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ABBREVIATIONS[1]

EAC	Eastern Adriatic current
EU	European Union
IMAP	Integrated system for monitoring and assessing the state of the Mediterranean Sea and coast
LGUS	Local Government Units
JP(R)S	Regional self-government units (Counties)
MSFD	Marine Strategy Framework Directive
PAH	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated biphenyls
RoC	Republic of Croatia
UNEA	United Nations Environment Assembly
UNEP/MAP	United Nations Environment Program / Mediterranean Action Plan
UN	United Nations
WAC	Western Adriatic Current

CONTENTS

1. INTRODUCTION

Marine litter is any artificial or processed object or part thereof that is either intentionally discarded or accidentally lost directly into the coastal and/or marine environment or has somehow reached the sea from the land, e.g. through rivers or wastewater, wind or storm water runoff. At the same time, in Croatia, the term marine litter means any substance or object which the holder discards or intends or is required to discard and is found in marine environment and coastal area in direct contact with the sea, and it is created by human activities on land or at sea, and is located on the surface of the sea, in the water column, on the seabed or washed ashore.

It is well known that most marine litter comes from land-based activities and uses, although in some areas offshore activities are important as well. Marine litter is therefore a consequence of the way societies and individuals produce and manage waste. In order to identify the drivers and shortcomings in the waste management systems that contribute to marine litter generation, it is crucial to understand where, by whom and why litter is generated and how it enters the marine environment. This approach is necessary to establish appropriate operational objectives and to design, implement and monitor effective management measures primarily under the Waste Framework Directive but also under the Marine Strategy Framework Directive (MSFD).

Marine litter is one of the major threats to marine ecosystems in the Mediterranean and is recognized to have environmental, economic, safety, health and cultural impacts. In order to jointly plan policies at the regional level related to the management of marine litter, as well as monitoring the state of the environment and the impact of marine litter on the Mediterranean Sea, the United Nations Environment Program (UNEP/MAP) has developed Regional Plan for Marine Litter Management in the Mediterranean (RPMLM) the first of which (UNEP/MAP, 2013) entered into force in 2014.

Adoption of the revised RPMLM took place in Antalya, Turkey in 2021 during COP21 BC, and Decision IG.21/7 regarding revision of said Plan was agreed. The main objectives of the Regional Plan include measures related to marine litter management, prevention, disposal, assessment,

monitoring, awareness, etc., which will contribute to the achievement of the the main objectives of the RPMLM, described in Article 4 of the mentioned plan.

It is predicted that there will be more plastic than fish in the world's oceans by 2050. Plastic production increased from 15 million tonnes in the 1960s to 311 million tonnes in 2014, and is expected to triple by 2050. Today, plastics account for 80% of litter in seas and oceans worldwide. Although the prevention of marine litter pollution is ensured by the adoption of several legal documents at the international, national and regional levels, the effectiveness of these instruments and initiatives is still unclear.

To date, there is no legal act in place that directly addresses and regulates the problem of marine plastic pollution, nor is there any unique mechanism for regulation and control of its spreading. Although the fifth session of the UN Environment Assembly (UNEA-5.2), adopted resolution to develop an international legally binding instrument on plastic pollution, including in the marine environment, the work on preparation of such document is still in its early stage. Given that marine pollution originates from both land and marine sources, it is necessary to establish measures that directly regulate marine pollution and more general measures to reduce the production, sales and consumption of plastics, which can play a significant role in reducing marine pollution from marine litter.

The purpose of this plan is a more harmonized implementation of policies to protect the marine environment and coastal areas from the impact of marine litter at the regional level by strengthening sub-regional cooperation, defining the pressure of marine litter at the sub-regional level, improving the exchange of information on marine litter status at the regional level, educating and informing, and strengthening cross border cooperation in marine litter management. The term „regions" used in this plan refers to those constituent regions on the Italian side and counties on the Croatian side that have access to the Adriatic Sea.

2. LEGAL ASPECTS RELATED TO MARINE LITTER

2.1. International legal framework

Marine plastic litter, including microplastics, has been recognized by important political actors globally (UN, G20, G7, APEC, etc.) as one of the major threats to the environment of our time. However, despite several decisions, declarations, resolutions and source documents, the issue of littering remains largely unresolved. There is a number of different instruments globally and intergovernmental agreements that address plastic marine litter and microplastics, but none of the existing frameworks is designed to prevent ever-increasing amount of plastics and microplastics from entering the environment.

Some of these instruments focus on preventing marine pollution (UNCLOS and IMP's MARPOL, London Convention/Protocol), others on protecting biodiversity (CBD, CMS, FAO, UNFSA) or targeting waste and chemicals (Basel, Rotterdam and Stockholm Conventions). One example is the new legally binding amendment to the Basel Convention, which makes global trade in plastic waste more transparent and better regulated. In addition, there are several voluntary measures and action plans, such as the Sustainable Development Goals (SDGs), United Nations Assembly (UNEA) resolutions, FAO guidelines for labeling fishing gear, and G7 and the International Maritime Organizations (IMO) action plans on marine litter. Presently there is also noteworthy UN level effort on resolution to develop an international legally binding instrument on plastic pollution.

However, the above-mentioned instruments refer to marine litter and pollution in general, and mainly deal with secondary microplastics resulting from the shredding of larger plastic objects, while ambiguity remains regarding primary microplastics, which are not specifically addressed ny any of the current global instruments. The only exception to a certain extent, UNEA resolutions which consider marine plastics and microplastics as packaging, but still recognize specific problems related to microplastics. Solutions to the problem of plastic pollution are complex and require transboundary and multilateral cooperation. Despite the realization that long-term, comprehensive and multilateral

actions are necessary, there is no international agreement that primarily focuses on combating plastic pollution. The growing awareness that plastic pollution is a global problem, and that the existing legal framework is not suitable to address it, has opened many opportunities at the international level. For example, the UNEA advocates proposing amendments to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal to ensure that countries most at risk of plastic pollution and unable to dispose of it safely may refuse to do so in order to better protect their environment and populations. It is important to mention the International Maritime Organization (IMO), the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) and other maritime instruments, such as the Stockholm Convention on Persistent Organic Pollutants and the Strategic Approach to International Chemicals Management (SAICM).

Although no specific legislation has yet been developed at the international level, many proactive measures have been taken - on a voluntary basis or through legally binding practices at the international, national and regional levels.

2.1.1. Regional Plan for Marine Litter Management in the Mediterranean (RPMLM)

The Regional Plan for Marine Litter Management in the Mediterranean, adopted in 2013 and entered into force in June 2014, was developed as part of the implementation of the Strategic Framework for Marine Litter Management in the Mediterranean from 2012 developed under UNEP/MAP activities (Barcelona Convention) and in the framewok of the LBS Protocol. Same Plan was updated during last COP21 of Barcelona Convention that was held in 2021 in Antalya, Turkey, but most of its reporting obligations still are not due.

2.2. European legal framework

The European Union (EU) has adopted a number of measures on litter management, and in particular on packaging and environmental protection, which are essential for the reduction of plastic marine litter. The EU has a wide range of instruments that directly and indirectly target the issue of

plastics and microplastics in the seas. These instruments include several directives and strategies that apply to all EU Member States. An overview of European Commission (EC) policies, laws and initiatives related to marine litter was published in 2012 (EC 2012). They relate both to specific initiatives within the EU and to broad international obligations. For example, EU Directive 2019/883 includes an obligation for states to provide reception facilities for waste in ports. The European Union, which actively participates and significantly contributes to international efforts to prevent and reduce marine litter and mitigate its impacts, has introduced a number of policies, legislation and initiatives aimed at addressing marine litter strategies, including the Waste Framework Directive (WFD) and Marine Strategy Framework Directive (MSFD) as key European legislation solving the problem of marine litter. The MSFD was the first legal instrument at EU level for more effective protection of the marine environment and was adopted on 17 June 2008. Marine litter is defined as one of eleven "descriptors" of the state of the environment in the European seas. Although ambitiously envisaged as an environmental pillar of Integrated Maritime Policy, MSFD unfortunately does not posess equally ambition tools through which equally ambitious goals can be achieved. The MSFD includes provisions for setting indicators and targets for good environmental status (GES) which, among others, include the obligation that the amount of marine litter will not harm the coastal and marine environment. The main goal of this strategy is to enable coherent and harmonious implementation of the Directive, through the development of national strategies that include, in addition to the above, the development and implementation of a program of measures to achieve or maintain GES in European seas. For each of the eleven descriptors, a number of criteria and associated indicators for assessment of good environmental status has been defined. Commission Decision (EU) 2017/848 of 17 May 2017 establishing criteria and methodological standards for good state of the marine environment, as well as specifications and standardized methods for monitoring and evaluation, and repealing Decision 2010/477 / EU on marine litter, defines two primary and two secondary criteria dealing with large marine litter and microplastics:

D10C1 - Primary: The composition, quantity and spatial distribution of litter along the coast, in the surface layer of the water column and on the seabed are at levels that do not harm the coastal

and marine environment. The Member States shall set limit values for those levels by cooperation at the Union level, taking into account the specificities of the region or sub-region.

D10C2 - Primary: The composition, quantity and spatial distribution of micro-litter along the coast, in the surface layer of the water column and in the seabed sediment are at levels that do not harm the coastal and marine environment. The Member States shall set limit values for those levels by cooperation at Union level, taking into account the specificities of the region or sub-region.

D10C3 - Secondary: The amount of litter and micro-litter that marine animals enter the body is at a level that does not have a detrimental effect on the health of the species concerned. The Member States shall set limit values for these levels through cooperation at the regional or sub-regional level.

D10C4 - Secondary: Number of individuals of each species that have suffered damage due to waste, e.g. entanglement, other types of injury or mortality, or adverse health effects of waste. Member States shall set limit values for the adverse effects of waste through cooperation at regional or sub-regional level as well as accompanying specifications and standardized methods for monitoring and evaluation.

1. For D10C1: shore-based litter is monitored and can be monitored in the surface layer of the water column and on the seabed. Data on the source and routes of litter are collected, if feasible.
2. For D10C2: micro-litter is monitored in the surface layer of the water column and in the seabed sediment, and can also be monitored on shore. Micro-litter is monitored so that it can be connected to point inputs (e.g. ports, marinas, wastewater treatment plants, stormwater effluents), if feasible.
3. For D10C3 and D10C4: monitoring may be based on random occurrences (e.g. number of stranded dead animals, entangled animals in breeding colonies, affected individuals per test).

Annex III of the Directive was also amended in 2017 to better link ecosystem components, anthropogenic pressures and impacts on the marine environment to the 11 MSFD descriptors and the new GES Decision.

In addition to the above documents dealing with the issue of solving the problem of marine litter in the EU, the Directive on port facilities for the reception of ship-generated litter, amending Directive 2010/65/EU and repealing Directive 2000/59/EC (2019/883/EU), and the issue of marine conservation as an environmental component is also addressed by the Bathing Water Quality

Management Directive (76/160/EEC and 2006/7/EC); Urban Wastewater Treatment Directive (91/271/EEC and 98/15/EC); Directive on Environmental Liability for the Prevention and Elimination of Environmental Damage (2004/35/EC); Packaging and Packaging Litter Directive (2004/12/EC); and the Directive on the reduction of the environmental impact of certain plastic products (2019/904/EU).

The "European Strategy for Plastic Litter in the Environment" was published as a Green Paper in 2013 (EC 2013), addressing aspects of production, use, management of plastic litter, recycling and efficiency of plastics as a resource, asking a number of questions to facilitate development of more effective guidelines and regulations on waste management. A revision of the existing legislation followed, and, for example, an amendment to reduce the consumption of lightweight plastic bags (thickness <50 μm), was adopted in April 2015 (EC 2015). The EC has commissioned several studies on the generation of marine litter, specifically plastic waste, and on potential impacts and mitigation measures. In addition, the EC is currently working on regulation on intentionally added and used microplastic particles. The European Union also adopted the Circular Economy Package in 2015, which includes a Plastics Strategy that contains specific elements to prevent pollution from marine litter and microplastics. The Disposable Plastics Directive is the result of such a Strategy, as is the proposal of the European Chemicals Agency (ECHA) to limit the use of intentionally added microplastic particles in products, which could be an important instrument in addressing the use of microplastics in products in Europe (**SUP Directive** (**EU**) 2019/904 of the European Parliament and of the Council of 5 June 2019 on the reduction of the impact of certain plastic products).

2.3. Legislative framework in the Republic of Croatia

In the Republic of Croatia, the issue of marine litter is dealt through several legal instruments, primariliy from the environment and maritime domain. Act on Litter Management (Official Gazette 84/21) defines marine litter as "*waste that is found in marine environment and coastal area in direct contact with the sea, and it is created by human activities on land or at sea, and is located on the surface of the sea, in the water column, on the seabed or washed ashore"* Said Act, unfortunately

prescribes obligations for marine litter management only in the “washed ashore” part, while giving no obligations for marine litter handling while marine litter is in the sea.

The Marine Strategy Framework Directive (MSFD) of 17 June 2008 (2008/56/EC) establishes a framework for Community action in the field of marine environmental policy, within which Member States must take measures to achieve or maintain the good state of the marine environment (GES) by 2020 at the latest, including those related to marine litter which is defined as one of the important pressures on the marine environment. The Republic of Croatia (hereinafter: RoC) has adopted and in force the Regulation on the Development and Implementation of Strategy on Management of Marine Environment and Coastal Area, (Official Gazette ”, No. 112/14, 39/17 and 112/18, hereinafter: Regulation), which transposed into national law the provisions of the Marine Strategy Framework Directive and related Commission Decision 2010/477 / EU and 2017/848 / EU on criteria and methodological standards for the good status of the marine environment, and the Protocol to the Barcelona Convention on Integrated Coastal Zone Management in the Mediterranean (Official Gazette - International Agreements, No. 8/12, hereinafter: ICZM Protocol). The Regulation regulates the starting points and criteria for drafting, developing, implementing and monitoring the implementation of the Strategy for the Protection of the Marine Environment and Coastal Area, which is legally established in the Environmental Protection Act (Official Gazette 80/13, 78/15, 12/18 and 118/18). The Regulation also establishes a framework for the coordination and integration of the management planning process for the maritime (according to the MSFD) and coastal (according to the ICZM protocol) areas of the Republic of Croatia.

According to the provisions of the MSFD, the Program of measures for the protection and management of the marine environment and the coastal area was adopted in 2017 (PoM). The PoM sets out the measures that need to be taken to achieve and/or maintain good environmental status (GES) and the measures that need to be taken to achieve the marine environment and coastal zone management objectives.

One of the strategic priorities of the PoM is Strategic Priority 3. Improving the implementation of the instruments to achieve a good status of the marine environment and coastal area with specific

objective 3.3. Improvement of the marine litter management system and the measures defined under this specific objective 3.3.1. Development of a national marine litter management plan.

Furthermore, Directive (EU) 2019/904 of the European Parliament and of the Council of 5 June 2019 on the reduction of the environmental impact of certain plastic products (EU Directive 2019/904) provides that each Member State shall ensure that the measures it takes to transpose and implement this Directive are an integral part of its programs of measures established in accordance with Article 13 of Directive 2008/56/EC for those Member States with marine waters, programs of measures established in accordance with Article 11 of Directive 2000/60/EC, waste management plans and prevention of litter generation established in accordance with Articles 28 and 29 of Directive 2008/98/EC and litter acceptance and waste management plans established in accordance with Directive (EU) 2019/883, and that these measures are in line with these programs and plans.

The measures provided for in the Marine Litter Management Plan therefore include, to an appropriate extent, the measures provided for in Directive (EU) 2019/904, in particular as regards the establishment and implementation of extended producer responsibility schemes for fishing gear containing plastics and other disposable plastic products subject to extended producer responsibility, establishing and meeting a national minimum annual collection rate for discarded fishing gear containing recyclable plastics and ensuring that the European Commission monitors and reports on plastic-containing fishing gear placed on the market and plastic-containing fishing gear collected and handed over as waste during recycling.

RoC is currently prepairing an update of aforementioned PoM through which a follow up of marine litter related measures from current PoM are envisaged. Beside the plan to form a special expert body for ML issues, improvement of ML management information sistem or ML awareness raising campaign meassures, some of said measures contain actions are concerend with actual “green” campaings. Deliverance of aupdated PoM is expected shortly.

Furthermore, there is a legislative gap regarding the issue of primary microplastics and none of the current national documents address this particular issue.

2.4. Legislative framework in the Republic of Italy [2]

In the Republic of Italy the Legislative framework regarding marine litter and environmental protection it's constantly updated following the evolutions of new threats.

The first milestone in the legislation was approved in the 2006 with the D.Lgs 152/2006: Legislative Decree 3 April 2006, n. 152 on Environmental Act. The introduction of the Single ENVIRONMENTAL ACT represents a turning point in Italian legislation. Until now, the environment was considered in a fragmented way in its various parts, without an overview. The D.Lgs 152/2006 has as a novelty the desire to unify the various environmental components, so as to consider them different parts from each other but at the same time consider them unique. In the Law, every environmental matrix is thoroughly treated: water, air, soil are protected by specific limits to ensure the good level of environmental quality.

In particular:

- in the third part is treated the protection of water from pollution and the management of water resources
- in the fourth part the Environmental Act deepens the management of waste and the remediation of sites contaminated by waste
- in the sixth part, compensation for environmental damage.

This Legislative Decree clearly defines various concepts including packaging, recycling, disposal and prevention and enshrines in the classification of municipal waste, inter alia, "waste of any nature or origin lying on roads and public areas or on roads and private areas in any case subject to public use or on sea and lake beaches and on the banks of waterways". The Environmental Consolidated Law (TUA, in Italian) has as its primary objective the promotion of levels of quality of human life, to be achieved through the preservation and improvement of environmental conditions.

LEGISLATIVE DECREE No. 196 of November 8, 2021.

Implementation of Directive (EU) 2019/904, of the European Parliament and of the Council of June 5, 2019 on reducing the impact of certain plastic products on the environment.

This decree establishes measures to prevent and reduce the impact of certain plastic products on the environment, particularly the aquatic environment, and on human health, and to promote the transition to a circular economy; it aims to promote responsible behavior with respect to the proper management of plastic waste. This Decree also establishes measures to promote the use of recycled plastic suitable for direct food contact in beverage bottles.

In the definitions, the Decree includes the following definitions:

a) "plastic": material consisting of a polymer, as defined in point 5 of Article 3), Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 to which additives or other substances may have been added, and which may function as the main structural component of finished products, except for natural polymers which have not been chemically modified; materials such as paints are excluded from this definition, inks, adhesives and plastic coatings weighing less than 10 per cent of the total weight of the product, which are not the main structural component of the finished products;

b) “disposable plastic product": a product made wholly or partly of plastic, with the exception of a product made of natural polymers which have not been chemically modified, and which is not designed, designed or placed on the market to fulfil, during its lifetime, More than one movement or rotation to be returned to a manufacturer for charging or otherwise reused for the same purpose for which it was designed. For example, containers for dry food, including aged food, or for food sold cold that requires further preparation, shall not be considered as disposable plastic products, containers containing more than one portion of food or single-portion food containers sold in more than one unit;

c) “oxo-degradable plastic": plastic materials containing additives which, through oxidation, result in the fragmentation of the plastic into micro fragments or chemical decomposition;

The New Salvamare Law of May 17, 2022 n.60

On 10 June 2022, Law No.60 of 17 May 2022 on "Provisions for the recovery of waste at sea and in inland waters and for the promotion of the circular economy" was published, which entered into force on 25 June 2022. The aim of the Law is to contribute to the rehabilitation of the marine ecosystem and the promotion of the circular economy, as well as to the awareness of the community for the dissemination of virtuous behavioural models aimed at preventing the abandonment of waste in the sea, in lakes, rivers and lagoons and the proper management of waste.

The Act stresses the following definitions concerning inland waters:

a) "accidentally caught waste" means waste collected at sea, in lakes, rivers and lagoons by nets during fishing operations and that collected occasionally at sea, in lakes, rivers and lagoons by any means;

b) "waste voluntarily collected" means waste collected by means of waste capture systems, provided that it does not interfere with the eco-systemic functions of water bodies, and during the cleaning campaigns of the sea, lakes, rivers and lagoons referred to in letter c);

c) "clean-up campaign" means the initiative planned to clean up the sea, lakes, rivers and lagoons in accordance with the conditions laid down in Article 3;

d) "awareness campaign" means activities aimed at promoting and disseminating models behavioural virtuous prevention of the abandonment of waste at sea, in lakes, rivers and lagoons;

e) "competent authority" means the municipality having territorial jurisdiction;

f) "promoter of the cleaning campaign": the subject, among those qualified to participate in the cleaning campaigns for the sea, lakes, rivers and lagoons in accordance with Article 3, paragraph 3, which submits to the competent authority the request referred to in the aforementioned Article 3, paragraph 1;

The highlights of the Salvamare Law are the following:

1. Without prejudice to the provisions of this Article, incidental waste caught shall be treated as waste from ships within the meaning of point 3 of the first paragraph of Article 2, of Directive (EU) 2019/883 of the European Parliament and of the Council
2. The master of the vessel or the driver of the vessel calling at a port shall transfer the waste accidentally caught at sea to the port reception facility. In the case of the mooring of a vessel in areas not covered by the territorial competence of a port system authority, the territorially competent municipalities shall provide that the waste is delivered to appropriate collection facilities, whether or not temporary, fitted out near berths.
3. The master of the vessel landing in a small non-commercial port shall transfer the accidentally caught waste to port reception facilities integrated into the municipal waste management system.
4. The supply of accidentally caught waste to the port facility of collection, after weighing of the same at the time of delivery, is free of charge for the conferent
5. For the purpose of distributing the charges referred to in this Article throughout the national community, the costs of managing incidental waste caught shall be covered by a specific component added to the waste tax
6. By decree of the Minister for Agricultural Food and Forestry Policies, in agreement with the Minister for Ecological Transition, to be adopted within four months of the date of entry into force of this Act, reward measures shall be identified, with the exception of economic provisions, to the master of the fishing vessel subject to compliance with the obligations laid down in this Article, which do not affect the protection of the marine ecosystem and compliance with safety rules.
7. Waste collected voluntarily may also be collected by means of waste capture systems, provided that they do not interfere with the eco-systemic functions of water bodies, and as part of specific cleaning campaigns organised on the initiative of the competent authority. Are promoters of cleaning campaigns:

-the managing bodies of protected areas
-the environmental associations
-fishermen's associations
-fishing cooperatives and enterprises, as well as their consortia
-sports and recreational fishermen's associations
-sports associations of divers and boaters
-the professional associations
-diving and diving training centers
-the managers of bathing establishments
-Third sector entities
-non-profit organizations of social utility
-social promotion associations
-foundations and associations with the purpose of promoting and protecting and safeguarding natural and environmental assets
-other entities identified by the competent authority.

The managing bodies of protected areas may also carry out, also in consultation with the representative bodies of fish entrepreneurs, public communication and environmental education initiatives to promote the campaigns referred to in this article.

8. In order to promote the recycling of plastics and other materials not compatible with the marine ecosystem and inland waters, the Minister for Ecological Transition shall establish the criteria and modalities for accidentally caught waste and waste voluntarily collected cease to be classified as waste
9. In order to reduce the impact of marine pollution from rivers, the District Basin Authorities shall introduce, in their planning acts, experimental measures in watercourses to capture floating waste, compatible with the needs of water and ecosystem protection

10. by 31 March 2022, the Ministry of Ecological Transition shall initiate a three-year experimental programme for the recovery of plastics in rivers most affected by this form of pollution, including by the installation of floating instruments
11. Awareness campaigns can be carried out regarding the protection of the marine environment, for the achievement of the aims expressed in the Salvamare Law and the objectives contained in the 2030 Agenda for sustainable development, adopted by the UN General Assembly on 25 September 2015.
12. In order to provide fishermen and operators with adequate information on the way in which accidentally caught or voluntarily collected waste is delivered, appropriate forms of advertising and awareness-raising by the port system authorities or by the municipalities territorially competent in the field of municipal waste management pursuant to Article 198 of the Legislative Decree of 3 April 2006, n. 152, including through technical protocols to ensure the mapping and advertising of harvesting areas and maximum simplification for fishermen and operators
13. The Ministry of Education promotes, in schools of all levels and levels, activities aimed at making pupils aware of the importance of the conservation of the environment and, in particular, of the sea and inland waters, and the correct conditions for the transfer of waste
14. The schools also promote good waste delivery practices and the recovery and reuse of goods and products at the end of the cycle, including with regard to the reduction of the use of plastics and the re-use systems available.
15. In the Amendment to Article 52 of the code referred to in Legislative Decree No. 171 of July 18, 2005 the following words are added at the end: "also with reference to measures to prevent and combat the abandonment of waste at sea".
16. To fish farmers who, in the course of their activities, take part in cleaning campaigns or give the accidentally caught waste an environmental recognition attesting to the commitment to the environment

17. Provision is also made for municipalities to implement an incentive system for respect for the environment aimed at awarding recognition to boat owners, not engaged in professional activities, who recover and deliver ashore plastic waste accidentally caught or voluntarily collected.
18. In order to coordinate action to combat marine pollution, including that due to plastics, the Permanent Inter-Ministerial Consultation Table is established at the Ministry of Ecological Transition.
19. The Minister of Ecological Transition submit to the Chambers, by December 31 of each year, a report on the implementation of this law → We are waiting for…?

2015

CAM: MINIMUM ENVIRONMENTAL CRITERIA - ART. 18 of LAW on 28 DICEMBER 2015 N. 221

CAM are the Minimum Environmental Criteria and are a tool that the Italian country has adopted to support virtuous operators who invest to reduce their environmental impact.

Their application is ensured by Art. 34 Criteria for energy and environmental sustainability of Legislative Decree 50/216 or Procurement Code, revised by Legislative Decree 56/17. As they introduce environmental sustainability requirements, CAMs are one of the tools that Italy uses to support the environment and force operators to adapt in order to enter public tenders with a green line. New CAMs continue to be added to the existing ones by updating the list presented by the Italian Government on the basis of technological and market evolution.

3. STATE OF MARINE LITTER MANAGEMENT IN THE REPUBLIC OF CROATIA AND THE REPUBLIC OF ITALY [3]

Regarding waste management at the national and regional levels, the most common shortcomings are inadequate or non-existent administrative coordination, insufficient financial resources and technical capacity, and poor implementation of existing litter management legislation. In addition, there is a lack of sufficient database on the quantities, composition and trends of marine litter, a poor understanding of oceanographic and climatic processes that affect its distribution and retention in the marine environment, and lack of knowledge about further fate of marine litter once it reaches the sea (sinking to the bottom and the like). Furthermore, data collection and analysis methods at the subregional level (Adriatic Sea level), are poorly developed and insufficiently comparable. Given that research and waste collection actions were mainly carried out by NGOs and individuals in smaller areas (usually on beaches and outside the tourist season and at the initiative of local governments, counties or concessionaires), they were not targeted, so the data obtained are scarce and spatially isolated, and therefore poorly comparable. As part of the development of the current state of marine litter, it is also necessary to assess its economic impact and further investigate the impact of marine litter on natural resources and human health, following the regional approach and the EC approach in the application of MSFD.

The problem of marine litter is becoming increasingly visible and obvious in the Adriatic Sea, and knowledge of its problems largely corresponds to the situation in the Mediterranean. With a surface of 138.600 km^2, the Adriatic is a relatively small and shallow semi-enclosed sea connected to the Mediterranean Sea by the 70 km wide Otranto Strait. Considering the distribution of the population along the coast, strong tourist activities, cage fish farming activities, hydrocarbon exploitation as well as intensive shipping, nautical (sailing, yachts) and tourist (cruisers, tourist ships) traffic and the regime of sea currents, a significant litter pollution of the sea was recorded.

Although the issue of marine litter is recognized as one of the main threats to marine ecosystems in the Mediterranean due to its ecological, economic, safety, health and cultural impacts, the lack of adequate data from systematic research is a problem for the Adriatic Sea. In addition to litter entering the sea in different ways and through different activities, a special problem is the input of transboundary wastes reaching the Adriatic Sea through sea and wind currents, especially during extremely unfavourable meteorological and hydrological conditions.

The share of such waste in the southern Adriatic can account for almost 70% of the total. Furthermore, marine litter management is important to detect and prevent the problems of spontaneous spread of invasive alien species (IAS - Invasive Alien Species). Namely, waste in the sea, together with other floating objects, is the vector for their transmission. Spontaneous spread of invasive alien species poses one of the main threats to the conservation of marine biodiversity.

Although the impact of marine litter in the Adriatic has been present for a long time, knowledge about it is still quite scarce. Data from scientific research on its quantity, distribution and composition are limited, and therefore insufficient to draw systematic conclusions about trends. There are also activities of removing marine litter through certain diving club actions . Such diving environmental actions are usually initiated for the purpose of removing larger litter along the shores and waterfronts of smaller settlements. However, there is no systematic coordination of such marine litter collection activities, and there are no records and monitoring of collected litter to provide data on their composition, spatial distribution and potential sources. In most cases, the data collected were reported as the total amount of litter collected or the amount of litter collected by type of material without further classification by items.

Systematic recording of marine litter on the Croatian side of the Adriatic Sea started with the DefishGear project (IPA Adriatic CBC program 2007-2013) entitled "Derelict Fishing Gear Management System in the Adriatic Region", 2013-2016. The project initiated the search for appropriate sites and testing of a methodology that meets the specific requirements of collecting data on marine litter in the Adriatic Sea.

In the period 2018-2019 ML-REPAIR project "Reduction and prevention, integrated approach to marine litter management in the Adriatic" was implemented. The objectives of the ML-REPAIR

project were to raise environmental awareness and educate target groups about marine litter issues by adopting examples of "good practice", to reduce seabed litter by actively involving the fisheries sector and to monitor and remove bottom litter accumulated in selected Natura 2000 sites.

3.1. Marine litter management in Croatia

In the Republic of Croatia, as part of the Monitoring and Observation System for the continuous assessment of the state of the Adriatic Sea, the model has been applied since mid-2017 to monitor all elements of marine litter, from litter deposited on beaches, to floating litter on the sea surface, litter sunk on the seabed, to microplastics in sediment on sandy beaches, sea surface and digestive tract of marine animals. All predicted parameters are monitored at designated locations using a specific methodology that depends on the individual group of litter that is observed/monitored and includes the determination and analysis of the status of the predicted indicators. The monitoring system is implemented at the national level. The Monitoring System ensures the fulfillment of the obligations of the RoC to protect the marine environment and implement EU maritime policies set before the RoC within the obligations of implementing the Integrated System for Monitoring and Assessing the Mediterranean Sea and Coast (Integrated Monitoring and Assessment Program of the Mediterranean Sea and Coast - IMAP) in accordance with the Barcelona Convention to which the RoC is a contracting party.

Furthermore, in the RoC, state administrative bodies, county and local government bodies and scientific and professional institutions are responsible for implementation of the key type of measures of the Program of Measures Related to the Reduction of Marine Litter in the Marine Environment.

3.2. Marine litter management in Italy[4]

Besides the application of the MSFD for the monitoring of the Marine litter, that it's performed in each Italian Region by the Regional Environmental Protection Agency but coordinated at national level by ISPRA.

As already mentioned in the chapter 2.4, before the implementation of the Salvamare law, there were only few acts that were directly tackling the Marine Litter issue:

- Dlgs 152/2006 Waste Directive: In the Article 183 b-ter 4. are defined as “urban waste” the waste of any nature or origin, that remain on roads and public areas or on roads and private areas, however subject to public use or on sea and lake beaches and on banks of waterways. This create a gap for the waste collected by the fishermen or the floating litter that should be treated as “special waste” with an higher economical cost.
- Legislative Decree 182/2003 (implementation of the EU directive 2000/59/CE) on the other hand, regulates the presence of port collection facilities for ship-generated waste and cargo residues; also in this case, the waste accidentally collected by fishermen during fishing activity is not taken into consideration by the legislation, even if it is established that fishermen are not required to pay any fees for the disposal of this type of waste in the port. The "marine litter", within the described regulatory framework, is not falling into any category of waste, is recognized and therefore treated as a special waste.

But witht the implementation of the Salvamare Law (May 17, 2022 n.60) Italian legislation made a step forward.. The aim of the Law is to contribute to the rehabilitation of the marine ecosystem and the promotion of the circular economy, as well as to the awareness of the community for the dissemination of virtuous behavioural models aimed at preventing the abandonment of waste in the sea, in lakes, rivers and lagoons and the proper management of waste.

The Act stresses the following definitions concerning inland waters:

a) "accidentally caught waste" means waste collected at sea, in lakes, rivers and lagoons by nets during fishing operations and that collected occasionally at sea, in lakes, rivers and lagoons by any means;

b) "waste voluntarily collected" means waste collected by means of waste capture systems, provided that it does not interfere with the eco-systemic functions of water bodies, and during the cleaning campaigns of the sea, lakes, rivers and lagoons referred to in letter c);

c) "clean-up campaign" means the initiative planned to clean up the sea, lakes, rivers and lagoons in accordance with the conditions laid down in Article 3;

d) "awareness campaign" means activities aimed at promoting and disseminating models behavioural virtuous prevention of the abandonment of waste at sea, in lakes, rivers and lagoons;

e) "competent authority" means the municipality having territorial jurisdiction;

f) "promoter of the cleaning campaign": the subject, among those qualified to participate in the cleaning campaigns for the sea, lakes, rivers and lagoons in accordance with Article 3, paragraph 3, which submits to the competent authority the request referred to in the aforementioned Article 3, paragraph 1;

The highlights of the Salvamare Law are the following:

1. Without prejudice to the provisions of this Article, incidental waste caught shall be treated as waste from ships within the meaning of point 3 of the first paragraph of Article 2, of Directive (EU) 2019/883 of the European Parliament and of the Council
2. The master of the vessel or the driver of the vessel calling at a port shall transfer the waste accidentally caught at sea to the port reception facility. In the case of the mooring of a vessel in areas not covered by the territorial competence of a port system authority, the territorially competent municipalities shall provide that the waste is delivered to appropriate collection facilities, whether or not temporary, fitted out near berths.

3. The master of the vessel landing in a small non-commercial port shall transfer the accidentally caught waste to port reception facilities integrated into the municipal waste management system.
4. The supply of accidentally caught waste to the port facility of collection, after weighing of the same at the time of delivery, is free of charge for the conferent
5. For the purpose of distributing the charges referred to in this Article throughout the national community, the costs of managing incidental waste caught shall be covered by a specific component added to the waste tax
6. By decree of the Minister for Agricultural Food and Forestry Policies, in agreement with the Minister for Ecological Transition, to be adopted within four months of the date of entry into force of this Act, reward measures shall be identified, with the exception of economic provisions, to the master of the fishing vessel subject to compliance with the obligations laid down in this Article, which do not affect the protection of the marine ecosystem and compliance with safety rules.
7. Waste collected voluntarily may also be collected by means of waste capture systems, provided that they do not interfere with the eco-systemic functions of water bodies, and as part of specific cleaning campaigns organised on the initiative of the competent authority. Are promoters of cleaning campaigns:

   -the managing bodies of protected areas
   -the environmental associations
   -fishermen's associations
   -fishing cooperatives and enterprises, as well as their consortia
   -sports and recreational fishermen's associations
   -sports associations of divers and boaters
   -the professional associations
   -diving and diving training centers
   -the managers of bathing establishments

-Third sector entities

-non-profit organizations of social utility

-social promotion associations

-foundations and associations with the purpose of promoting and protecting and safeguarding natural and environmental assets

-other entities identified by the competent authority.

The managing bodies of protected areas may also carry out, also in consultation with the representative bodies of fish entrepreneurs, public communication and environmental education initiatives to promote the campaigns referred to in this article.

8. In order to promote the recycling of plastics and other materials not compatible with the marine ecosystem and inland waters, the Minister for Ecological Transition shall establish the criteria and modalities for accidentally caught waste and waste voluntarily collected cease to be classified as waste
9. In order to reduce the impact of marine pollution from rivers, the District Basin Authorities shall introduce, in their planning acts, experimental measures in watercourses to capture floating waste, compatible with the needs of water and ecosystem protection
10. by 31 March 2022, the Ministry of Ecological Transition shall initiate a three-year experimental programme for the recovery of plastics in rivers most affected by this form of pollution, including by the installation of floating instruments
11. Awareness campaigns can be carried out regarding the protection of the marine environment, for the achievement of the aims expressed in the Salvamare Law and the objectives contained in the 2030 Agenda for sustainable development, adopted by the UN General Assembly on 25 September 2015.
12. In order to provide fishermen and operators with adequate information on the way in which accidentally caught or voluntarily collected waste is delivered, appropriate forms of advertising and awareness-raising by the port system authorities or by the municipalities territorially competent in the field of municipal waste management

pursuant to Article 198 of the Legislative Decree of 3 April 2006, n. 152, including through technical protocols to ensure the mapping and advertising of harvesting areas and maximum simplification for fishermen and operators

13. The Ministry of Education promotes, in schools of all levels and levels, activities aimed at making pupils aware of the importance of the conservation of the environment and, in particular, of the sea and inland waters, and the correct conditions for the transfer of waste
14. The schools also promote good waste delivery practices and the recovery and reuse of goods and products at the end of the cycle, including with regard to the reduction of the use of plastics and the re-use systems available.
15. In the Amendment to Article 52 of the code referred to in Legislative Decree No. 171 of July 18, 2005 the following words are added at the end: "also with reference to measures to prevent and combat the abandonment of waste at sea".
16. To fish farmers who, in the course of their activities, take part in cleaning campaigns or give the accidentally caught waste an environmental recognition attesting to the commitment to the environment
17. Provision is also made for municipalities to implement an incentive system for respect for the environment aimed at awarding recognition to boat owners, not engaged in professional activities, who recover and deliver ashore plastic waste accidentally caught or voluntarily collected.
18. In order to coordinate action to combat marine pollution, including that due to plastics, the Permanent Inter-Ministerial Consultation Table is established at the Ministry of Ecological Transition.
19. The Minister of Ecological Transition submit to the Chambers, by December 31 of each year, a report on the implementation of this law → We are waiting for…?

3.3. Obligations towards the EU

Based on the obligations arising from the MSFD, and as part of the process of drafting and implementing marine strategy documents, EU MS, among other things, have the obligation to carry out the following processes: identify the existing situation with marine litter (assessment of quantities, composition, distribution and sources of marine litter) on beaches, on the sea surface and on the seabed, as well as to determine the quantities of microplastics on the sea surface, in sandy sediment and in fish), to determine the good state of the marine environment (GES) related to marine litter as pressure, set targets related to marine litter, develop and implement monitoring of marine litter, and define and implement measures to reduce inputs and pressures caused by marine litter and remediation measures.

As noted, all of these tasks were carried out at the national level. Taking into account the knowledge gained during the implementation of the first MSFD cycle, it can be said that it was not possible to determine the existing status and trends for the descriptor of marine litter in the Croatian and Italian Adriatic due to insufficient knowledge about the state, quantities, properties and impacts of marine litter. Therefore, in addition to the broader MSFD objective of reducing overall marine litter in the Adriatic Sea, it is defined that there is a need to further develop indicators and methodological approaches for monitoring the quantities and trends of litter and microlitter/microplastics on the seabed, in the sea column, in the stomachs of marine organisms, as well as levels of impact on marine ecosystems and humans.

In the Adriatic Sea, it is currently not possible to determine the exact amount of litter entering the sea. There are no strategic documents nor legislative acts that refer exclusively to such litter.

3.3.1. Monitoring of marine litter in accordance with EU obligations

Marine litter has a significant impact on marine and coastal environment. The knowledge of the pressures caused by marine litter as well as awareness of the problem have increased significantly in recent times.

Monitoring the marine environment for the presence of plastic litter is a necessary part of assessing the extent and potential impact of marine litter, devising possible mitigation methods to reduce inputs, and evaluating the effectiveness of such measures. However, it is important to use consistent and reliable methods of sampling and sample characterisation (e.g. number, size, shape, mass and type of material) to obtain the greatest benefit from plastic marine litter monitoring. When setting up a sampling programme, management objectives (e.g. compliance, efficacy of reduction measures), the environmental conditions and the most appropriate indicators must be considered. Indicators are selected to describe the 'state' of the environment, such as the quantity of litter per unit of measurement (i.e. area, length, number of organisms). Generally, the measured 'state' is compared to a baseline or reference state. The techniques used and the frequency and location of sampling must be consistent to some degree to allow reliable estimates ofspatial and temporal change. The magnitude of the change to be detected, coupled with the inherent variability of the measured parameter, determines the sampling effort required to reliably detect spatial and temporal trends.

There is a growing need to develop transboundary standardized operational guidelines for marine litter survey and monitoring programmes so that litter generation on beaches and in sea can be estimated and interpreted in the context of long-term, broad-based comparative studies that will support management at both national and transboundary scale. Since marine litter management is ultimately related to social and behavioural changes, there is a need to develop or maintain public awareness and education through simpler, less rigidly structured, programmes. The intention is to promote a harmonised transboundary approach to the design of sampling programmes, the selection of appropriate indicators (i.e. type of sample), the collection of samples or observations, the characterisation of sampled material, dealing with uncertainties, data analysis and reporting of the results. We therefore reiterate the need to use the planned joint guidelines that cover all size ranges

of plastic litter encountered in the marine environment, on shorelines, floating on the sea surface, suspended in the water column, deposited on the seabed or associated with biota (ingested/encrusted/entangled). These may be used to monitor items originating from specific sources (e.g. Abandoned Lost or otherwise Discarded Fishing Gear, ALDFG) or specific items to evaluate the effectiveness of dedicated reduction measures (e.g. single-use consumer plastics, sanitary related items).

The use of the „Master List of Categories of Litter Items“ developed by the EU MSFD TG10 for recording litter items has proven instrumental in detecting the sources of litter and is rather easy to use. Therefore it is highly recommended to adopt it in the design of marine litter monitoring programmes. However, certain litter category types need to be added to the list and further refined to better capture the litter inputs from certain sources relevant to the Adriatic region and the Mediterranean.

The predicted parameters need to be monitored at designated locations by implementing a specific methodology that depends on the individual group of litter being observed/monitored, and it is necessary to include the determination and analysis of the status of the predicted indicators. Given the lack of a previous systematic database, and a short period of systematic monitoring program, our knowledge on marine litter is still very scarce. One of the main shortcomings in the evaluation of the aforementioned parameters in terms of environmental impact is the still undeveloped system of limit values, which is also expressed at the EU level. Therefore, at the moment it is still not possible to reliably express the qualification of a possible degree of burden.

4. SOURCES AND TRENDS OF MARINE LITTER IN THE ADRIATIC SEA

Inadequate waste management on land, lack of awareness, indifferent behaviour in the absence of adequate disposal systems, resulting in plastics being dumped or abandoned wherever convenient, contribute to the uncontrolled release of plastics into the environment. When plastic waste is not properly managed on land, much of it enters waterways and consequently the marine environment, where it remains for long periods of time. The input of plastic waste into the seas can also be amplified by extreme weather events, e.g., flooding, strong weather and winds, etc. The impacts of plastic litter are far-reaching, affecting marine environment and is not only felt locally, but even regionally in the case of Adriatic Sea. Many economic dependent upon clean water and a litter-free environment such as fisheries and tourism, may experience economic losses. Human health might also be affected by toxic chemicals entering water and the food chain as well as an increase in waterborne diseases, although this has not been extensively studied. Plastic pollution degrades ecosystems and affects riverine and marine species in many different ways. Therefore, in order to identify and define the problem of marine litter, it is first necessary to properly detect and define the sources, origins and methods of litter entering the Adriatic Seaso that the future fate of litter is better known.

Regardless of the source and method of maturation, marine litter is a growing environmental problem in the Adriatic Sea and a lasting environmental and sociological challenge to the surrounding states that share it. In addition to the problem of litter accumulation on beaches, the seabed, where large amounts of litter have been recorded, is also endangered. The amount and presence of plastic litter at the bottom of the Adriatic Sea is among the highest in Europe after the north-eastern part of the Mediterranean and Celtic Sea, both on the Italian[5] and Croatian[6] sides.

The area along the Adriatic Sea is densely populated and has a high level of development, tourism and industrialization. Approximately 3.5 million people live along the shores of the Adriatic Sea, with more than 50% of the population living on the Italian coast in 6 coastal cities (Trieste, Venice, Ravenna, Rimini, Ancona and Bari). The uneven distribution of the population is also characteristic of the eastern Adriatic coast, where approximately 85% of a total of 1.3 million inhabitants, are located in six large urban centers (Pula, Rijeka, Zadar, Šibenik, Split and Dubrovnik).

During the tourist season, the population increases almost six fold. If we add to this the increase of already intensive economic activities such as tourism, maritime transport (the Adriatic has a significant number of commercial and recreational vessels), fishing and aquaculture, and all this results in increased amount of waste in the marine environment. In addition to environmental waste, marine litter also has an important socio - economic impact on coastal communities that largely rely on tourism for their local development. Coastal population and intensive maritime traffic in the Adriatic have led to the accumulation of significant amounts of anthropogenic litter such as plastic, glass, wood and rubber on the coast (beaches), sea surface and seabed. The topography of this region and strong human activities pose a pronounced risk of pollution by plastic and other forms of anthropogenic litter, so marine litter is not evenly distributed in the Adriatic Sea. It accumulates mostly in the coastal areas, especially near settlements, on shipping routes or where recreational vessels operate, and on the seabed. Likewise, the open current of seawater between the Adriatic and the Ionian Sea, and thus the rest of the Mediterranean Sea, significantly leads to an increased input of floating debris which later accumulates in its individual parts.

In order to be able to identify with certainty the places and ways of accumulation of marine litter, it is necessary to determine where and how it is generated, and how it enters the marine environment, i.e. how is transferred and reaches the appropriate areas. This is necessary in order to establish effective procedures for its removal and mitigation to meet the requirements of the MSFD. Litter enters the sea from various points and diffuse sources which can be terrestrial or marine. Also, litter can travel long distances before reaching the shore or sinking to the seabed. Determining the source can be very difficult and demanding, especially if the litter remains in the marine environment for a long time. Marine litter consists not only of items that can be relatively easily identified and attributed to a specific source (e.g. ear sticks - sewage sources, cigarette butts - offshore activities, fishing gears - fishing sector), but also of individual items that may originate from various sources (plastic bottles - various activities such as coastal tourism, shipping, etc.), and indeterminate objects such as small plastic fragments that result from the disintegration of larger ones.

Such fragments can be very difficult or almost impossible to determine their initial purpose and possible origin. Furthermore, a certain areas may be exposed to pressure from waste from various

sources; local, regional or even distant, as waste can travel long distances with sea currents and winds. Due to its durability and lightness, and the ability to float (buoyancy), plastic predominant among marine litter can be transported over long distances and remain in the marine environment indefinitely, often making it difficult to assess its geographic, sectoral and temporal origin. Therefore, accurately determining the origin of the various items that make up marine litter is a difficult and complex task.

Despite the observed problems, the data on the quantities of waste entering the Adriatic, as well as on the marine litter that is there, are still incomplete, which is why estimates of the mass or amount of plastic waste in it differ greatly. One of the reasons for such differences in the estimates of the sea load with plastic waste is the insufficient knowledge of the source and origin of waste and its quantity that reaches the sea, and different computer models for its calculation.

4.1. Sources of marine litter in the Adriatic Sea

Products or objects become litter when accidentally or intentionally discarded, abandoned or lost in public space and the natural environment during any phase of their cycle; production, use, disposal, treatment. It is common to define the economic sector (e.g., fisheries, maritime, coastal tourism, waste management, landfills) responsible for the initial generation of litter as a source. However, this definition of source does not explain much about why and how an object ends up in the sea. In order to effectively implement measures to combat marine litter pollution, we need to understand the reasons why objects became waste and how they ended up in the marine environment. The term *source* refers to the economic sector or human activity from which the litter originates, while the method of release/maturity refers to the mechanism or manner in which a particular item leaves the system of use in a natural or urban environment and becomes an environmental problem. Thus, the geographic origin can be defined by the geographic location of the source and the place where the discharge occurred. This origin may be, and often is, far from the sea or the place where the object was recorded.

The ability to differentiate between locally, regionally and globally generated litter is important when deciding on appropriate measures to prevent marine litter in a particular area. Waste loads in a

given area may be of local origin - dumped directly on the beach or into the sea in the area - or transmitted from inland by rivers and runoff, or from remote areas by sea currents and prevailing winds. Sometimes rivers or sea currents are described as sources. However, these are actually *transport mechanisms/transmission routes* by which litter is transferred to the marine environment from various terrestrial and marine sources. We consider *roads* to be the physical and/or technical way by which litter enters the marine environment. According to defined sources, marine litter can be classified into several main categories which mainly include: 1. coastal activities (including inadequate waste management, tourism and recreational activities), 2. fisheries and mariculture, 3. maritime affairs, 4. unregulated landfills, 5. personal hygiene and sewage sources (e.g. ear sticks, tampons, etc.), 6. related to medical activities, 7. agriculture, 8. unspecified sources. This classification is based on the assumption that certain items found in marine litter are commonly or frequently used in certain sectors (e.g. tourism) or discharged into the environment through clearly defined routes (e.g. sewer drains).

Litter enters the sea from various sources: by direct and indirect inputs into the sea from the land, most often through rivers, drainage systems or wind, and activities at sea. The main terrestrial sources of waste are coastal activities, i.e. unregulated landfills in urban areas on the seacoast or river banks, drainage systems and untreated wastewater, rivers, rainwater and wind from the coast and touristic activities. Marine resources are considered to be all types of litter from maritime facilities, as a result of activities such as fishing and mariculture, maritime transport (including activities in ports and port areas), platforms for the exploitation of mineral resources and tourism activities as main sources. According to research conducted during the DeFishGear project (Vlachogianni et al., 2017), most of the litter found in the Adriatic Sea, and on the coast, are anthropogenic polymeric materials, i.e. plastics representing 91,4% and 91,1% of floating and beach litter, respectively. Potential sources of litter in the Adriatic refer to litter from coastal activities, as well as from urban and industrial areas, maritime transport, fisheries and aquaculture, and in some areas tranboundary litter.

Assigning sources to the collected litter items was a rather challenging task since a considerable amount of items at national and regional level could not be attributed to a source. In particular, the contribution of the fisheries and aquaculture sector to the marine litter issue could be

identified with a very high level of confidence. According to the study by Vlachogianni et al. (2017), litter from shoreline sources including poor waste management practices, tourism and recreational activities, accounted for 33.4% of all litter collected on beaches; 38.5% from the sea surface and 36.6% from the seafloor (bottom trawl surveys), which is far below the Mediterranean average of 52% (UNEP/MAP MEDPOL, 2011) and the global average of 68.2% (Ocean Conservancy, 2011). At a regional level, smoking related items accounted for 7.8% of all items collected, which is much lower than the 40% reported for the Mediterranean. Sea-based sources of marine litter (fisheries and aquaculture, shipping) vary between countries from 1.54% to 14.84%, with an average of 6.30% at regional level for beach litter. Fisheries and aquaculture related items accounted for 8.75% of all floating litter at regional level while their share in the total number of items collected by the seafloor trawl surveys and seafloor visual surveys with scuba/snorkelling were 17% and 6%, respectively. This is much higher than 5% recorded for the Mediterranean Sea (UNEP/MAP, 2015) and confirms the already large body of evidence that these two sectors are largely responsible for marine debris.

Table 1 provides examples of how the previously defined concept of sources can be applied to different items of marine litter frequently found on the coast. For the same type of object, the sources, methods of discharge and routes may differ depending on geographic location, human activities and behavior, infrastructure and transport mechanisms that may influence the composition of litter for a particular site.

Table 1. Example of source, method of release, geographical origin, route of entry and mode of transfer for some types of marine litter items.

Type of object	Source	Methods of release	Geographical origin	Route of entry	Transport mechanism
plastic bags	coastal tourism / recreation	discard on the beaches	local (beach,coastal settlement)	direct entry (if on the beach), wind blowing (from the coastal settlement)	wind, sea currents
	consumers	rejection (e.g. on the street, etc.)	local (coastal settlement), remote (remote settlement)	direct input (wind blowing - from a coastal settlement), remote - wind blowing and / or river yield	wind, river currents, sea currents
	litter management	exhaust from utility containers	beaches, coastal resorts	direct input (wind blowing -from a coastal settlement), remote - wind blowing and / or river yield	wind, river currents, sea currents
hygienic ear sticks	consumers	reckless throwing into sewer by dumping in toilet bowl	households	sewage systems and / or rivers	sewage discharges and / or rivers, sea currents
cigarette filters	consumers	reckless rejection into environment	local (beach, coastal settlement)	direct input	sewage discharges and / or rivers, sea currents

4.2. Vectors of marine litter transfer in the Adriatic Sea

The growing coastal populations and their lifestyles are changing, intensive economic activities such as tourism and recreation are increasing, and maritime transport, fisheries and aquaculture, have also led to an increased litter input into the Adriatic coastal and marine environment. Waste can reach the sea in various ways, both from near and far areas: through rivers and/or rainwater, sewage systems or could be blown away by wind.

Rivers can be key input vectors by which litter from various terrestrial sources enters the marine environment. The most important rivers related to sediment input in the Adriatic are located in the northwestern part (Po, Adige, Isonzo), while in its southeastern part the Neretva and the Buna - Bojana basin play an important role in the transfer of transboundary litter. The Po River, which flows into the Adriatic through a wide delta in the Veneto region and whose valley is the main industrial zone in Italy, is under great pressure from various types of pollutants such as heavy metals, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAH), organic halides and plastic materials. The Neretva River is an internationally important wetland delta of about 12,000 ha, also included in the Ramsar Convention. With its 230 km long course it is the largest river on the eastern part of the Adriatic basin that passes through cities and settlements in Bosnia and Herzegovina and Croatia before flowing into it,. The mentioned rivers usually have the highest flow in autumn, which is reflected in the amount of litter brought from the mainland to the Adriatic Sea in that period. As continuous monitoring is not carried out in these areas, we do not have exact data from relevant sources, and even if there are any, these are only very rough estimates.

Population growth along the coastlines and intensive economic activities, especially tourism, maritime transport, and fisheries and aquaculture, have resulted in increased waste input into the coastal and marine environment of the Adriatic Sea. According to the Revision of the Marine Environment and Coastal Zone Management Strategy documents from 2019, an important feature of the coastal area is the high share of casual residents (up to 27% of entire coastal area population), according to some estimates. Distinct seasonal variation in population (more residents in summer and fewer in winter) has significant implications on life dynamics in the coastal area, and poses a major

challenge to the efficiency and sustainability of utilities and all other infrastructure and service systems for citizens. The average annual per capita amount of municipal waste in the coastal area of the Republic of Croatia was about 590 kg/dwelling/year, which is 50% more than the average of the Republic of Croatia and 23% more than the European Union average. One of the key factors for this situation is tourism, which generates an estimated 8% of the total municipal waste, and over 95% of overnight stays take place in the coastal area. The island area presents a particular challenge for litter management, due to the additional cost of transporting litter from the island to the mainland.

Maritime traffic in the Adriatic Sea is constantly growing every year. The majority of freight traffic is international, while most of the passenger traffic is domestic[7]. The increase in maritime traffic puts an additional burden on the existing litter management system, especially related to the insufficient information of those involved in the process about the methods of litter management from vessels/ships.

4.3. Marine litter transfer vectors in the Adriatic Sea

Once the litter reaches the sea, its further distribution is largely determined by the hydrographic transport mechanisms represented by circulation in the seas; especially waves and sea currents, and tidal regimes. Sea currents are responsible for the movement and transport of objects of all sizes and at all depths in the marine environment, including litter in the sea. Depending on the composition and weight of the object, its distribution in the water column is different; for example while plastic floats at the seasurface due to its composition and light weight , metal, which is heavier than plastic, sinks and accumulates on the seabottom. Crucial factor that affects i the movement of water masses is the geographic position of a particular area. Knowing how litter is distributed in the sea and where it finally ends up is critical to understanding its further fate and the impact on marine ecosystems. In the Adriatic Sea, the movement of water masses results in inflow currents from Otranto Strait, along the Croatian coast to the northern part of the Adriatic, and outflow current along the Italian coast back to Otranto.The greatest pressure caused by marine litter is therefore in the southern part of the Adriatic, where the impact of rising currents are greatest.

The general surface circulation in Adriatic is characterized by a cyclonic circulation with a northerly inflow along the east coast (eastern Adriatic Current, hereinafter: EAC) and a southerly outflow along the west coast (western Adriatic Current, hereinafter: WAC). In winter, the broad easterly current is more pronounced, while in summer the westerly current prevails. The circulation of Adriatic surface water is driven by the inflow of fresh water from the Po River, the inflow of Mediterranean water through the Otranto Strait and secondary rivers (i.e. Buna-Bojana shed, Neretva River,...), while the variability is related to wind influences. There are three cyclonic gyres pronounced in open waters, one in the northern shallower part, one in the central and one in the southern, deepest part of the Adriatic basin. The circulation in the central part, above the Jabuka Pit, is subject to seasonal variations in response to changing wind and heat fluxes throughout the year[8] Due to the influence of sea currents and wind, litter accumulates significantly in the certain locations. The Croatian coast is additionally burdened by the input of transboundary litter coming from neighboring countries, which is most pronounced in the southern Dalmatian counties. Extreme cases of marine pollution occurred in late 2010 and 2017 in Dubrovnik-Neretva County, when the coastal and island areas were polluted with large amounts of marine litter from the confluence of Albanian rivers, Otranto and the Neretva River.

4.3.1 Marine litter hotspots and accumulation sites

In the last few decades, the problem of marine litter, especially of plastic origin, has increased around the globe, and the Adriatic region is not excluded. About 80% of marine litter originates from the mainland and is usually brought to the sea by wind (e.g. from the landfills), rivers, sewage discharges, waste industrial water or is deliberately thrown into the sea. It is of great importance to identify pollution hot-spots and sensitive areas to prioritize marine litter reduction efforts. The highest litter densities in the Adriatic were observed in areas under great influence of human activities in the populated coastal areas – aquatorium near the biggest cities and around nautical tourist destinations. Coastal and channel waters are loaded with greater variety of litter mostly from nearby mainland, while more distant areas are dominated by floating plastics originating from distant coastal sources. Plastic materials float and take longer to sink to the seabed and their distribution primarily depends

on the currents. Occasionally, large quantities of floating litter are discharged into Adriatic through rivers, due to uncontrolled dump yards along the river banks. On the southern shores of eastern Adriatic coast, due to geographical position and orientation towards currents, winds and waves, the appearance of large amounts of litter is observed repeatedly. In addition to the general surface cyclonic circulation in the Adriatic, several cyclonic gyres occurs, of which the most prominent are those in south and central Adriatic. Both areas, Jabuka and South Adratic Pit, are significant fishing areas and important shipping routes. Therefore, we can assume that the fishing and merchant ships are the main source of industrial waste and these areas are the main sink for marine litter.

5. PROPOSALS FOR THE OBJECTIVES OF THE JOINT CROSS-BORDER MARINE LITTER MANAGEMENT PLAN

Goal 1. Establish and strengthen regional cooperation in addressing the marine litter issues

Goal 2. Define the status of marine litter (sources, transmission vectors and hotspots)

Goal 3. Improve the regional information exchange system

Goal 4. Continuous implementation of joint educational activities and information

Goal 5. Strengthen cross-border cooperation in solving marine litter problems

The proposed objectives of the Transboundary Marine Litter Management Plan (hereinafter: Plan) are in line with relevant international strategic and planning documents, from the Regional Plan for Marine Litter Management in the Mediterranean to the European Strategy for Plastics in the Circular Economy. Also, the Plan includes basic guidelines of previously prepared and adopted strategic and planning documents related to local development and especially for waste management in local and regional self-government units in the coastal area and on the islands.

5.1 Suggestions for other possible goals:

1. Goal: **Establish a responsible and appropriate level of regional cooperation**. Responsability for marine litter management is sometimes divided between authorities, and in some cases the level of competence can be quite uncertain and/or ambiguous. Responsibilities and authorities need to be clarified to ensure that management is efficient and effective. Different public authorities may have partial responsibility for select components, resulting in a division of resources and ineffectiveness in overall marine litter management. Collaboration between NGOs and government agencies, where authority is clearly defined, should be encouraged to strengthen the management of regional efforts.
2. Goal: **Effective Legislation and Enforcement**. Existing waste management legislation needs to be evaluated for its effectiveness and and levels of implementation, as legislation in both countries does not adequately address marine litter. In most cases, substantial legislation and regulations exist

but are poorly enforced for variety of reasons. MARPOL Annex V needs to be assessed to determine if it is functioning effectively in terms of reduction/prevention of ocean-based sources of marine litter. Lack of an integrated approach in dealing with different types of waste, and the lack of cooperation between authorities responsible for waste management, can have a negative impact on waste management and monitoring. Evaluate existing legislation, regulations and enforcement practices that deal with marine litter and strengthen or enact new legislation/regulations as appropriate.

3. Goal: **Assessment of Environmental Impacts of Marine Litter**. Joint marine research needs to be strengthened to determine the various impacts of marine litter on the coastal and marine ecosystems and other indicators. Analysis of marine litter sources coupled with the hydrographic movements of the sea masses can be used to monitor the impacts and areas that are particularly vulnerable to the accumulation of marine debris. The economic impacts need to be assessed to help develop and prioritise response for industries and the public. Social impacts, such as health issues, should also be assessed to inform policymakers and the public about the need for effective management.

4. Goal: Development and harmonization of **National Monitoring Programmes**. Both countries have monitoring programmes to address marine litter issue which they continuously implement in their chosen areas. However, there is still need for closer networking and data exchange in the common regional interest for a continuous assessment of coastal areas and seas, in particular with regard to the sources, origins, transmission vectors and accumulation hotspots of marine litter. Data collection and its joint interpretation would be a positive step for the Adriatic region and would help to conserve the coastal areas more effectively.

5. Goal: **Education and Awareness Campaigns**. Education and awareness campaigns need to be developed and implemented to encourage increased involvement of NGOs and the private sector in the development and programming stages. Educational components need to be more accessible to facilitate the integration of the waste management into the educational curriculum. Therefore, education should target young population and wider public to raise the level of responsibility to a higher level.

6. Goal: Increase engagement in **Recycling Programs**. More recycling program activities need to be developed to minimize the amount of litter entering the waste stream and later the sea. Activities need to be developed to encourage the community to separate their waste on land in a larger scale. The recycling programs need to be monitored to see how effective they are in reducing the waste.

7. Goal: **Affordability of Resources**. A financial basis for joint cooperation efforts needs to be established. Funding is also important for providing training courses for government authorities, NGOs and private sector to take part in the monitoring and recycling programs.

6. PROPOSED MEASURES OF THE PLAN IMPLEMENTATION

Table 2. Measures for achieving the strategic objectives of the Plan management of marine litter.

No.	Measures	Description	Project holders	Potential funding sources	Deadline
1.1.	Establishment of an expert working body for marine litter	Establish working body for marine litter and define procedure rules			2021
1.2.	Joint IT / CRO actions to collect lost or discarded fishing gear	The measures are aimed at reducing the intentional or accidental input of waste into the marine system	Fisheries sector	Counties/EU funds, other domestic and international sources	Continuously
1.3.	Joint coordination of intervention actions for marine litter collection	The measure is applied in case of sudden sea pollution by marine litter			
1.4.	The measure includes the provision of preconditions and protocols for the systematic collection of data within information systems with the use of digital technologies	The measure includes provision of preconditions and protocols for the systematic collection of data within information systems with the use of digital technologies			Continuously
1.5.	Joint IT / CRO organization of information and educational campaigns for the interested public	The measure includes the implementation of activities envisaged by the Communication Strategy, especially the organization			Continuously

	on the topic of prevention of marine litter	of information and educational campaigns			
1.6.	Strengthen scientific research on new technologies for the prevention and / or disposal of marine litter	The measure envisages the cooperation of sectoral competent authorities in encouraging scientific research, development of new innovative solutions for the reduction and disposal of marine litter			Continuously
1.7.	Continuous communication and cooperation in international organizations solving problems on marine litter management at European, sub-regional, regional and global levels	The measure includes communication and cooperation in international organizations in solving problems on marine litter (EU, UNEP/MAP, UN)			Continuously

7. LITERATURE

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