analysis process can be expensive and time consuming	Very large coverage area and high detail of observation generated. Images available for future analyses. Automation of analyses can reduce the overall cost and time dedicated to analyses
	Drone (Photo)	Sensitive to weather and sea conditions. Unless automated, the analysis process can be expensive and time consuming	Very high detail of observation. Depending on the technology used, can be easily adapted to routine low-cost monitoring of small coastal areas. Automation of analyses could further reduce costs
Ingestion	**Ingestion - macro (turtles)**	Depends on the availability of animals	Potential to collaborate with rescue centres to collect dead turtles. Wide coverage across the Mediterranean thanks to the wide distribution of *Caretta caretta*
	Ingestion - micro (turtles & fish)	Depends on the geographic coverage of species and the availability of animals.	Potential to collaborate with rescue centres to collect dead turtles; fish monitoring programmes and/or the fish market to collect fish. Species are

		Costs and expertise needed for micro-litter analyses are still high	selected to guarantee wide coverage across the Mediterranean
	Ingestion - invertebrates (micro)	Depends on the geographic coverage of species and the availability of animals. Costs and expertise needed for micro-litter analyses are still high	The indicator species is still to be determined; relatively easy sampling. Depending on the distribution of the species, it could provide information on large areas

The final protocols are complemented by an estimation of the required costs and level of expertise, as well as the main benefits and limitations, of different monitoring techniques included in the proposed protocols. The results of this estimation are summarised in Table 3.

Based on the outcomes of MEDSEALITTER and on other recent scientific and policy advances made in the field, PLASTIC BUSTERS MPAs will elaborate a harmonised approach to monitor macro- and micro-litter, as well as their impact on biota, in Mediterranean pelagic and coastal MPAs, including the identification of hotspot areas and their overlaps with endangered species. This harmonised approach will be tested in 2019 in specific areas.

2.1.3 New tools to support marine litter assessment

2.1.3.1 The use of UAVs and manned aircrafts

Policy relevance!

The AMAre project showed that the use of drones may be a valid cost-effective tool for marine litter monitoring, especially for hotspots and for local management purposes.

The use of UAVs like aerial drones has been investigated in the context of the AMAre project because of its promising high cost-effectiveness and rapidity. The objective of this work[36] (see Figure 4) was to formulate an optimised protocol to detect and monitor marine litter through the use of an off-the shelf aerial drone, by applying machine learning techniques to the analysis of the images captured, including the provision of recommendations on the integration of these protocols within the monitoring indicators currently being formulated for the second six-year MSFD cycle (the results of beach litter monitoring are presented in Section 2.1.1).

This study demonstrated that the use of drones is a ready-to-use, off-the-shelf methodology, which allows covering a relatively large sampling area in a short period of time and with lower costs, and may be particularly suited to MPA managers. The main limitations on the use of drones relate to their limited use in case of adverse weather conditions; the difficulty in discriminating between the sources of plastic litter (either coming from activities on land or washed ashore by the sea originated from sea-based sources); and data protection issues. For these reasons, drones can be seen as a useful additional tool for beach marine litter assessment, but cannot replace commonly used beach monitoring protocols. These limitations notwithstanding, the work of the AMAre project showed how the use of drones is particularly effective, and has the potential to be mainstreamed into the national monitoring programmes required by the MSFD, especially for hotspot mapping and assessment, and for local management purposes.

[36] See of Deidun et al. (2018).

Figure 5 The drone transects implemented to monitor beach marine litter in Malta, at Qawra Point (left) and at Baħar iċ-Ċagħaq (right), as part of the AMAre project.

The MEDSEALITTER project reviewed existing methods and provided guidelines for monitoring macro-litter through the use of UAVs and manned aircrafts. This draft protocol on field techniques and image processing is based on the preliminary operational experiments conducted by the University of Barcelona and the Spanish National Research Council (CSIC). Recommendations have been drawn from the results of the field experiments and the analyses of photographs taken, focusing on aspects such as the sampling scale and platform, the sampling design, the environmental conditions, and the type and size of marine litter.

Finally, in conjunction with these activities, the use of wavegliders to monitor marine litter has been explored in the context of the AMAre project. An experiment was conducted in July 2018 that collected more than 40,000 images that are currently under analysis.

2.1.3.2 Geo-spatial tools

Two main tools are currently being developed, which aim to improve marine litter data access, harmonisation, and sharing: the AMAre WebGIS and the Mediterranean Biodiversity Protection Platform.

The AMAre WebGIS is a web-based portal, designed to interactively display the spatial data collected during the project and organised in a common spatial infrastructure (see screenshot in Figure 5). This portal harmonises relatively large and multi-dimensional datasets. Its spatial coverage includes five MPAs, from west to east: Freus d'Elvissa i Formentera (Spain); the North-East MPA (Malta); Porto Cesareo MPA (Italy); Torre Guaceto MPA (Italy); and the Sporades Islands MPA (Greece). It combines intelligent web maps with graphs, charts, tables, and text to unlock, make accessible and re-usable the data relevant for the management of the MPAs in a coordinated manner. The AMAre metadata are available online through the dedicated metadata catalogue. A necessary activity, envisaged in the context of AMAre, is the training of personnel to use the geospatial and other tools, targeted especially at MPA managers.

MEDSEALITTER UAV by Agustín Lobo

Devised as an entry point to scientific evidence and supporting best practices on protected area management and environmental policy-making in the region, the Mediterranean Biodiversity Protection Platform is the main communication and capitalisation tool developed by the PANACeA project. The objective of the platform is to give visibility to effective methodologies, key project results, and actions involving biodiversity protection. By combining scientific evidence, practice, and policy, this platform will provide a gateway to all results derived from the Interreg Med Programme and a knowledge reference to support regional environmental policy decisions and actions on biodiversity protection, natural resource management, and sustainable growth in Mediterranean protected areas and beyond.

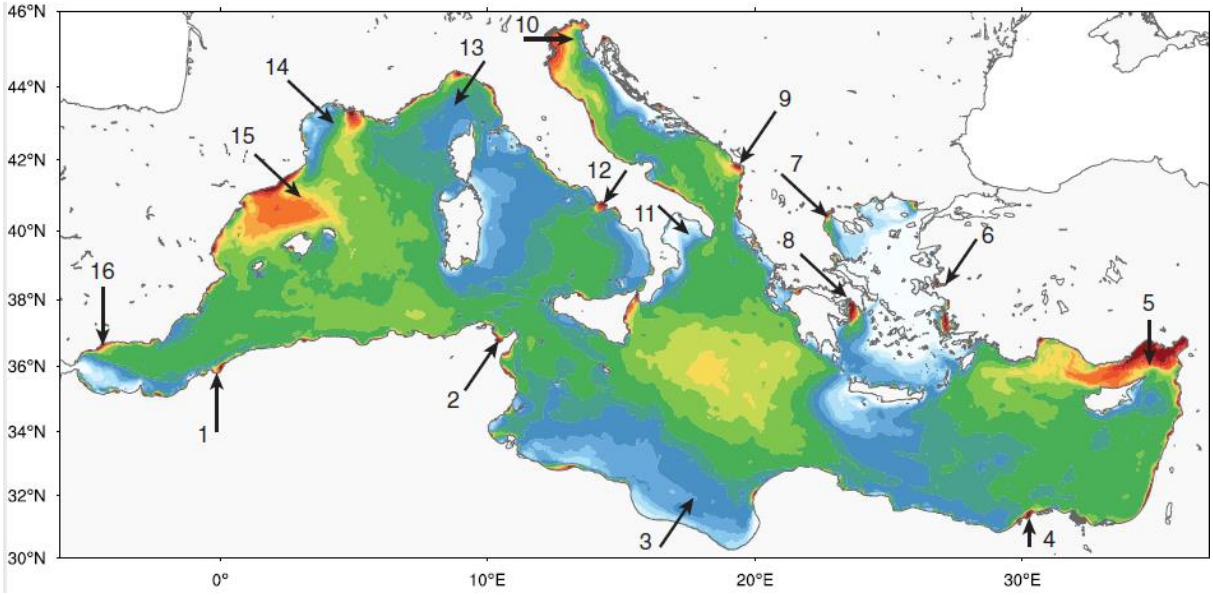
Figure 6 A screenshot of the AMAre WebGIS.

2.1.3.3 Modelling Marine Litter in the Mediterranean

Modelling how floating debris drifts across the Mediterranean was one of the focuses of the AMAre project, which published in 2018 a scientific paper[37]. In this paper, the emissions of plastics in the surface, coastlines, and on the sea bottom of the Mediterranean were quantified, using surface ocean and wave-induced current data. It also attempted to compute the relative contributions of plastics from different origins. The results show that a significant quantity of particles (~1.8×10^{10}) was released from the largest coastal Mediterranean cities, rivers, and the most congested shipping lanes over the period 2013-2017 (see Figure 6). Moreover, a sort of "boomerang effect" seems to be in place in the Mediterranean, whereby the plastic pollution of almost every country is mainly caused by its own terrestrial plastic sources. Finally, they conclude that, in respect to floating plastics, the Mediterranean basin is a dissipative system, which means that any long-term accumulation of plastics on the sea surface would be unlikely (in contrast to the global ocean). Instead, there is a substantial accumulation of plastics on the coastlines and sea bottom, with the former sink greatly dominating the latter one.

The numbers in the figure correspond to the following geographical names: the (1) Gulf of Arzew, (2) Gulf of Tunis, (3) Gulf of Sidra, (4) Abu Qir Bay, (5) Cilician Sea, (6) Izmir, the (7) Thermaic Gulf, (8) Saronic Gulf, (9) Buna-Bojana, (10) NW Adriatic, (11) Taranto Gulf, (12) Gulf of Naples, (13) Gulf of Genoa, (14) Gulf of Lion, (15) Catalan Sea, and (16) Malaga Bay.

Figure 7 Map of average plastic debris concentrations (g/km²) on the sea surface for the period 2013-2017.



[37] See Liubartseva et al. (2018).

2.1.3.4 New Indicators and indices

Policy relevance!

The AMAre protocol for the indicator D10C4 will be part of the EU-JRC Guidance that will be updated in 2019.

In the context of the BLUEISLANDS project, a marine litter Accumulation Index (AI) was developed to measure the rate of accumulation of marine litter on beaches after the last cleaning activity by local authorities. The AI values were assigned a quality class depending on the accumulation rate, from 'extremely low' (AI lower than 1) to extremely high (AI higher than 6). Results show that the accumulation of marine litter is generally higher during the high season, with an average AI of 4.87 (qualified as 'high'), while during the low season an average AI of 4.15 was calculated.

Other indicators are being developed in the context of both AMAre and PLASTIC BUSTERS MPAs for marine fauna entanglement. The AMAre project[38] investigated the possibility of using "animal forests", that is, areas dominated by sessile suspension feeders (i.e., animals that are anchored on rocks, algae, or other animals, and that feed on material suspended in the water, like coralligenous reefs, deep-sea corals, and sponge aggregations) as indicators to monitor the spatial and temporal entanglement trends for marine litter, especially fishing gear. In fact, animal forests are particularly vulnerable to damage from marine litter because of their slow growth rate. Moreover, they are highly exposed to marine litter and trophic features. In addition, there is a low risk of misinterpretation in relation to possible interactions with active fishing gear, as these organisms will not actively move towards active fishing gear, nor will they be attracted by any prey already captured. Along this line of action, PLASTIC BUSTERS MPAs will apply the protocol used by AMAre to build a database on animal forests, with particular focus on coastal areas.

Key achievement of the Biodiversity Protection Community on marine litter monitoring and assessment in a nutshell

Marine litter monitoring findings:

- ⇨ Plastic constitutes more than 80% of marine litter in all compartments, especially packaging, bags, wrappers, and fisheries-related objects (ALL PROJECTS)
- ⇨ Marine litter in beaches accumulates more rapidly during the warmer seasons (spring and summer) (BLUEISLANDS).
- ⇨ There is a higher presence of floating litter during the warmer seasons, especially in the Ligurian Sea, Sardinian-Balearic basin, and Central Tyrrhenian Sea (MEDSEALITTER).
- ⇨ Marine litter in the Mediterranean comes mainly from the largest coastal cities, rivers, and the most congested shipping lanes. Modelling how floating marine litter drifts in the entire Mediterranean indicates that the most contaminated areas are the Cilician sub-basin, the Catalan Sea, the Po River Delta area, and the Venice Lagoon (AMAre).
- ⇨ Boomerang Effect: modelling how floating marine litter drifts shows that the plastic pollution of almost every country is mainly caused by its own terrestrial sources (AMAre).
- ⇨ Marine litter was found in the stomach of 78% of the marine turtles and of 46% of the fish sampled (MEDSEALITTER).
- ⇨ There is a high spatial overlap between the presence of marine litter and marine species (cetaceans and sea turtles), especially in spring and summer, and in the Sardinian-Sicily Channel and in the Adriatic Sea (MEDSEALITTER).

[38] See Deidun et al., 2018.

Refining common protocols

⇨ MEDSEALITTER proposed enhancing the existing protocols for monitoring floating and ingested marine litter, to be included into the upcoming review of EU-JRC Guidance for monitoring marine litter in 2019.

New tools for marine litter monitoring

⇨ The use of drones and other UAVs showed to be a promising and cost-effective tool for monitoring marine litter, especially for hotspots and for local management purposes (MEDSEALITTER and AMAre).

⇨ The geo-spatial tool being developed by AMAre is a useful means for MPA managers to visualise and analyse the results of marine litter monitoring. In addition, the Biodiversity Protection Platform can be easily used to display existing knowledge and ensure access and sharing of data and information at the Mediterranean scale.

⇨ Modelling tools have proved to be useful to understanding the fate of marine litter throughout the whole Mediterranean (AMAre).

⇨ The new indicator developed (the Marine Litter Beach Accumulation Index), and the research into using animal forests as indicators of entanglement can contribute towards establishing clearer baselines and reduction targets in the context of both the EU MSFD and the UNEP/MAP IMAP (AMAre, BLUEISLANDS, and Plastic Busters MPAs).

2.2 Managing marine litter in coastal and marine ecosystems in protected areas

2.2.1 Tools and measures for MPA managers

2.2.1.1 The ACT4LITTER list of marine litter measures implemented

As highlighted in Section 1.3, Mediterranean MPA managers are in need of knowledge and tools to tackle the issue of marine litter within their MPAs. In this respect, the ACT4LITTER project gathered, reviewed, and shortlisted a set of effective measures that can be implemented by MPA managers to tackle the problem of marine litter.

A total of 105 showcases of measures implemented were identified in the literature and classified into five broad categories: regulatory policy instruments; voluntary agreements; economic/market-based instruments; awareness raising and environmental education; and, practices and activities. These showcases of measures were further grouped into 25 classes of measures; moreover, they were fully mapped to provide valuable information on their implementation on the ground. In this respect, the main characteristics of each measure were mapped, like the type of litter involved, the scale of implementation, and the potential role of MPA managers in their implementation (either as implementer, facilitator, or promoter). The mapped measures were fed into the ACT4LITTER decision-making tool (see 2.1.1.2) to help MPA managers identify the most effective measures for their specific context.

2.2.1.2 The ACT4LITTER Decision-Making Tool

The ACT4LITTER comprehensive list of measures implemented was the basis for developing a Decision-Making Tool (DMT), an innovative system designed to address the needs and specificities of Mediterranean MPAs. The objective of the DMT is to help the MPA managers identify the most effective and feasible measures to tackle marine litter in their specific context. The development of the decision-making tool was based on the assessment of marine litter measures, taking into consideration environmental and socio-economic aspects, and integrating the ecosystem services

perspective. It was developed via a participatory approach, involving MPA managers and marine litter practitioners. The DMT was piloted in nine Mediterranean MPAs, and facilitated the shortlisting of the measures that fed into the elaboration process for marine litter action plans (see Section 2.2.1.3).

The basic idea of the DMT is to automate the choice of a best practice to tackle marine litter, suggesting the measures that are usually selected in similar contexts. An algorithm has been developed to match the MPA-specific context and characteristics with the marine litter measures collected, and to generate a set of priority measures.

The DMT was developed in five steps:

1. Collection of information on measures implemented to prevent and mitigate the marine litter problem;
2. Evaluation of the effectiveness of the measures collected in yielding environmental and socio-economic results;
3. Building of a data warehouse, with information on the measures (classified in categories) and the key indicators;
4. Development of an algorithm to automate the shortlisting of relevant measures; and
5. Design of an online, user-friendly interface.

When accessing the DMT, the user is asked seven questions that provide input information related to aspects such as the prevalent marine compartments where marine litter is found, the main types of litter, their sources, as well as information on the actors that may be involved, and the role the respondent would like to have (either implementer, facilitator, or promoter). Based on the multiple-choice answers submitted, the DMT tool retrieves a list of relevant measures, including their description, the necessary costs and organisational efforts, as well as their major benefits and limitations, and the types of actors to involve.

2.2.1.3 The ACT4LITTER MPA-Specific Action Plans

A central output of the ACT4LITTER project was the development of nine Action Plans to curb marine litter in the following MPAs: Kornati (Croatia); Miramare (Italy); Thermaikos Gulf Protected Areas Management Authority (Greece); Torre Guaceto (Italy); Strunjan (Slovenia); Torre del Cerrano (Italy); Ebro Delta (Spain); Cabo de Gata (Spain); and Llevant de Mallorca-Cala Ratjada (Spain). These Action Plans were developed step-by-step; by engaging all relevant stakeholders, these pilot MPAs sought to identify effective priority measures against marine litter, which would reflect their specific context and characteristics. At the heart of the process of preparing the Action Plans lies the Decision-Making Tool, which facilitated the shortlisting of priority measures.

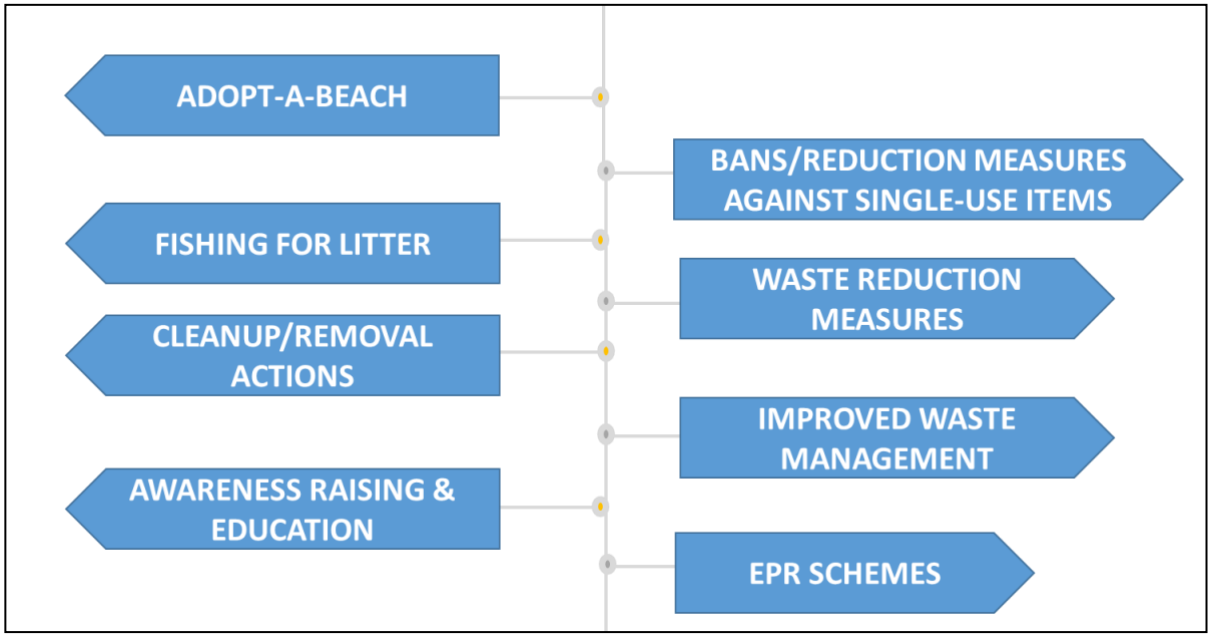
The collective experience of the pilot MPAs set the baseline for a common, urgent response by Mediterranean MPAs to deal with marine litter. This response, along with its strategic elements, was captured in a joint plan, whose aim is to help other MPA managers in the Mediterranean to achieve their conservation goals. In an effort to obtain a wider consensus on which actions should be included within a set of no-regret measures, ACT4LITTER ran a survey to gather feedback from 110 MPA managers from 17 Mediterranean countries, namely Albania, Algeria, Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Libya, Monaco, Slovenia, Spain, Tunisia and Turkey (see Section 2.2.2).

2.2.2 Beyond Single MPAs: Towards an Integrated Management of Marine Litter

The PHAROS4MPAs project has the objective of designing and implementing a practical approach to coordinate the activities between MPAs and other important maritime economic sectors. As for marine litter, four sectors have been identified: maritime transport, cruises, leisure boating, recreational fisheries, and artisanal fisheries.

The main output of PHAROS4MPAs is a detailed list of recommendations on the interactions between MPAs and these maritime sectors, which will be published in 2019. One of the central recommendations, as related to the issue of marine litter, is for MPAs to draft lobbying strategies that would target policies and upcoming legislative proposals. As a practical example, MPAs may propose transforming the current taxation on waste delivered by ships into an incentive taxation mechanism, to further increase the quantity of waste delivered in ports by ships. Moreover, other concrete recommendations being formulated by PHAROS4MPAs to tackle marine litter focus on developing and strengthening the sorting of waste inside ships, as well as on promoting awareness campaigns to encourage waste reduction on board ships, and on using leisure boating to fish for litter as part of awareness-raising campaigns.

Figure 8 The no-regret measures included in the ACT4LITTER Joint Plan of Action for marine litter in the Mediterranean



A key achievement of the ACT4LITTER project was the preparation of a Joint Plan of Action to curb marine litter in Mediterranean MPAs. Based on the nine Action Plans drawn up and adopted by the pilot MPAs (see Section 2.2.1), the Joint Plan captures the strategic elements of the collective response needed to tackle marine litter in all pelagic and coastal Mediterranean MPAs. Some of the no-regret measures included in the Joint Plan are illustrated in the following Figure.

These results will be mainstreamed through the PLASTIC BUSTERS MPAs project, which will ensure their uptake into a joint governance plan for managing marine litter in pelagic and coastal Mediterranean MPAs. This plan will consolidate all the knowledge gained throughout its life-cycle, empowering MPA managers, decision makers, and other stakeholders with coordinated and targeted actions against marine litter. Policy and decision makers will be involved throughout all the phases of the project to ensure a concrete link between the project activities and the policy needs at various stages of the policy cycle, thus substantially strengthening the science-policy-practice interface.

Key Achievements of the Biodiversity Protection Community on marine litter management in a nutshell

- ⇨ A comprehensive list of best practices to fight marine litter in Mediterranean MPAs has been compiled by ACT4LITTER.
- ⇨ PHAROS4MPAs formulated recommendations on how to increase coordination between MPAs and other maritime sectors, centred on policy lobbying, waste reduction, and raising awareness.
- ⇨ A Decision-Making Tool has been developed to help MPA managers identify the most effective measures to tackle marine litter (ACT4LITTER).
- ⇨ Nine pioneering MPAs have developed MPA-specific Marine Litter Action Plans (ACT4LITTER).
- ⇨ These Action Plans form the backbone of a Joint Plan for Action that sets the baseline for a common urgent response by all other Mediterranean MPAs (ACT4LITTER).

3. What's Next?

3.1 The added value of the Biodiversity Protection Community Projects on marine litter

The results presented in Section 2 are directly linked to the main challenges that the Mediterranean faces in relation to marine litter assessment and management, presented in Section 1.3. A summary of these links is illustrated in Table 4.

The six Interreg-MED projects considered in this report hold many similarities, as well as important differences. All projects focus on, or at least involve in their activities, MPAs and their managers, with the exception of BLUEISLANDS, which targets Mediterranean islands in general. MEDSEALITTER and AMAre have a more 'technical' focus and involve data collection, refinement of common assessment methodologies, and the use of new tools to assess marine litter. In contrast, both PHAROS4MPAs and ACT4LITTER target the management side. While PHAROS4MPAs focuses on recommendations for increasing the coordination between MPAs and maritime economic sectors, ACT4LITTER proposes new tools and measures, organised into both MPA-level Action Plans and a Joint Plan of Action for Mediterranean MPAs.

In this respect, PLASTIC BUSTERS MPAs will use a holistic approach to address the whole marine litter management cycle, including science, policy, and implementation of pilot actions. In this way, it will act as a catalyst and enhance the results achieved by the other Interreg MED projects. Specifically, PLASTIC BUSTERS MPAs will further investigate the impacts of marine litter on biota; moreover, it will contribute to the development of a database on animal forests in the Mediterranean.

In addition, based on the results and the experience of MEDSEALITTER, PLASTIC BUSTERS MPAs will formulate a common protocol for ingested marine litter, and identify priority overlapping areas/seasons between macro-fauna and macro litter.

PLASTIC BUSTERS MPAs will build also on the outcomes of ACT4LITTER to prepare and implement marine litter demonstration projects in pilot MPAs, with fit-for-purpose knowledge transfer, capitalisation, and replication mechanisms. Finally, PLASTIC BUSTERS MPAs will ensure the uptake of the ACT4LITTER Joint Plan of Action for Mediterranean MPAs, involving policy and decision makers to

ensure that the project activities are linked and respond to the policy needs at all stages of the policy cycle.

Table 4 Summary of the major actions of the MPs to tackle the problems identified and the challenges posed by marine litter in the Mediterranean.

The challenges	Our actions
Need for long-term, consistent, and more comparable information on marine litter for the whole Mediterranean	Beach and floating litter monitoring and assessment activities (ACT4LITTER, BLUEISLANDS, MEDSEALITTER, AMAre) Modelling marine litter in the Mediterranean (AMAre) Overlaps with marine species (MEDSEALITTER) Knowledge base on the pressures and impacts of marine litter on biota in the Mediterranean (PANACeA)
Need for harmonised protocols to monitor and assess certain marine compartments and the impacts on biodiversity	Refinement of existing protocols for floating and ingested marine litter (MEDSEALITTER and PLASTIC BUSTERS MPAs) Use of drones and wavegliders (AMAre and MEDSEALITTER)
Need to empower local managers (especially in MPAs) with the necessary tools and knowledge to tackle marine litter	List of measures, Decision-Making Tool (DMT), MPA Action Plans and Joint Governance Plan (ACT4LITTER) Geo-spatial tools (AMAre, PANACeA) Use of drones and wavegliders (AMAre and MEDSEALITTER)
Need for clearly defined baselines and targets	Development of new indicators (AMAre, BLUEISLANDS)
Need to ensure effective cross-border coordination at the Mediterranean scale when implementing existing policies	Joint Governance Plan for coordinated action among Mediterranean MPAs (ACT4LITTER) Recommendations on coordination between MPAs and maritime sectors (PHAROS4MPAs) Evidence-based recommendations to regional governance instruments in the Mediterranean (PANACeA)

3.2Recommendations for further action

The results and achievements of the Interreg-Med projects notwithstanding, several gaps still exist, which should be addressed by future actions to tackle marine litter in the Mediterranean, with a special focus on MPAs.

Recommendation #1 – Marine litter data and information

⇨ Further support scientific assessment and monitoring of marine litter, ensuring the creation of long-term data and information series that cover the whole Mediterranean basin. Moreover, support further research to close current knowledge gaps on marine litter fluxes, on the impacts of marine litter on maritime socio-economic sectors, on the impacts of marine litter on biota and on human health, on the occurrence of Abandoned, Lost or otherwise Discarded Fishing Gear (ALDFG), and on the degradation mechanisms of marine litter in the environment, including the consideration of "biodegradable" materials with enhanced degradation properties, as there is the concern that they may break down into non-degradable fragments.

In this respect, in order to further capitalise on the efforts of the Community projects, we recommend reinforcing and consolidating the Community participatory science initiatives (i.e., the Marine Litter Watch Month and the floating litter monitoring through sailing vessels), strengthening the collaboration between the scientific community and MPA managers, Mediterranean NGOs, and local communities, also in other Mediterranean MPAs. Moreover, we recommend promoting the use of

drones, wavegliders and other UAVs for marine litter data collection, especially in MPAs. Finally, we recommend ensuring that the Mediterranean marine litter knowledge base hosted in the Biodiversity Protection Knowledge Platform is regularly maintained and updated, and permanently linked to the UNEP/MAP Regional Cooperation Platform on Marine Litter.

Recommendation #2 – Refining and improving assessment protocols

⇨ Further support the development and employment of common protocols and standardised methods for marine litter assessment in the Mediterranean, especially in relation to different size categories, sampling procedures, and reference values. Specifically, new protocols should be developed to monitor micro-litter, the entanglement of marine species, the effect of litter colonisation by small species, and deep-sea areas on a Mediterranean scale.

In this respect, in order to further capitalise on the efforts of the Community projects, we recommend:

- Fostering the adoption of the enhanced protocols for floating macro-litter and ingested litter, proposed by MEDSEALITTER and included into the revision of the EU-JRC Guidance on monitoring marine litter in 2019, at Mediterranean scale; and
- Further supporting the development of new Mediterranean-wide protocols for micro-litter, for the entanglement of marine species, for the effect of litter colonisation by small marine species, and for deep-sea areas, envisaged in the context of PLASTIC BUSTERS MPAs.

Recommendation #3 – Knowledge and tools for local managers

⇨ Further support local authorities, MPA managers and local communities with effective instruments to monitor and manage marine litter, by improving their administrative coordination, capacity building, and technical support, and prioritising upstream solutions in keeping with the waste management hierarchy.

In this respect, in order to further capitalise on the efforts of the Community projects, we recommend:

- Sharing the management tools developed in the context of ACT4LITTER (i.e. the list of measures, the DMT, the MPA-specific Action Plans, and the Joint Plan of Action) with other Mediterranean MPAs in both EU and non-EU countries by using existing networks of Mediterranean MPAs (namely MedPAN) and the UNEP/MAP network;
- Supporting an increase in human and technical resources and the capacity of MPA managers to address marine litter, by training the personnel on using the geospatial tools developed by the Biodiversity protection Community (i.e. the Knowledge Platform and the AMAre WebGIS), whose sustainability beyond the end of the MPs should be ensured; and
- Ensuring that funding mechanisms require the development of geospatial tools that are user-friendly and can be easily used in an effective way by MPA managers.

Recommendation #4 – Clearly defined baselines and targets

⇨ Further support scientific research towards a clearer definition of baseline values and reduction targets against which to measure progress in tackling marine litter.

In this respect, we recommend considering the use of the new Marine Litter Beach Accumulation Index, and further investigating the use of animal forests as indicators of entanglement, so as to establish clearer baselines and reduction targets in the context of both the EU MSFD and the UNEP/MAP IMAP.

Recommendation #5 – Cross-border cooperation (especially with non-EU countries)

⇨ Further support cross-border cooperation and coordination in the Mediterranean by sharing the knowledge and tools developed by the Interreg MED community for marine litter, especially with partners from non-EU countries.

In this respect, in order to further capitalise on the efforts of the Community projects, we recommend:

- Sharing the management tools developed by the pilot MPA managers with other Mediterranean MPAs in both EU and non-EU countries by using existing networks of Mediterranean MPAs (namely MedPAN) and the UNEP/MAP network; and
- Considering extending the horizontal approach used to develop and implement the Biodiversity Protection Community, to include other lines of EU funding for the Mediterranean (e.g. other Interreg, LIFE, European Fisheries Fund (EFF)) as an instrument to streamline best practices and recommendations into management and policy instruments.

Recommendation #6 – Cross-sector coordination

⇨ Further support the coordination between marine conservation and maritime socio-economic sectors, by including the Ecosystem-Based Management principles into other policies (especially in the Circular Economy Package and the Plastics Strategy), and by fostering a coordinated approach between MPAs, costal and marine resource managers, and other maritime sectors.

Recommendation #7 – Sea-based sources of marine litter

⇨ Ensure a wider coverage of potential sources of marine litter, by supporting projects that address sea-based sources of marine litter like shipping, fishing, offshore installations, or dumping of refuse at sea.

Recommendation #8 – Involve local stakeholders and civil society

⇨ Further strengthen the connection of future projects with society at the local level, by implementing actions that aim to raise the awareness of local communities and involve local authorities, and by developing participatory science initiatives on marine litter monitoring and assessment, like the ones implemented in the context of ACT4LITTER and MEDSEALITTER.

Recommendation #9 – Sustainability of achievements

⇨ Guarantee the sustainability of the Community's achievements, by ensuring the creation of a permanent link between the Community outcomes and the existing, Mediterranean-wide knowledge platforms on marine litter, so as to foster the accessibility to available resources, the transferability of the knowledge and tools generated, and the replicability of the solutions tested.

In this respect, in order to further capitalise on the efforts of the Community projects, we recommend ensuring that the Mediterranean marine litter knowledge base hosted in the Biodiversity Protection Knowledge Platform is regularly maintained and updated, and permanently linked to the UNEP/MAP Regional Cooperation Platform on Marine Litter.

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The MED Biodiversity Protection Community featured by PANACeA

The Interreg MED Biodiversity Protection Community brings together a comprehensive network of experts from public & private institutions actively working to protect biodiversity and natural ecosystems in Mediterranean Protected Areas. Filling the current gap between Science, Management, and Policy is one of the priority targets of the Biodiversity Protection Community.

The Interreg MED Biodiversity Protection Community seeks to identify and generate synergies amongst the work of relevant Mediterranean stakeholders, including Protected Area managers, policymakers, socio-economic actors, civil society and the scientific community. The initiative undertakes actions to increase the visibility and impacts of the results of different thematic biodiversity protection projects that are being undertaken by members of its Community, also with the financial support of the Interreg Med Programme, reaching a common and pre-identified strategic target audience.

Several policy aspects are addressed under the umbrella of these thematic projects, covering biodiversity protection, sustainable use of natural resources, ecosystem-based management approaches - including Maritime Spatial Planning (MSP) and Integrated Coastal Zone Management (ICZM) - as well as governance mechanisms. The Community is working to advance more effective biodiversity protection in the Mediterranean through enhanced monitoring and management of coastal and marine ecosystems, specifically targeting more sustainable fisheries, better adaptation to climate change effects, better prevention of marine litter and improved waste management.

PANACeA supports the Interreg MED Biodiversity Protection Community by:

> Offering support as well as communication and capitalization opportunities to the MPs.

> Seeking interconnectivity amongst MPs and offering networking opportunities.

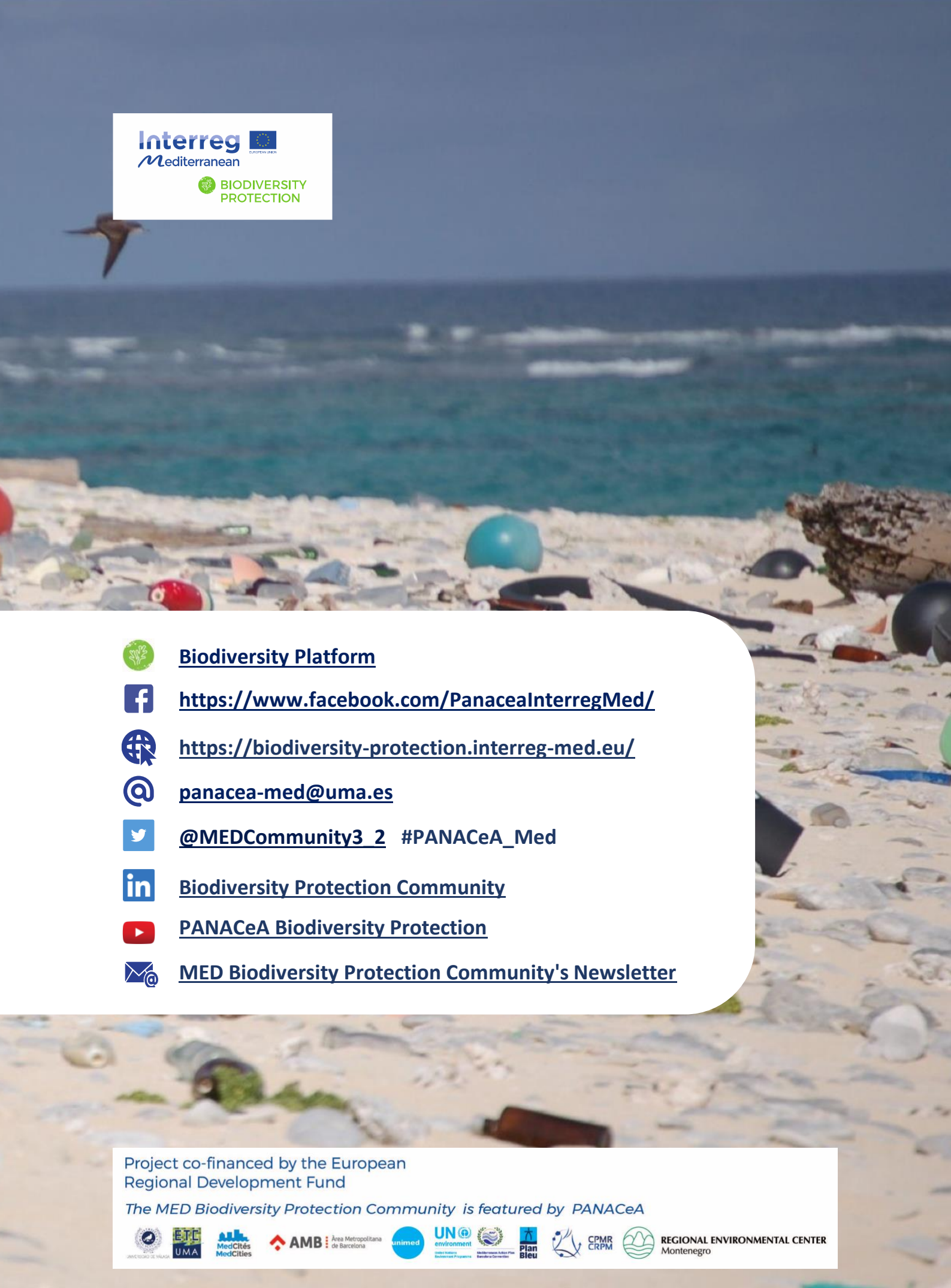
> Helping MPs achieve their results by creating opportunities to exchange and transfer methodologies, tools, practices and knowledge.

> Ensuring adequate deployment of the activities, services, and tools it develops by involving its Advisory Board throughout the project lifetime.

> Mobilizing experts from outside the interreg MED Programme, especially from the Eastern and Southern Mediterranean region, who focus on biodiversity protection, in order to make possible communication with a wider community of experts and a broader dissemination of the Community's results.

> Building upon the individual projects' needs to create a unique and adapted tool, the MED "Biodiversity Protection Knowledge Platform" (BPKP), as both a community building and a long-term capitalization tool that allows a one-entry-point access to all the knowledge generated by the biodiversity protection community.

The community's Open Seminars / Knowledge Sharing & Community Building meetings are amongst the key tools that have been devised to achieve the above-mentioned objectives. Open Seminars are knowledge-sharing events that seek to share information, advance knowledge, and outside



Interreg Mediterranean
BIODIVERSITY PROTECTION

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