Implementation of the ecosystem approach
in the Adriatic through marine spatial planning

Towards a Marine Good Environmental Status (GES) in Montenegro

Assessment of Marine Litter (EO10)

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Preamble

The pollution of the sea and the ocean as a consequence of human activity is to a large extent created by various activities. The main threats to marine ecosystem are eutrophication, overexploitation of its resources, global climate change, the spread of invasive species, coastal erosion etc. Lately, an increasing impact on the health of marine ecosystems and biota is marine litter, which, in addition to all mentioned, creates additional pressure for already endangered organisms, habitats and the overall ecosystem health.

Changes in marine ecosystem usually have several causes, and their joint impact, together with degrading pressures on marine biota, has a critical role in maintaining diversity of species, ecosystem health and achieving Good Environmental Status (GES). Seas and oceans hide huge quantities of litter under the surface, representing a global landfill for decades. Waste accumulation and poor pollution prevention is a threat that will increasingly cost the generations to come.

This document deals with the state of the marine ecosystem in Montenegro in relation to the pressure of marine litter pollution. The document is part of the project "Implementation of ecosystem approach in the Adriatic Sea through marine spatial planning" (GEF Adriatic) co-financed by the Global Environment Facility (GEF). The conclusions/results given in this document can be used for prevention of further introduction of marine litter, reduction of its total amount and achievement of GES.

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Introduction

UNEP/MAP Barcelona Convention and its seven Protocols provide the political and legal framework for the protection of the marine environment and the coastal areas of the Mediterranean region. Contracting Parties to the Barcelona Convention have committed to implement the ecosystem approach (EcAp) in the Mediterranean with the ultimate objective of achieving GES of the Mediterranean Sea and coast. Assessment of GES should be based on integrated quantitative assessment and monitoring of the marine and coastal environment of the Mediterranean, as agreed within the Integrated Monitoring and Assessment Programme and related Assessment Criteria (IMAP).

As part of the IMAP, CP to the Barcelona Convention agreed to join forces in order to ensure that "properties and quantities of Marine Litter (ML) do not cause harm to the coastal and marine environment." The process toward reaching this state includes the definition of GES, targets setting, monitoring, assessment and the implementation of measures.

Assessment of GES for Montenegro in relation to marine litter pollution is aligned with the IMAP and MSFD requirements. It was done by processing available data for several indicators, based on existing baseline values and environmental objectives.

This document includes the following chapters:

1. GES assessment policy context
2. Pressures and impacts of marine litter
3. Elements of GES assessment
4. Baseline: current state assessment
5. GES assessment gaps and needs

1 GES assessment policy context

In this chapter, most important international regulations, conventions and recommendations that need to be followed and implemented in national legislation are listed. These documents are important in order to adequately conduct national monitoring programme of marine litter and to comply with the recommendations of the Barcelona Convention in order to achieve GES, as well as to ensure adequate reporting to the European Union.

1.1 Mediterranean level

At the **Mediterranean level**, the **Barcelona Convention** is the most important regional instrument aimed at protecting and promoting sustainable development of the Mediterranean marine and coastal environment. In 1976, 16 Mediterranean countries (among them former Yugoslavia, of which Montenegro was a part) and the European Union signed the "Convention for the Protection of the Mediterranean Sea from Pollution "(i.e. the Barcelona Convention), which entered into force in 1978. The Barcelona Convention and its Protocols, together with the Mediterranean Action Plan (MAP) form a part of the Regional Marine Environment Program (United Nations Environment Program – UNEP).

Of the seven protocols of Barcelona Convention, the most relevant to marine litter is the **Land-based Sources and Activities Protocol (LBS Protocol)**. It states that parties undertake to eliminate pollution deriving from land-based sources and activities, in particular to phase out inputs of the substances that are toxic, persistent and liable to bio accumulate listed in its Annex I, including litter. In addition, the **Dumping Protocol** has relevance to marine litter. It states that dumping of wastes and other matter is prohibited, except for dredged material, food waste, platforms and other man-made structures, and inert geological materials.

The 19th Meeting of the Contracting Parties (COP 19) of the Barcelona Convention, held in February 2016, adopted the **Integrated Monitoring and Assessment Programme (IMAP)** of the Mediterranean Sea and Coast and Related Assessment Criteria (Decision IG. 22/7). IMAP is a key achievement for the Mediterranean region as it enables, for the first time, quantitative and integrative analysis of the state of marine (and coastal) environment, covering different environmental components, including marine litter. It is based on regionally agreed common indicators, targets and good environmental status descriptions, with principles and clear timeline for its implementation. IMAP builds on the previous Decisions of the Contracting Parties and the expert level discussions, including Decision IG.21/3 on the "Ecosystem Approach including adapting definitions of Good Environmental Status (GES) and targets" (the EcAp Decision). Therefore, IMAP and the common indicators are the outcome of the Ecosystem Approach Process and the coordinated efforts of the Contracting Parties at all levels. The ultimate goal of the IMAP is to assess the status of the Mediterranean Sea and coast, as a basis for enhanced action.

In line with IMAP, Guidance Factsheets for Marine Litter (Ecological Objective – EO 10) were developed, reviewed and agreed by the Meeting of the Ecosystem Approach Correspondence Group on Marine Litter Monitoring (CorMon on Marine Litter Monitoring) (Madrid, Spain, 2017), the Meeting of the MED POL Focal Points (Rome, Italy, 2017) and by the 6th Meeting of the Ecosystem Approach Coordination Group (Athens, Greece, 2017). The Guidance Factsheets for Marine Litter provide concrete guidance to the Contracting Parties on a way to support implementation of their respective national monitoring programmes in line with IMAP requirements. These factsheets were used during the elaboration of the Mediterranean Quality Status Report 2017 (MED QSR 2017).

Moreover, the Data Standards (DS) and Data Dictionaries (DD) for Common Indicators related to Marine Litter were reviewed and agreed during the Meeting of MED POL Focal Points (Istanbul, Turkey, 2019) and the 7th Meeting of the Ecosystem Approach Coordination Group (Athens, Greece, 2019).

In 2016, the 19th Meeting of the Contracting Parties proposed the marine litter Baseline Values (**Decision IG.22/10** – Annex II). These were established for IMAP Common Indicator 22 (i.e. beach macro-litter), Common Indicator 23 (i.e. seafloor macro-litter, and floating micro- and macro-litter), and Candidate Indicator 24 (i.e. affected (%) sea turtles and ingested (gr) marine litter). The 2016 Baseline Values were complimented with marine litter environmental reduction targets (Decision IG.22/10 – Annex III) including a reduction target of 20% for beach marine litter by 2024, and significant and measurable decrease of other marine litter types. Updated Baseline Values for IMAP EO10, together with subsequently recommended related Threshold Values, were presented during the 2019 Regional Meeting on Pilot Projects and Assessment Tools for Marine Litter in Athens, Greece (**UNEP/MED WG.476/3**). On the occasion of the 2020 CorMon Meeting (**UNEP/MED WG.482/23**) proposed baseline and threshold values were reviewed and subsequently approved only for the CI22, due to lack of data for the remaining indicators.

In addition, in 2013 the Contracting Parties to the Barcelona Convention and its Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities (LBS) adopted the first ever **Regional Plan for the Management of Marine litter** – RPML (EU Regulation 21/7), legally binding since 2014. This Plan envisages a number of programs and measures, a timeframe and implementation, all with the aim of reducing the amount and adverse impact of marine litter on the marine and coastal environment.

With the aim to address problem of marine litter on regional level, several "responses" have been developed that will make easier implementation of the Regional Marine Litter Management Plan in the Mediterranean Sea:

- Guidelines for supporting RPML implementation (e.g. fishing for litter);
- Baseline values and targets for reduction of the amount of marine litter;
- A platform for regional cooperation on marine litter in the Mediterranean Sea;
- Regional Action Plan on Sustainable Production and Consumption (SCP);
- Integrated Monitoring and Assessment Program (IMAP).

RPML obliges the signatory countries to commit themselves and implement measures to tackle marine litter, in particular including prevention, reduction, monitoring and evaluation of the amount of marine litter. The plan also encourages the development of national and regional cooperation among the main actors in the implementation of the plan, the coordination of joint efforts and the maximization of results.

1.2 European level

The **Marine Strategy Framework Directive (MSFD)** is the environmental pillar of Europe's maritime policy designed to create a framework for sustainable use of Europe's marine waters (2008/56/EC, 2010/477/EC, 2017/845/EC and 2017/848/EC). The MSFD aims to achieve Good Environmental Status (GES) of the EU's marine waters by 2020. In order to achieve GES by 2020, each Member State is required to develop a strategy for its marine waters (or Marine Strategy). To help Member States interpret what GES means in practice, the Directive sets out, in Annex I, eleven qualitative descriptors which describe what the environment will look like when GES has been achieved. One of the Descriptor relates to marine litter (Descriptor 10).

Following the revision of Commission Decision 2010/477/EU, the GES targets and indicators originally defined to achieve GES of the marine ecosystem in relation to marine litter were amended. Namely, the achievement of GES was originally planned through the implementation of operational objectives (10.1 and 10.2) and indicators (10.1.1, 10.1.2 and 10.2.1). Commission Decision (EU) 2017/845 revised and amended Commission Decision 2010/477/EU, in order to change and define new criteria. Indicators were changed and primary and secondary criteria were defined for Descriptor 10 (in accordance with Commission Decision 2017/848) (Table 1). **Primary criterion** is considered as a criterion for mandatory application by Member States in defining a set of properties typical of good environmental status in order to assess to what extent good environmental status is achieved. **Secondary criterion** is to complement a primary criterion or when, for a particular criterion, the marine environment is at risk of not achieving or not maintaining good environmental status.

Based on regional or sub-regional cooperation, MS should establish national threshold values, directional trends or pressure-based threshold values as proxies.

The difference in indicators and criteria is that Decision 2017/848 defines the obligation for Member States (MS) to establish threshold values for primary criteria through cooperation at Union level, taking into account regional or subregional specificities. The main difference between primary and secondary criteria is that no justification has to be provided from MS in case of secondary criteria is applied.

The spatial and temporal scales of assessment addressed by the New GES Decision constitute important link with the activities of UNEP/MAP aimed at defining the geographical and temporal scales for monitoring and assessment for the Ecological Objectives and Common Indicators of IMAP (Decision IG.23/6 – COP20) (see chapter 4).

Table 1.1. Operational objectives, indicators, primary and secondary criteria for marine litter

Objectives	Indicators	Primary criteria	Secondary criteria
10.1. Characteristics of litter in the marine and coastal environment	10.1.1. Trends in the amount of litter washed ashore and/or deposited on coastlines, including analysis of its composition, spatial distribution and, where possible, source.	D10 C1 – 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.	
	10.1.2. Trends in the amount of litter in the water column (including floating at the surface) and deposited on the sea- floor, including analysis of its composition, spatial distribution and, where possible, source.	D10 C2 – 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.	
	10.1.3. Trends in the amount, distribution and, where possible, composition of micro-particles (in particular micro- plastics).		
10.2. Impacts of litter on marine life	10.2.1. Trends in the amount and composition of litter ingested by marine animals (e.g. stomach analysis).		D10 C3 – 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.
			D10 C4 – 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)

1.3 National level (Montenegro)

Montenegro was declared an ecological country by the Declaration of ecological State of Montenegro, adopted on 20th September 1991 by the Parliament of the Republic of Montenegro. This fact points to an even greater obligation of the state to adequately assess the status and apply all possible legal measures to improve the state of the marine environment.

There is a significant number of Laws that are related to the conservation of the environment, nature, coastal and sea management and waste management. Some of the most significant ones will be mentioned here, which are considered (if supplemented) to have an important role in the prevention of marine litter pollution and measures for its troubleshooting.

1. Law on nature protection (Official Gazette of Montenegro No 54/16);
2. Law on Environment (Official Gazette of Montenegro no 52/16);
3. Law on the protection of the marine environment (Official Gazette of Montenegro no 73/19);
4. Law on waste management (Official gazette of Montenegro No 64/11, 39/16);
5. Law on Strategic Environmental Assessment (Official Gazette of Montenegro No. 80/05, 59/11, 52/16);
6. Law on integrated preservation and Control of environmental protection (Official Gazette of Montenegro No. 80/05, 54/09, 40/11, 42/15, 54/16);
7. Law of the Sea (Official Gazette of Montenegro No. 17/07,06/08, 40/11)M
8. Law on marine fisheries and mariculture (Official Gazette of Montenegro, No. 56/09, 47/15);
9. Law on Protection of the Sea from Pollution from Vessels (Official Gazette of Montenegro No. 20/11, 26/11, 27/14).

As part of the Law on the Protection of the Marine Environment, the following directives have been transposed: Directive 2008/56/EC of the European Parliament and Council establishing a framework for Community action in the field of marine environmental policy; 2017/845/EU of the European Parliament and the Council amending Directive 2008/56/EC and Commission Decision 2017/848/EU laying down criteria and methodological standards on good environmental status (GES) of the marine environment.

Although there is no term “marine litter” mentioned in the Law, compliance with the mentioned directives will enable the implementation of national monitoring programme, preventive and protective measures of the marine environment against marine litter pollution.

In addition to legal regulations, this document includes analyses of national strategies and action plans which should address the problem of marine litter and provide a list of measures and methodologies for problem solving. Among the most important are:

1. National Strategy with action plan for transposition, implementation and enforcement of the EU acquis on environment and climate change 2016-2020;
2. National Strategy for sustainable development until 2030;
3. Waste Management Plan of Montenegro for the period 2015-2020;
4. National Action Plan (NAP) for the implementation of the LBS protocol and its regional plans in the framework of the SAP-MED with the aim to achieve good environmental status for pollution-related EcAp ecological objectives;
5. National Strategy for Integrated Coastal Zone Management (2015).

Of the listed documents, only NAP describes in detail all the requirements of international conventions and regulations that should be implemented in Montenegro related to marine litter issue. Document gives the timeframe proposal for the implementation of preventive measures and activities for the prevention, preservation and improvement of marine environment. A certain part of the activities envisaged by NAP started with the realization during 2019, but with a significant delay compared to the proposed timeframe. It is most noteworthy to note that without recognizing marine litter in the Montenegrin legislation, it is not possible to adequately implement the envisaged measures.

2 Pressures and impacts of marine litter

Marine litter includes several main litter categories: artificial polymer material (plastics), rubber, clothing/textiles, paper/cardboard, metal and wood. Although each category can pose problems in the marine environment, plastics, due to their lightweight and durable nature, have become the most prevalent, widespread element of marine litter pollution (Derraik, 2002, Wright *et al.*, 2013).

Jambeck *et al.* (2015) estimated that between 4.8 and 12.7 million tons (MT) of waste reached the oceans in 2010. In 2017, 348 million tons of plastics were produced globally (PlasticsEurope, 2018) and in the next two decades, the amount of plastics produced is expected to double (Geyer *et al.*, 2017). Recent research on the amount of plastic entering the Mediterranean Sea has found that the quantities are worrying, i.e. that in the Mediterranean annual plastic leakage is about 229,000 tonnes (low and high leakage estimates equate to 150,000 and 610,000 tonnes year^{-1} respectively) (Boucher and Billard, 2020). The same document indicates that Montenegro is among the top 10 countries contributing in the total waste leakage per capita into the Mediterranean Sea, with 8.7 kg of plastic leakage per capita annually, as a consequence of mismanaged waste.

As the time required to decompose plastic in the sea is measured in hundreds of years, the annual amounts that reach the sea accumulate and create an increasing problem.

Negative impacts of marine litter are reflected in:

- Significant negative impacts on marine ecosystems (through entanglement of organisms, ingestion, cover, as a vector for transmission of pollution and invasive species), with fatal outcomes for numerous marine organisms (fish, birds, turtles, mammals), and even the survival of species;
- Direct threat to human health through pollution of marine organisms used for food (impact of microplastics), pollution of areas used for recreation (i.e. injuries to sharp objects on the beach, etc.); and
- Damage to economic activities that depend on the preserved marine environment – primarily the tourism and fisheries sectors.

Thus, the impact of marine litter is multidimensional and can be divided into three main categories: environmental, social and economic.

Environmental impact means, as mentioned earlier, mortality or sub-lethal effect on organisms due to entanglement or ingestion, unintentional interventions in abandoned fishing gears and physical damage of benthic communities. **Social impact** includes a reduction in the recreational, aesthetic or educational value of areas such as beaches, due to the risk to human health as well as a negative impact on navigation while sailing. The **economic impact** is reflected in direct costs and loss of income, which in turn affects a large number of marine activities such as aquaculture, fisheries, transport, tourism and possible damage to ships.

In order to assess the level of pressure of litter entering the sea, it is necessary to analyse the sources of its generation. Previous researches has shown that more than 60% of sea floor litter and more than 70% of beach and floating litter in Montenegro are land-based, (Vlachogianni *et al.*, 2017) and are a consequence of negligent behaviour of the local population, tourism and recreational activities, but above all poor waste management in general. It was not possible to determine the origin of about 30% of the analysed litter, while the rest originates from the shipping and fisheries sectors.

Poor land waste management, lack of legislation dealing with marine litter issue, poor behaviour patterns, lack of prevention, mitigation and removal measures of marine litter are the umbrella problems that prevent the reduction of total marine litter amount.

One of the methodological approaches to support the integrated assessment of the predominant pressures and their impacts on the marine and coastal environment is the Driver-Pressure-State-Impact-Response (DPSIR) model (EEA, 1999). DPSIR is a useful adaptive management tool to analyse environmental problems and to map potential responses (Ness *et al.* 2010; Gari *et al.*, 2015). DPSIR-based assessments support the integrated assessment under IMAP of the predominant pressures and their impacts on the marine and coastal environment, to assess the state of the marine environment and as a consequence, build policy responses (e.g. measures and priority actions) to address the drivers (e.g. economic sectors and activities) causing the degradation of the marine ecosystem and its ecosystem services (UNEP/MED WG. 463/5). DPSIR has therefore been acknowledged and approved by the Meeting of the CorMon on Pollution Monitoring as an appropriate approach to assess the state of the marine environment under IMAP. The proposed approach can be used to cross-map all the anthropogenic activities with significant contribution to pressures with the Common Indicators used for its monitoring and assessment.

Additionally, MSFD Common Implementation Strategy (European Commission, 2018) also recommends that certain topics in national text-based GES assessment reports could be addressed using the DPSIR framework and that indicators should cover all aspects of the DPSIR framework, where applicable.

In this chapter the DPSIR framework is used to assess the causes, effects, and management measures to improve the state of marine environment resulting from marine litter pollution. Responses are given as “short-term” and “long-term” solutions in order to prevent, eliminate and reduce the pressures and consequences of marine litter pollution in Montenegro (Table 2.1).

Table 2.1. DPSIR framework for marine litter problem in Montenegro

Drivers	Pressures	State	Impact	Relative impact of drivers (low, medium, high)	Responses
Human uses and activities: 1. Increased tourism and recreational activities; 2. Increasing exploitation of natural resources; 3. Aquaculture; 4. Transport, construction near the coast; 5. Mismanaged waste; 6. Riverine inputs of marine litter, especially in river basins. Environmental drivers: 1. Dynamic hydrography and strong seawater currents that cause accumulation of marine litter 2. Weathering and fragmentation of plastics	Deposition of plastics on coastlines; mismanaged waste; excessive consumption of natural marine resources; lack and/or insufficient waste collection, processing and disposal; Based on data from Jambect *et al,* 2015 It is estimated that 15-40% of the total poorly managed plastic waste enters the sea annually in Montenegro, i.e. that by 2025 the plastic waste ending up in the sea will amount between 1086-2897 tons per year. Boucher and Billard (2020) confirmed this fact and calculated that total leakage of waste in the sea is 2,146 tons per year in Montenegro. The watersheds hosting major rivers in the Mediterranean are prone to considerable leakage of marine litter (from 1,000 to 7,000 tonnes year $^{-1}$) (Boucher and Billard, 2020). Between 1.15 and 2.41 million tonnes of plastic litter enters the ocean per year as a result of mismanaged waste (Lebreton LCM *et al.*, 2017)	Beach litter Average value of 531.9 items/100 m of beaches. High concentration of marine litter on the coast and streams; loss in tourism revenue due to the reduction of aesthetic value of the urban, coastal, estuaries and riverine areas; increased risk for beach-tenants and beach-goers. Floating litter Average value of 131.08 items/km^2 Entanglement or ingestion by wildlife, damage on recreational and fisherman vessels, damaged fishing gears and contamination of catch/fishing gear, the reduction of aesthetic value Sea floor litter Average value of 290 items/km^2 High concentration of marine litter on the sea floor, habitat degradation and loss, socio-economic losses in the fisheries sector.	Polluted beaches and coast with environmental impact on marine ecosystem such as spreading of diseases (vector); chemical effects; loss of ecosystem services; economic impacts on tourism through littered shores and losses in tourism sector, impact on human health through injuries Environmental impact on marine ecosystem through entanglement or ingestion, possible accumulation of smaller particles in food chains, possible eco-toxicological impacts on species¸ bioaccumulation and transfer of plastics in food webs; degradation of plastic to micro-particles; poor social acceptability of Montenegro as high tourism destination; transmission vector of invasive species. Impacts on coastal habitats through habitat degradation or loss; artificial habitats for the settlement of alien species; entanglement and ingestion; covering of sessile individuals; economic impacts through depletion of commercial fish and shellfish stocks.	Impact of human uses and activities: 1. High 2. Medium 3. Low 4. High 5. High 6. High Impact of environmental drivers: 1. Medium 2. Medium	Short-term solutions: Legislation improvement and introduction of penalty provisions in legislation for any littering in the marine environment. Improve land waste management; source oriented (for example solid waste collection, good landfill management, recycling opportunities, plastic bag bans); mitigation and awareness rising; beach clean-up campaigns. Implementation of port reception facilities for marine litter. Fishing for litter activities. Long-term solution: Move towards circular economy - reduce, reuse, recycle, redesign, recover—through awareness raising; behavioural change (consumers and producers); reduce single use plastic; use of alternative materials such as biodegradable plastics or textiles.

3 Elements of GES assessment

3.1 GES assessment indicators and thresholds

Methodology of GES assessment

Good Environmental Status (GES) is defined as the ecological status of marine waters that are ecologically diverse and dynamic and seas that are clean, healthy and productive, while the use of the marine environment is at a sustainable level, thus protecting the potential and activities of present and future generations.

Contracting Parties to the Barcelona Convention commit to follow an ecosystem approach to achieve GES of its marine waters, by working at the regional (Mediterranean) and EU level. In order to support determining GES, criteria and methodological standards on GES as well as specifications and standardized methods for monitoring and assessment were adopted. The IMAP and MSFD provide such a framework for coordinated monitoring programmes, which will deliver data to assessing whether GES, and associated environmental targets, are being achieved.

In order to contribute to the determination of a set of GES characteristics and enable assessment of the extent to which GES is being achieved, definition of baseline and threshold values are mandatory.

According to definition provided by the UNEP/MAP Informal Online Group on Marine Litter in 2015[1], "*A baseline is a description of environmental state at a specific point against which subsequent values of state are compared. It may refer to a specified level of an impact or a pressure and act as a reference against which limit can be set or trends for the assessment of GES. Baselines can be derived from reference conditions, initial assessment values, the present state or a potential/predicted issue.*"

The Joint Research Centre (JRC) of the European Commission (EC) introduced a similar definition, addressing marine litter: "*A baseline value for marine litter refers to the information related to marine litter abundance that can be used as reference point in time in order to test the achievement of quantitative litter reduction goals (JRC, 2019).*"

The New GES Decision (2017/848) of the European Commission (EC) provides a definition for the Threshold Values for marine litter: "*Threshold value means a value or range of values that allows for an assessment of the quality level achieved for a particular criterion, thereby contributing to the assessment of the extent to which good environmental status is being achieved.*"

Although certain baseline and threshold values have already been defined at the Mediterranean and the EU level, it is necessary to have a database including at least four years data collection in order to adequately assess trends and possibly correct baseline and threshold values. For this reason, baseline and threshold values have not yet been defined for most Marine Litter indicators.

Therefore, the assessment of GES in this document will be done in accordance with the already defined and accepted baseline and threshold values, while for those indicators for which values have not yet been defined and accepted, GES will not be assessed.

Compatibility between IMAP and MSFD indicators/criteria as a basis for determining baseline and threshold values

UNEP/MAP IMAP EO 10 (Ecological Objective) **Marine litter** prescribes the obligation to achieve GES in such a way that litter on the coast and in the sea does not adversely affect the coastal and marine ecosystem (Table 3.1).

[1] UNEP/MED WG.411/Inf.10: First Report of the Informal Online Group on Marine Litter. Meeting of the Integrated Monitoring and Assessment Group (Athens, Greece, 30 March – 1 April 2015).

Table 3.1. Common indicators under the EO10 – Marine litter

Ecological Objective	IMAP Indicators
EO 10 Marine litter Marine and coastal litter do not adversely affect coastal and marine environment	Common Indicator 22: Trends in the amount of litter washed ashore and/or deposited on coastlines
	Common Indicator 23: Trends in the amount of litter in the water column including microplastics and on the seafloor
	Candidate Indicator 24: Trends in the amount of litter ingested by or entangling marine organisms focusing on selected mammals, marine birds, and marine turtles

Ecological objective 10 is compatible with the descriptor D10 of the EU Marine Strategy Framework Directive (MSFD). CI 22 and CI 23 are compatible with D10C1 and D10C2 of MSFD (in accordance with the Commission Decision (EU) 2017/848) which are primary criterion; Candidate Indicator 24 is compatible with D10C3 and D10C4 of MSFD (in accordance with the Commission Decision (EU) 2017/848) which are secondary criterion.

Although new GES criteria and IMAP indicators are highly compatible, the differences relate to the separation of micro and macro-litter in the MSFD criteria, i.e. D10C1 and D10C2 are separated based on the type/size of marine litter (macro and micro litter). Difference between IMAP common indicators CI22 and CI23 are based on the different marine compartments (coasts, water column and sea bottom), and not taking into account micro-litter on coasts.

An important difference refers to the size, i.e. the MSFD criteria define the minimum size of macro litter of 2.5 cm, while the IMAP indicator defines the minimum size of macro litter as 0.5 cm. These differences can significantly affect the difference in the definition of threshold values, and consequently the assessment of GES. When it comes to micro-litter, a maximum size of 5 mm is common for both, EU MSFD and IMAP indicators/criteria.

It is important to note that the monitoring forms and relevant reporting templates of IMAP CI22 and EU MSFD D10C1, for beach marine litter are harmonized, i.e., the total amount of recorded marine litter items on a 100 m stretch are expressed as item/100 m, including baseline and threshold values for the common indicator assessment. Also, for monitoring forms and relevant reporting templates of IMAP CI23 and D10C1, for seafloor marine litter are harmonized as well and the total density of recorded marine litter items found on the seafloor are expressed as item/km2, including baseline and threshold values for the assessment of the common indicator.

Determination of Baseline and Threshold Values at Mediterranean level (IMAP)

For each country and subregion, the basic statistical values have been calculated together with average and median values corresponding to the total amounts of marine litter found in each survey by year and then by country. Data distribution for IMAP CI22 (beach marine litter) is very irregular; and thus, **the median value is proposed as the most representative.**

Descriptive statistics were applied for the most common beach marine litter types, which together represent 80% of the total abundance of all items in each survey within a certain period (80% higher types of litter); thus, eliminating irrelevant information that could distort data analysis as shown in Table 3.2.

Table 3.2. Top-X descriptive statistics parameters by country

Country	Average	Standard Deviation	Median
Albania	597	291	529
Algeria	618	541	450
Cyprus	287	384	149
France	730	1,334	340
Greece	1,199	1,373	460
Israel	122	137	89
Italy	498	600	307
Libya	1,748	970	1,542
Malta	151	228	61
Montenegro	1,117	1,433	574
Morocco	1,373	1,292	932
Slovenia	463	321	387
Spain	244	315	113
Total Average	702	709	455

The Top-X calculation was conducted for each consecutive year for the period 2016-2018 (i.e. 2016, 2017 and 2018), and for each Country-SubRegion (e.g. IT-AD, IT-CM, IT-WM, etc).

The parameter used in the analysis (median) was defined and a weighing factor was applied. The weighing factor has been calculated as the percentage of the length of the coast corresponding to each country within its subregion and within the entire Mediterranean coast (JRC, 2019). This approach significantly increased the data representativeness. The baseline values for beach marine litter were calculated as depicted in Table 3.3..

Table 3.3. Median by sub-region and Mediterranean

	Median (item/100 m)	
Mediterranean Sub regions	100% data set	80% -Top X
WM	314	236
CM	808	638
AD	423	337
EM	205	104
Mediterranean Sea average	**438**	**329**

For **IMAP Common Indicator 22 (beach marine litter), the proposed, updated Baseline Value for the Mediterranean is 329 item/100 m.**

To calculate the threshold value, it was proceeded with the estimation of the 1st, 5th and 10th percentiles of the baseline results. The lowest values generated amongst the 1st, 5th and 10th percentiles are selected as threshold value against which to compare the state of beach marine litter in the Mediterranean, following the marine litter descriptor aim. In order to give each sub-region an equal contribution, it is proposed to give each an equal weight while calculating the corresponding threshold value/s in accordance with the above percentiles. For **IMAP Common Indicator 22 (beach marine litter), the proposed Threshold Value is 59 items/100 m**.

In order to reach achieve GES, a reduction percentage should be applied in order to give overall information about the reduction level that should be applied on the baseline value in order to comply with the proposed/calculated Threshold Value (TV). The reduction percentage is calculated as per Van Loon *et al.* (2019) as follows:

Reduction Percentage = ((median – TV)/median) x 100

Accordingly, it is found that the reduction percentage between the proposed Baseline Values and the proposed Threshold Value for the Mediterranean is approximately 82%.

Assessment of GES for CI 22, can be done in accordance with baseline and thresholds values (Tables 3.4 and 3.5) defined in 2020 for the Mediterranean Sea, based on UNEP/MED WG.482/23. For common indicators 23 and 24 baseline and threshold values are proposed (UNEP/MED WG.482/23). However, due to the lack of data it was concluded that Contracting Parties still cannot adopt the proposed values (UNEP/MED WG.482/23). **Therefore, the GES for Montenegro in this document will only be assessed for CI 22, and not for the other two indicators.**

Table 3.4. Marine litter baseline and threshold values (2020) defined and proposed for the Mediterranean Sea, based on UNEP/MED WG.482/23.

Common Indicator	Baselines (average)	Baseline (median)	Threshold
CI 22 – Beaches (items/100 m)		329	59
CI 23 – Floating litter (items/km^2)	47*	44*	5*
CI 23 – Sea floor litter (items/km^2)	464*	161*	54*

**due to lack of sufficient data these values have been proposed but not yet adopted*

Table 3.5. Marine litter environmental targets (Decision IG.22/10)

Marine Litter EcAp Indicators	Type of Target	Reduction (Targets)
Beaches (Common Indicator 22)	% decrease	20% by 2024
Floating Litter (Common Indicator 23)	% decrease	Statistically significant
Sea Floor Litter (Common Indicator 23)	% decrease	Statistically significant

Determination of Baseline and Threshold Values at EU level (MSFD)

Baseline values for marine litter on beaches have also been established at EU level (Hanke, G. *et al.*, 2019) (Table 3.6).

Table 3.6. Median, Mean and Trimean results of data aggregation at EU level. Baseline values for **FISH** – Fishery related litter types, **SUP** – Single Use Plastic, **TA** – Total Abundance (according to Hanke G. *et al.*, 2019)

		N of litter items/100 m shoreline		
Year	Group	Mean	Median	Trimean
2015	TA	545	154	231
2015	FISH	101	16	30
2015	SUP	202	53	87
2016	TA	532	148	206
2016	FISH	111	20	31
2016	SUP	157	58	74
2015-2016	TA	575	149	256
2015-2016	FISH	107	22	31
2015-2016	SUP	201	58	89

It is important to note that cigarette butts/filters, paraffin/wax and litter types < 2.5 cm have been omitted from the calculations of basic values (and threshold values) due to the extremely high values of those sub-categories in majority of surveyed beaches used for definition of baseline values. Those items were excluded in order to obtain more robust values for Total abundance (TA) of marine litter on beaches. Furthermore, cigarette butts were not included in the group of single use plastics (SUP). Calculation of extrapolation to 100 m of beaches showed that very abundant types of marine litter (like cigarette butts) can be erroneous and not comparable on a European scale, and for that reason they are omitted from the calculation of baseline and threshold values.

Considering the implications of various factors, such as the robustness of the method against extreme values but also the transparency of the calculation method, the TG ML (MSFD Technical Group on Marine Litter) agreed to use the median values as the calculation method to average beach litter data across surveys (Hanke, G. *et al.*, 2019).

The baseline dataset was developed within the TG ML. Calculation of the 10th percentile of the EU baseline dataset resulted in a value of **13 litter items per 100 m** of coastline length. Further consideration of the 95% confidence intervals of the TV (threshold value) and assessment value, respectively, led to a **final TV of 20 litter items/100 m beach length**, which corresponds to the 15th percentile value of the EU baseline dataset.

The setting of TVs commits to a level of litter pollution above which it is agreed that GES has not been achieved. These values cannot be conclusive on some aspects but aims to consolidate the discussion towards the setting of TVs for ML criteria. D10C1 and D10C2 are to be established at European Union level, D10C3 and D10C4 at a regional or sub-regional level.

3.2 Scales of assessment

When it comes to the scale of assessment, all assessments have been done at the national level. Although marine litter is a problem that for the majority of cases cannot be observed only at the national level, as it knows no borders, the available data are presented only for the territorial sea and coast of Montenegro. In addition to the assessment at the national level, for each group of processed data (indicators), available data at the level of the Adriatic and the Mediterranean Sea were presented (depending on availability).

Given the fact that the spatial distribution of marine litter is significantly affected by sea currents, the scale of assessment should be established for certain indicators in the description of criteria and methodological standards for GES assessment (Table 3.7).

What appears as a problem for an adequate assessment of GES is the lack of a series of data (at least the six-year assessment cycle) on the basis of which trends would be determined. Nevertheless, for all indicators covered in this document, GES was assessed on the basis of available data and available baseline and threshold values.

Table 3.7. Criteria and methodological standards for GES assessment for EO10 Marine litter in Montenegro. Based on: IMAP, 2016; Barcelona Convention 19th COP Decision IG.22/7; UNEP/MED WG.482/23, 2020; Commission Decision (EU) 2017/848; EO =Ecological objective, CI = common indicator

Criteria			**Methodological standards**	
Elements/Parameters	**Indicator with related GES definition (minimum requirements for achieving GES)**	**Indicator measurement and thresholds**	**Scale of assessment**	**Use of criteria / Target**
Marine litter related to EO10				
CI22 Beach litter: Trends in the amount of litter washed ashore and/or deposited on coastlines (EO10);				
Selected beaches in the area of Boka Kotorska Bay and open part of Montenegrin coast	GES definition IMAP: Number/amount of marine litter items on the coastline does not have negative impacts on human health, marine life, and ecosystem services. GES criteria MSFD: 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.	What is monitored: ▪ Distribution of beach litter expressed as number of items/100 m and total weight/100 m of transect ▪ CCI (Clean Coastal Index). Proposed Baseline: Baseline on Mediterranean level **329 items/100 m of beach transects** (UNEP/MED WG.482/23, 2020) . Threshold: TV on Mediterranean level – **149 litter items/100 m beach length** (Hanke *et al.*, 2019). Reduction trend in the number of/amount of marine litter (items) deposited on the coast. Real trend should be based on at least the six-year assessment cycle. Threshold: TV on Mediterranean level – **59 litter items/100 m beach length** (UNEP/MED WG.482/23, 2020). TV on EU level – **20 litter items/100 m beach length** (Hanke *et al.*, 2019).	Adriatic level assessment (sub-regional) and national level	Amount of beach litter per main litter categories and its distribution (number of items/100 m of transect), and whether the threshold values set have been achieved (% decrease).

Criteria			Methodological standards	
Elements/Parameters	**Indicator with related GES definition (minimum requirements for achieving GES)**	**Indicator measurement and thresholds**	**Scale of assessment**	**Use of criteria / Target**
Marine litter related to EO10				
Floating litter and sea floor litter – Trends in the amount of litter in the water column including microplastics and on the seafloor (EO10)				
CI 23 Floating litter				
Selected transects in the area of Boka Kotorska Bay	GES definition IMAP: Number/amount of marine litter items in the water surface and the seafloor do not have negative impacts on human health, marine life, ecosystem services and do not create risk to navigation. GES criteria MSFD: 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.	What is monitored: Distribution of floating litter at 3 transects in the area of Boka Kotorska Bay, expressed as N items/km^2 of sea surface Proposed baseline (44–47 items/km^2) and threshold values (5 items/km^2) are not yet adopted due to the scarcity of available data.	Adriatic level assessment (sub-regional) and national level (for Boka Kotorska Bay area)	Amount of litter items per main litter categories and its distribution (N items/km^2), and whether the threshold values set have been achieved (statistically significant % decrease).
CI23 Sea floor litter				
MEDITS surveys (10 transects in open sea), fisheries surveys (Boka Kotorska Bay area) and visual census (scuba diving)	GES definition IMAP: Number/amount of marine litter items in the water surface and the seafloor do not have negative impacts on human health, marine life, ecosystem services and do not create risk to navigation. GES criteria MSFD: 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	What is monitored: Distribution of sea floor litter at 10 transects in the open waters of Montenegro and 2 transects in Boka Kotorska Bay area, expressed as N items/km^2. Proposed baseline (51–61 items/km^2) and threshold values (4 items/km^2) are not yet adopted due to the scarcity of available data.	Adriatic level assessment (sub-regional) and national level (open sea and Boka Kotorska Bay area)	Amount of litter items per main litter categories and its distribution (N items/km^2), and whether the threshold values set have been achieved (statistically significant % decrease).

4 Baseline: current state assessment

In accordance with the recommendations of Decision IG.22/7, for the estimation of GES of marine environment in Montenegrin waters, following data were used: available data for beach litter (in the area of Boka Kotorska Bay and for the rest of Montenegrin coast), sea floor litter (the area of Boka Kotorska Bay and for the rest of Montenegrin coast) and floating litter (for the area of Boka Kotorska Bay). The assessment of GES was made on the basis of available data collected through different international projects (EU IPA DeFishGear project, MEDITS surveys and national fishery resources research and UNEP/MAP "Adopt a beach" project).

UNEP/MAP and the Italian Ministry for Environment, Land and Sea Protection (IMELS) have signed in September 2016 a cooperation agreement for implementation of specific pilot projects such as the project "Adopt-a-beach". This specific project aims, on the one hand, at keeping beaches clean, and, on the other hand, at raising awareness and educating citizens on marine litter in Albania, Bosnia and Herzegovina and Montenegro. (UNEP/MED WG.452/5)

4.1 Beach litter

Since the analyses of marine litter on Montenegro beaches refer to different years, different periods and sampling dynamics, as well as different beaches, comparative data are presented in accordance with defined indicators.

Figure 4.1. Beach litter survey in Montenegro

4.1.1 Generals status, trends and GES assessment

Within the **IPA EU DeFishGear** project two beaches were monitored by seasonal dynamics during 2014 and 2015. In order to compare litter abundance in the Bay area and open sea area, two beaches were selected based on the influence of the open waters (Blatna beach in the area of Boka Kotorska Bay and Kamenovo beach which is located at open part of Montenegrin coast – Figure 4.2).

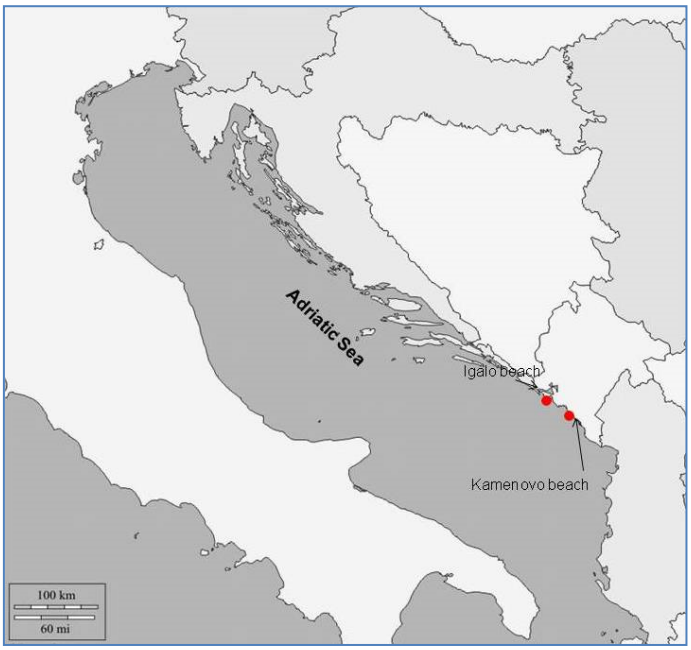

Figure 4.2. Two beaches (Igalo and Kamenovo) monitored for marine litter during the DeFishGear project

Results from all four seasons showed that most dominant type of litter belongs to plastic with 75.30%, followed by metal 7.78%, paper 5.10%, glass/ceramics 4.05%, textile 3.34%, wood 2.90%, rubber 1.24% and other 0.28%. Average number of marine litter items for both beaches was 0.37 items/m^2 (374.2 items/100 m stretch). The top 20 litter item categories accounted for 85.4% of the total recorded litter, with cigarette butts and filters being by far the most abundant litter item accounting for 40.8% of the sampled litter. According to clean coastal index (CCI) Kamenovo beach belong to „dirty" beaches (CCI = 10.5), while Igalo – Blatna beach belongs to „clean" beaches (CCI=4.4). According to the CCI scale values from 0–2 indicate very clean beaches, 2–5 clean, 5–10 moderately clean, 10–20 dirty and > 20 extremely dirty beaches (Alkalay *et al.*, 2007).

Within the **UNEP/MAP** „**Adopt a beach project",** two beaches were monitored, from which the same beach was selected as in the DeFishGear project (Blatna beach) while different beach was chosen for the open sea of Montenegrin coast – Jaz beach (Figure 4.3). These two beaches were chosen due to the proximity of the river mouths to the sea.

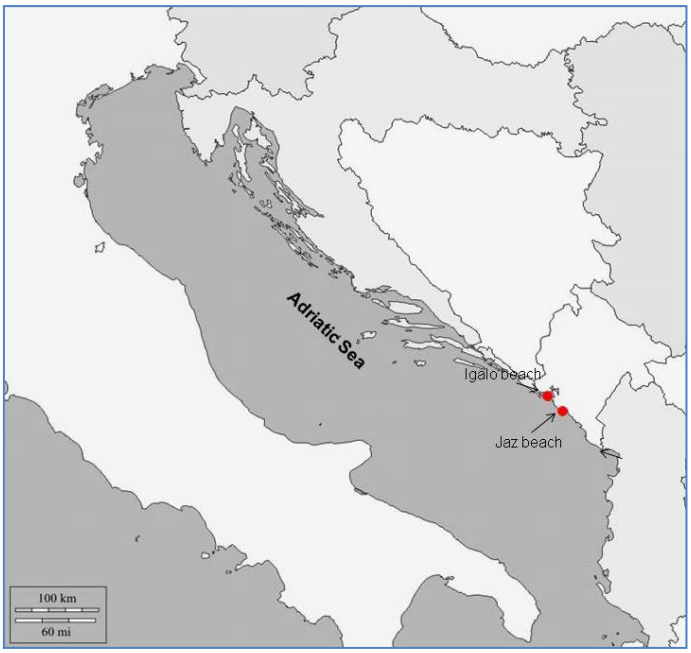

Figure 4.3. Two beaches (Igalo and Jaz) monitored for marine litter during UNEP/MAP Adopt a beach project

Obtained results indicate a fairly high level of beaches pollution by solid waste during all investigated seasons. On Jaz beach during all three seasons it was found in total 4,227 items/100 m with total weight of 48.4 kg, while on Blatna beach it was found in total 3,831 items/100 m with total weight of 85 kg. **Average abundance of marine litter during all three seasons was estimated to be 0.35 items/m² (350 items/100 m stretch) and 0.85 items/m² (850 items/100 m stretch) on Jaz and Blatna beach, respectively.** According to CCI Jaz beach belong to moderately "clean" beaches (CCI = 7), while Blatna beach belong to "dirty" beaches (CCI = 17.14).

The largest percentage share of marine litter belongs to APM on both beaches with cumulative percentage of 90.6% and 79.11% of total litter on Jaz and Blatna beach, respectively.

Table 4.1. Average values of beach litter calculated for all surveyed seasons

Beach name	Month/year of sampling	Beach type	N of items per 100 m stretch (average for all seasons)
Kamenovo beach	10/2014, 01/2015, 04/2015, 07/2015	Semi-urban	520
Igalo – Blatna beach	10/2014, 01/2015, 04/2015, 07/2015	Urban	220
	10/2018, 12/2018, 05/2019		850
Jaz beach	10/2018, 12/2018, 05/2019	Semi-urban	350

The existing data indicate that beach litter pollution is above the proposed baseline and threshold values (according to UNEP/MED WG.482/23 and Hanke *et al.*, 2019), and for the amount of litter on the beaches, expressed as the number of items/100 m, it can be said that the GES has not been achieved. Detailed results are presented in Table 4.2 and 4.3.

The following table provides available data on the amount of beach litter for the Adriatic-Ionian region (Table 4.2). The data indicate that in most countries the amount of beach litter has a growing trend, which certainly points to the fact that the issue of marine litter is unresolved and that GES is not achieved in all countries if the values are compared with the defined baseline and threshold values at the EU level.

Table 4.2. Comparative data of beach litter abundance (average N of items/100 m²) in the Adriatic-Ionian region

Country	N of items/100 m² 2014/2015 (average)	N of items/100 m² 2017/2018 (average)	References
Albania	220	130	Vlachogianni *et al.* 2017, Vlachogianni *et al.*, 2019
Croatia	2,920	3,350	Vlachogianni *et al.* 2017, Mokos *et al.* 2019
Italy	280	760	Vlachogianni *et al.* 2017, Vlachogianni *et al.*, 2019
Greece	240	1,680	Vlachogianni *et al.* 2017, Vlachogianni *et al.*, 2019
Montenegro	370	600	Vlachogianni *et al.* 2017, Vlachogianni *et al.*, 2019
Slovenia	490	320	Vlachogianni *et al.* 2017, Vlachogianni *et al.*, 2019

Table 4.3. GES assessment for beach litter pollution according to Decision IG.22/7, UNEP/MED WG.482/23, 2020 and EU baseline and threshold values (Hanke *et al.*, 2019). The mean values for all surveyed seasons are presented.

Area	N of surveys	Min	Max	Average litter abundance N of items/ 100 m	Median litter abundance (N of items /100 m)	Baseline values (UNEP/MED WG.482/23, 2020) – median)	Baseline values EU level (median abundance)	Threshold value (Mediterranean level – UNEP/MED WG.482/23, 2020)	Threshold value EU level	GES UNEP/MED WG.482/23, 2020	GES (Hanke *et al.*, 2019)
Boka Kotorska Bay – Igalo beach	7	72 82*	1,896 1,906*	522.3 671.3*	217 448*	329*	149	59*	20	NO	NO
Open sea – Kamenovo and Jaz beaches	7	171 193*	547 3,533*	308.5 842.9*	271 412*	329*	149	59*	20	NO	NO

* – *values with included cigarette butts and filters*

4.2 Floating litter

Since the data on floating macro-litter in Montenegro refer to only one year of seasonal surveys, comparative data for the Adriatic and Mediterranean Sea are also presented.

Figure 4.4. Floating macro-litter

4.2.1 Generals status, trends and GES assessment

First floating macro-litter survey was carried out in the area of Boka Kotorska Bay during October 2014, January 2015, April 2015 and July 2015. Those surveys were performed within the IPA EU DeFishGear project on three transects (Figure 4.5) using methodology developed under the project.

Figure 4.5. Three transects monitored for floating litter during the DeFishGear project

The average density of floating macro-litter during autumn 2014 was 75.06 items/km^2; during winter 2015 124.91 items/km^2, during spring 2015 it was 167.9 items/km^2 and during summer 2015 it was 156.43 items/km^2. **Average value of floating macro-litter abundance for all four seasons is 131.08 items/km^2**. The most abundant litter category was artificial polymer material (plastics) with contribution of 81.99% for all investigated seasons.

Semi-enclosed area of the Boka Kotorska Bay is isolated from the influence of open waters and litter items found are not expected to be related to major transportation mechanisms, fishery sector or shipping. It is more likely that source of floating macro litter is consequence of shoreline, tourism and recreational activities.

Due to the data scarcity on the basis of which baseline and threshold values could be proposed and agreed, the assessment of GES for floating litter is not possible at this stage.

The following table provides available data on the amount of floating macro-litter in the Mediterranean (Table 4.4). The data indicate that the Adriatic Sea is one of the most polluted seas when it comes to marine macro-litter pollution.

Table 4.4. Comparative data of floating macro litter (average N of items/km^2) in the Mediterranean

Country/area	Year	Minimum detectable size class	N of items/km^2 (average)	References
Western Mediterranean	2006 – 2015	> 1 cm	15 ± 23	Di-Méglio and Campana, 2017
Western Mediterranean	2013	2 – 10 cm	0 – 162	Suaria and Aliani, 2014
Adriatic Sea	2014 – 2015	2.5 – 5 cm	260 ± 596	Zeri *et al.*, 2018

4.3 Sea floor litter

The data on sea floor litter in Montenegro presented here refer to the area of open waters of Montenegro and the area of Boka Kotorska Bay. Additionally, the available data for the Adriatic and Mediterranean Sea area are presented, for comparative purposes.

Figure 4.6. Sea floor litter

4.3.1 Generals status, trends and GES assessment in the open sea

Data on the amount, type and spatial distribution of marine litter on the seabed for the open sea of the Montenegrin coast were collected during the monitoring of fishery resources (MEDITS research) on a total of 10 transects during the three research years (2014, 2015 and 2016). The research was conducted by the research vessel "Pasquale e Cristina" at the same positions during the August each year using a specially designed bottom trawl net used by all other Mediterranean countries. In order to estimate the density of litter (expressed as the number of items/km^2 or kg/km^2), an analysis was performed using the "swept" methodology. Marine litter was classified into six basic categories (plastic, rubber, textile, metal, glass/ceramics, other), while within each category a detailed classification was made in accordance with the MEDITS protocol (MEDITS-Handbook. Version n. 8, 2016).

A total of 454 items of marine litter were found, which was categorized in detail in accordance with the MEDITS protocol. Litter was found on all investigated transects. The total density of litter ranged from 10.8 – 1407 items/m^2, with an **average value for all researched years of 290 items/km^2.**

In the context of weight, the most dominant category of litter belonged to plastic, with a percentage of 77.4%, 84.2% and 69.05% for 2014, 2015 and 2016, respectively. The total weight of plastic litter ranged from 0.81-699 kg/km^2 (for 2014), 0.6-103.8 kg/km^2 (for 2015) and 1.41-498.8 kg/km^2 (for 2016). The spatial distribution of sea floor litter by categories is shown in Figure 4.7.

The analysis of the mean values of the total litter by weight showed an average pollution of 89.64 kg /km^2, with the largest share belonging to the category of plastics (73.4%) and rubber (16.7%).

The largest amount of plastic, and at the same time total litter ("hot spots") were found in the area between Petrovac and Sutomore and in the area between Bar and Ulcinj at depths between 50 and 65 meters (Figure 4.7). The category of rubber is present both in shallower parts (up to 80 meters depth) and in the bathymetric zone of 200-500 and over 500 meters depth. The largest amount of rubber was found in the area between Petrovac and Bar in the bathymetric zone up to 100 meters depth.

Due to the data scarcity on the basis of which baseline and threshold values could be proposed and agreed, the assessment of GES for sea floor litter in the open sea of Montenegro is not possible at this stage.

The following table provides available data on the amount of sea floor litter in the Mediterranean (Table 4.5). The data indicate that the Adriatic Sea is one of the most polluted seas when it comes to marine litter pollution.

Table 4.5. Comparative data of sea floor litter abundance (average N of items/km^2) in the Mediterranean

Area	Average litter abundance	% plastics	Reference
South-eastern Adriatic	290 items/km^2, 89.64 kg/km^2	84.1%, 73.4%	This document
North and central Adriatic (western part)	85 kg/km^2	34%	Strafella *et al.*, 2015
North and central Adriatic (western part)	913 items/km^2, 82 kg/km^2	80%, 62%	Pasquini *et al.*, 2016
Sicilian channel	66 items/km^2	55%	Fiorentino *et al.*, 2015
Adriatic-Ionian	510 items/km^2, 65 kg/km^2	89.4%	Vlachogianni *et al.*, 2017
Sardinia (GSA[2] 11)	39 items/km^2	58%	Spedicato *et al.*, 2019
Lionski Zaliv (GSA[1]7)		99%	
Eastern Corsica (GSA[1] 8)	534 items/km^2	33%	
Cyprus (GSA[1] 25)	198 items/km^2	35%	
Aegean Sea (GSA[1] 19)	136 items/km^2	50%	
Northern and central Adriatic (eastern part) (GSA[1] 17)	112 items/km^2	45%	

[2] GSA – Geographical Sub-Area (Resolution GFCM/33/2009/2)

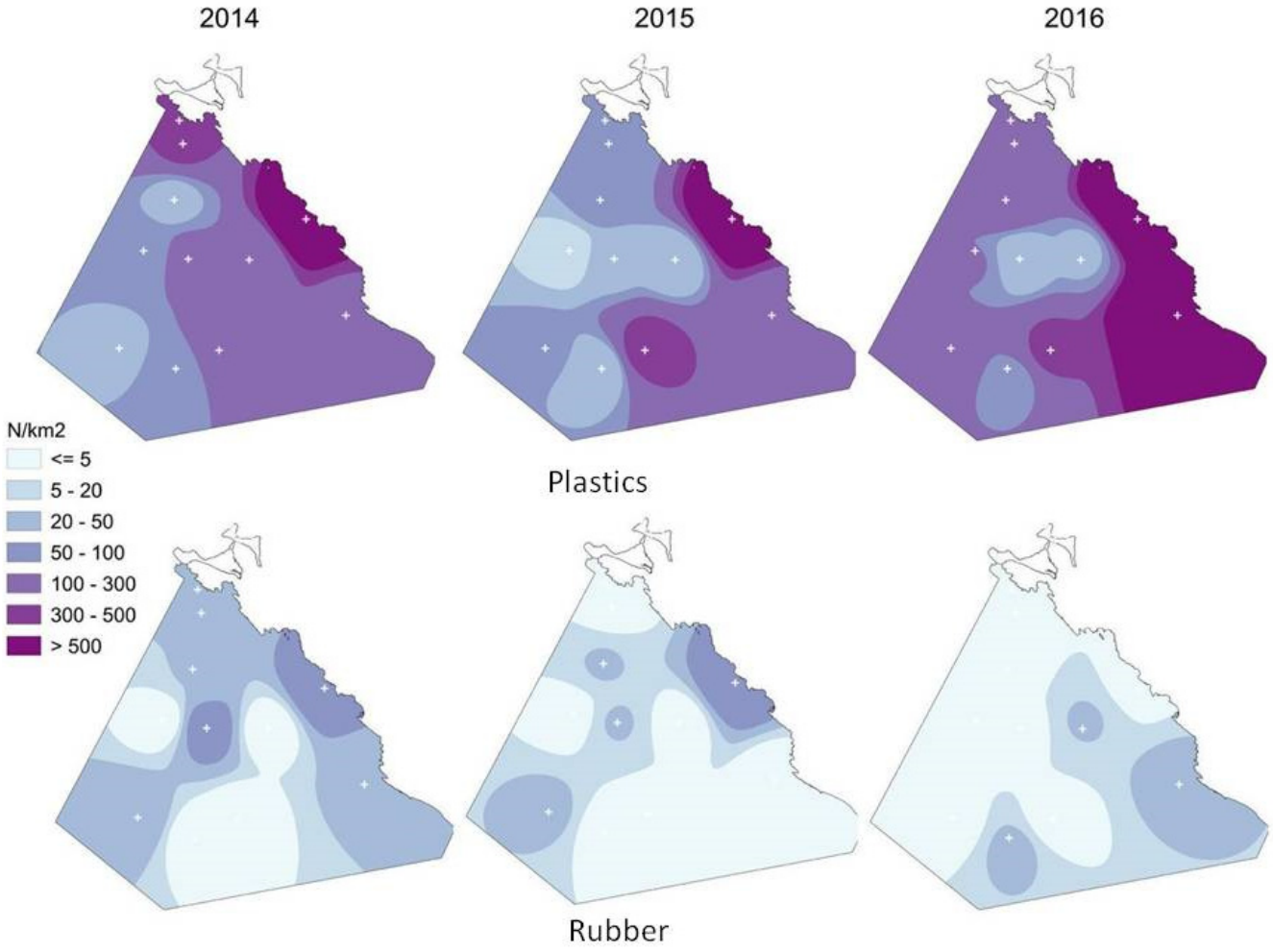

Figure 4.7. Spatial distribution of sea floor litter in the open sea of Montenegro Source: State and Pressures on the Marine Environment of Montenegro Source: UNEP/MAP-PAP/RAC and MESPU; in preparation, 2021; GEF Adriatic project

4.3.2 Generals status, trends and GES assessment in the Boka Kotorska Bay area

Data on the amount, type and spatial distribution of marine litter on the seabed were also processed for the area of the Boka Kotorska Bay. The monitoring was conducted as part of the research of fishery resources of the Institute of Marine Biology for the area of the Kotor and Risan Bays during June and July 2014.

For the area of Herceg Novi Bay and Tivat Bay, a rough expert assessment of the amount of litter was made, based on the analysis of data collected by trawling in the area of the entrance to Boka Kotorska Bay, data from underwater clean-up actions and collection of abandoned fishing gears, taking into account the amount of litter collected in Kotor -Risan Bay.

Unlike the MEDITS research, when monitoring litter in the Boka Kotorska Bay, only data on litter weight were taken, without monitoring the number of items of litter by the litter categories.

In the context of weight, the most dominant litter category belongs to rubber, with a percentage share of 38.38% for all transects. The total weight of rubber ranged from 402-723 kg/km^2. Out of a total of five researched transects, no rubber was found on two. A slightly smaller share (36.29%) belong to plastic litter, which was found on all research transects with a total

weight in the range of 29-402 kg/km^2. It is followed by the category of metal with a percentage share of 24.27% and a weight in the range of 0.94-804 kg/ km^2. Metal was also found on all investigated transects.

The analysis of the mean values of sea floor litter in the context of weight, an average litter pollution in the area of the Boka Kotorska Bay was calculated to be 165.90 kg/km^2.

Significant amounts of litter was found on all transects, so it can be said that the entire research area is a "hot spot" in terms of marine litter pollution (Figure 4.8). However, the pollution with plastic and metal litter is greatest on the stretch from the Turkish Cape to Kostanjica and in the area of the Straits of Verige, where the dynamics of water masses is significant. The spatial distribution of rubber litter indicates the greatest pollution in the zone from the Straits of Verige to the Bay of Kotor. The categories of glass and ceramics are more dominant in the narrow coastal part of the Boka Kotorska Bay.

Relatively small depths in the research area, but also the specificity of the bay in terms of relief, basin shape, relatively poor communication with the open sea and the specifics of water mass dynamics, indicate that the origin of litter is from land, recreational activities and poor municipal waste management.

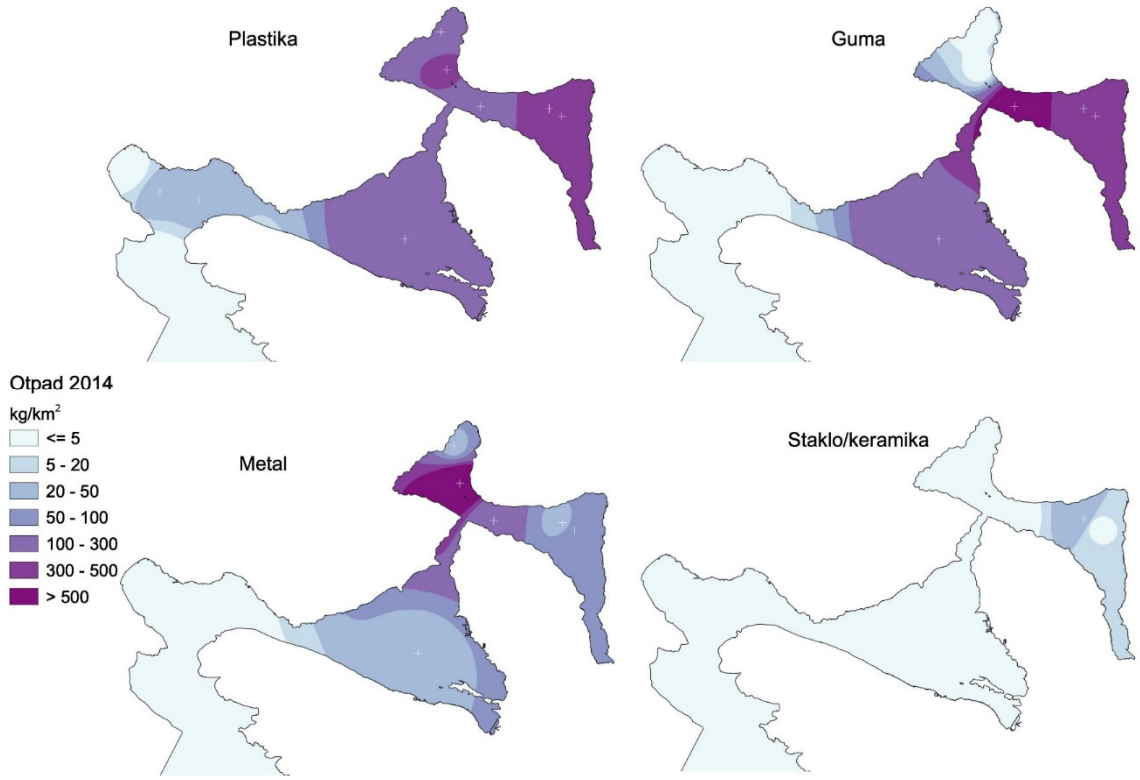

Figure 4.8. Spatial distribution of sea floor litter in the Boka Kotorska Bay (2014) Source: State and Pressures on the Marine Environment of Montenegro Source: UNEP/MAP-PAP/RAC and MESPU; in preparation, 2021; GEF Adriatic project

It is important to note that during the trawling in the area of the Boka Kotorska Bay, only "smaller" litter was sampled, i.e. there is a significant amount of large litter items under the sea surface that cannot be sampled with trawl net. A significant amount of large litter was identified during the monitoring of abandoned fishing gears ("ghost nets"), which was conducted within the DeFishGear project in the Boka Kotorska Bay during October 2014 and September 2015 (Figures 4.9 and Figure 4.10).

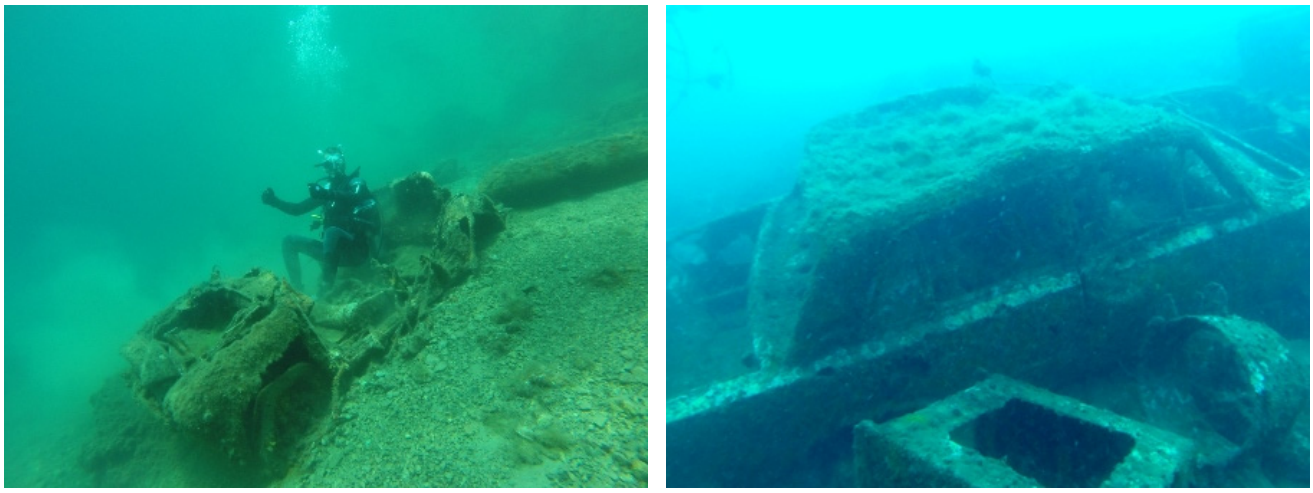

Figure 4.9. Large litter in the area of Boka Kotorska Bay

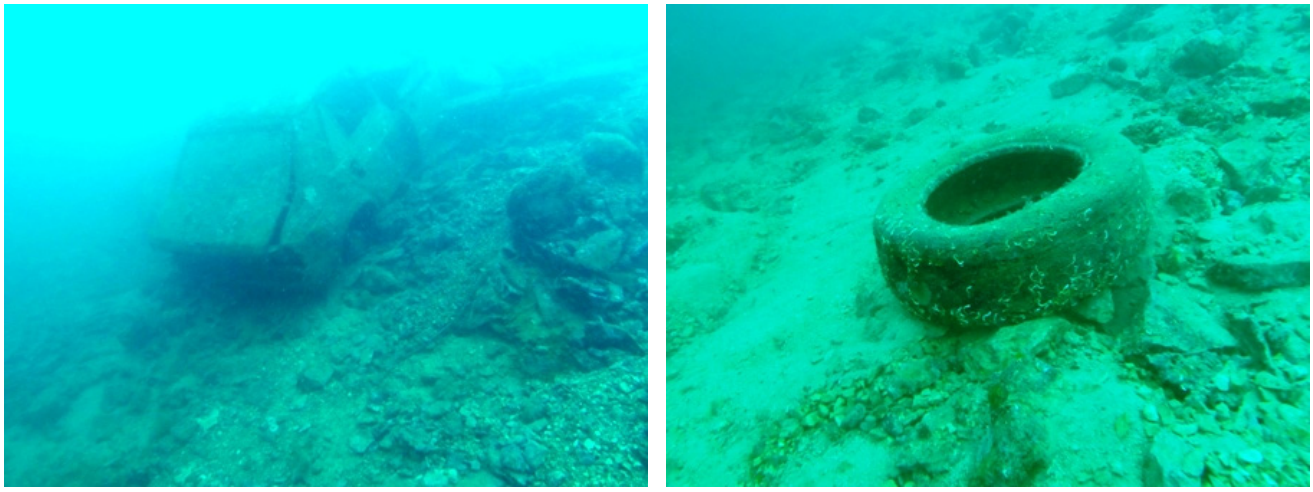

Figure 4.10. Large litter in the area of Boka Kotorska Bay

The research of the amount, type and spatial distribution of sea floor litter was also conducted using the methodology of scuba diving on three transects in the area of Kotor and Tivat bays – at the sites of Kostanjica, Strp and Sveta Nedjelja. The research was conducted on a seasonal basis in the period from October 2014 to August 2015. At the locality of Strp, the depth of the transect ranged from 13-24 m, at Kostanjica from 15-21 m and at Sveta Nedjelja from 9-22 m.

The methodology used in that research was developed in the framework of the DeFishGear project (Vlachogianni and Kalampokis, 2015) and was recommended as the most adequate for estimating the amount, type and distribution of litter in shallow coastal zones (0-25 m depth) (Katsanevakis and Katsarou 2004).

The results of the research in the context of weight (kg/100 m^2) showed that the most dominant category is glass/ceramics with a total percentage share of 43.26% for all researched seasons. It is followed by the metal category (21.49%) and the plastic category (19.25%)

When it comes to the number of items per 100 m^2, the dominant category of litter also belongs to glass/ceramics with a total percentage of 45.26% for all surveyed seasons. It is followed by the plastic (30.51%) and t metal (16.15%).

The largest number of litter items was found during the first sampling (October 2014) when the maximum number of items was collected (21 items/100 m^2), while the smallest number of items was found in August 2015 (3.9 items/100 m^2). **The mean value for all surveyed seasons ranged from 0-6.47 items/100 m^2, with a total mean value of 1.35 items/100 m^2.** During all research, the largest number of litter items was found at the Sveta Nedjelja transect.

Although GES is usually assessed based on the data on the number of marine litter items found during trawling activities (MEDITS research), Decision IG. 22/7 indicates the use of data from other surveys, such as monitoring in marine reserves or programmes on biodiversity monitoring. Due to the lack of data from trawls, the GES assessment was done on the basis of data from monitoring of marine litter in shallow coastal areas of the Boka Kotorska Bay.

Due to the data scarcity on the basis of which baseline and threshold values could be proposed and agreed, the assessment of GES for sea floor litter in the area of Boka Kotorska Bay is not possible at this stage.

4.3.3 Conclusion

The results on sea floor litter in Montenegro indicate that the amount of marine litter in shallow coastal zones (such as Boka Kotorska Bay) is significantly higher than the amount in open waters. This is in line with the research undertaken in other areas of the Adriatic and the Mediterranean (Table 4.6).

Table 4.6. Comparative data of sea floor litter abundance (by visual surveys with scuba/snorkelling) in the Mediterranean

Area	Average litter abundance (items/100 m^2)	Average litter abundance (items/km^2)	Depth (m)	Reference
Montenegro – Boka Kotorska Bay (2014–2015)	1.35	13,500	0 – 20	This document
Montenegro (open sea and Boka Kotorska Bay)	0.25	2,500	0 – 40	Mačić *et al.*, 2017
Slovenia	0.68	6,800	2 – 17	UNEP, 2015
Greece	1.50	15,000	0 – 25	Katsanevakis and Katsarou, 2004
Central Mediterranean	0.11	1,100	5 – 30	Consoli *et al.*, 2019
Mediterranean Sea	43.55	43,500	< 30	Consoli *et al.*, 2020

Namely, the research of sea floor litter conducted on 47 transects in the area of Montenegrin waters (Mačić *et al.* 2017) at depths between 0-40 meters showed pollution of 0.25 items/100 m^2. In Slovenia, marine litter pollution of shallow areas showed pollution of 0.68 items/100 m^2 at depths between 2-17 m (UNEP, 2015). In Greece, the study of the shallow coastal part at depths of 0–25 m showed pollution of 0–2.51 items/100 m^2, with a mean value of 1.5 items/100 m^2 (Katsanevakis and Katsarou, 2004), which largely coincides with our results for the area of the Boka Kotorska Bay. Consoli *et al.* (2019) conduct monitoring of marine litter pollution by ROV (Remotely Operated Vehicle) in the coastal part of the middle Mediterranean and find pollution of 0.11 items/100 m^2 at depths between 5 and 30 meters. The latest research on the amount and categorization of marine litter in the Mediterranean Sea, conducted by the methodology of autonomous diving in the coastal areas, determined an average pollution of 43.55 items/100 m^2 (Consoli *et al.* 2020).

By comparing the results from Montenegro with the above mentioned available data for the Mediterranean Sea, it can be confirmed with certainty that the coastal part is under the greatest pressure when it comes to marine litter pollution, which undoubtedly leads to the conclusion that the main source of pollution is land-based, i.e. careless behaviour and poor waste management in general.

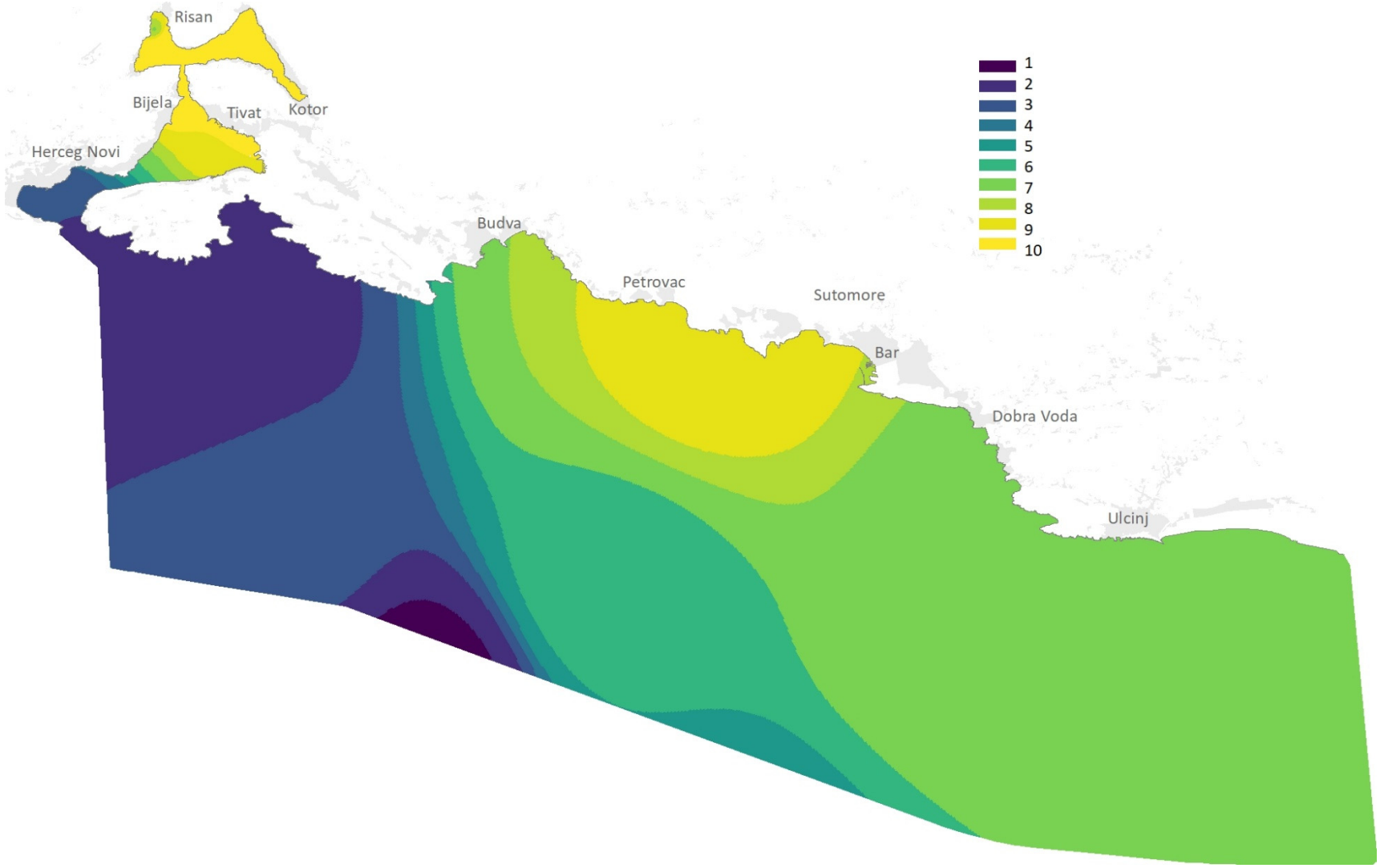

Figure 4.11. Areas with pressures from marine litter (*key: 1 the lowest; 10 the highest pressure*). Source: State and Pressures on the Marine Environment of Montenegro
Source: UNEP/MAP – PAP/RAC and MESPU; in preparation, 2021; GEF Adriatic project

5 GES assessment gaps and needs

Analysis of the national legislation in Montenegro showed that only instrument prohibiting the dumping of solid waste directly into the sea and coasts, is the Law on Prevention of Marine Pollution from Vessels (Official Gazette of Montenegro No CG 20/11, 26/11, 27/14).

Therefore, it is necessary to amend the legislation in Montenegro in order to reduce the amount of marine litter that reaches the sea and coastal areas, protect the environment of the sea and preserve the natural values of the area.

It is important to note that the "GEF Adriatic" project started with the introduction of measures prescribed by international regulations, in particular the MSFD and Regional Marine litter Management Plan and implementation in accordance with IMAP indicators. Implementation of the national monitoring program for marine litter started in 2020, after which regular annual monitoring is expected in accordance with the prescribed monitoring plan.

Therefore, it can be said that Montenegro has started to tackle the problem of marine litter seriously, but it is certainly missing the amendment of the legislation that would allow the implementation of penalty measures and show the determination of state institutions to properly deal with this problem.

After analysing the practices of developed countries and those less developed but aware of waste issues in general, harmonization of legislation with the requirements of EU directives and recommendations of international conventions and strategies should be made as clearly as possible, i.e. the term "marine litter" should be included in one sector (waste management sector) and facilitate the implementation of measures and the definition of institutional responsibility in the country.

Therefore, it is proposed to include in the **Law on Waste Management** the term "marine litter" as a specific category of waste, and to regulate specific measures by adopting a by-law (Rulebook) that would more closely define the conditions and measures for the implementation of marine litter management policies.

In addition, given the importance of the fisheries sector in addressing marine litter problem, it can be proposed that the **Law on Marine Fisheries and Mariculture** also introduce the term "marine litter" and prohibit any disposal of solid wastes (including old and/or damaged fishing gears), and more importantly, the prohibition of returning marine litter to the sea after regular fishing activities. This is of the utmost importance because during regular fishing a huge amount of marine litter is caught which, due to lack of space on ships, manpower for separation and waste selection and significant loss of time, have been returned back to the sea.

In the proposed cases, the Administration for Inspection Affairs would be in charge of controlling the measures prescribed by the Waste Management Law, while in addition the fisheries department would have the authority to control fishing vessels and the method of disposal of "caught" marine litter.

5.1 Proposed management measures for marine litter

The United Nations Environment Action Plan has the first ever legally binding Regional Plan for the Management of Marine litter (EU Regulation 21/7). One of the basic measures of the RPML is obligation of the Contracting Parties (in accordance with Article 5 of the LBS Protocol) to update by 2015 the existing LBS National Action Plans to integrate marine litter measures in accordance with the provisions of the RPML.

In Montenegro, NAP („*National Action Plan for the implementation of the LBS protocol and its regional plans in the framework of the SAP-MED with the aim to achieve good environmental status for pollution-related EcAp ecological objectives*") describes in detail all the requirements of international conventions and regulations that should be implemented in Montenegro

related to marine litter issue. Document gives the timeframe proposal for the implementation of preventive measures and activities for the prevention, preservation and improvement of marine environment. A certain part of the activities envisaged by NAP started with the realization during 2020., but with a significant delay compared to the proposed timeframe. It is most noteworthy to note that without recognizing marine litter in the Montenegrin Legislation, it is not possible to adequately implement the envisaged measures.

In accordance with the Regional Plans' technical requirements the NAP of Montenegro defines number of priority measures for marine litter, including:

1. Develop the Plan to reduce the amount of marine litter by 2020 (in relation to achievement of EO10 while implementing EcAp).
2. Improvement of knowledge and capacities of relevance for marine litter management and monitoring.
3. By 2017, involve municipal enterprises, beach lessees and fishermen in the activities of beach cleaning and record keeping of types and quantities of marine litter on the beaches and in the sea, in order to collect necessary data for the development of the Plan for reduction of marine litter.
4. Prevent inflow and/or reduce the quantity of marine litter inflow via rivers and main torrent flows into the sea.
5. Following the adoption of the Plan for reduction of marine litter, ensure adequate support for the development and implementation of the program for solid waste monitoring deposited on the bottom of the sea and implementation of the cleaning campaign, including the development of scientific-research projects to test microplastics in the water and its impact on the marine ecosystem.
6. Develop and adopt legislation on floating solid waste (marine litter) by 2017.
7. Control of marine litter inflow via rivers Bojana and Sutorina into the sea.
8. By 2020 minimize run-off and riverine inputs of solid waste as to reduce marine litter impacts and pressures to marine ecosystem.
9. Application of cost-effective measures to prevent any marine littering from dredging activities.
10. Implement programs on regular removal and sound disposal of accumulations/hotspots of marine litter.
11. Explore and implement National Marine Litter Clean-up Campaigns; participate in International Coastal Clean-up Campaigns and Programs; apply "Adopt-a-Beach" or similar practices; and apply "Fishing for Litter" practices (Deadline 2019).
12. Design National Monitoring Programme on Marine Litter (Deadline 2017).

The measures defined in the NAP are in line with Articles 7-10 of the RPML, and, although very well defined, have not yet been implemented. Part of the planned measures were already applied: cleaning actions, implementation of the UNEP/MAP "Adopt a beach" project, improvement of knowledge and capacities of relevance for marine litter management and monitoring, participation in International Coastal Clean-up Campaigns and Programs. Also, National Monitoring Programme on Marine Litter was prepared, and first national monitoring activities were conducted during 2020. However, there are still very important measures that need to be implemented in accordance with the obligations of international conventions and regulations.

In addition, the Ministers and Heads of Delegation of the Contracting Parties to the Barcelona Convention have committed (through the Naples Ministries Declaration, UNEP/MED IG.24/22 – 2019) to scale-up efforts to address the issue of marine litter by empowering the regulatory framework for reducing single-use plastic products, setting ambitious quantitative targets, and incorporating reduction measures including on microplastics in national marine litter agenda, and to undertake, among the others, the following actions:

- Promoting prevention measures and circular approaches also to open green economy opportunities; supporting long-term viable recycling targets; adopting national plans to progressively achieve 100%plastic waste collection and recycling by 2025; and addressing the private sector to minimize plastic packaging;
- Making the Integrated Monitoring and Assessment Programme-based marine litter monitoring in the Mediterranean fully operational, providing an assessment of the impacts of marine litter in the Mediterranean Sea and coastal areas;
- Further enhancing the coordinated actions of stakeholders, through the Regional Cooperation Platform on Marine Litter;
- Launching awareness-raising campaigns on the impacts of litter, and in particular plastic litter and microplastics, on the marine environment

National Montenegrin regulations do not recognize the problem of marine litter, although it is a precondition to introduce measures to prevent its entry into the river flows or into the sea. However, at the end of 2019, the Law on protection of marine environment was adopted, which is fully harmonized with MSFD, and it can be considered that (although the term marine litter does not exist in national legislation) through the development of the Marine Strategy Montenegro will finally start with active and operational implementation of the envisaged measures for the reduction and prevention of marine litter.

Below are some of the additional measures and examples of good practices proposed for implementation in order to reduce and prevent marine litter reaching into the sea and coastal environment. It is possible to divide them into several categories:

1. Prevention measures;
2. Mitigation measures;
3. Removal measures;
4. Behavioural measures.

5.1.1 Prevention measures

Preventive measures should focus on avoiding marine litter generation and preventing it from entering the sea or beaches. Measures include pollution prevention, reuse or recycling, waste to energy conversion, provision of waste acceptance infrastructure, labelling of fishing nets and gears, and a set of land-based waste management initiatives.

Some good examples of prevention are: modifying and improving the packaging of products in terms of eco-design, which can partly enable the education and reduction of waste generation at source; reuse of packaging (refillable cosmetic bottles, etc.), sending of SMS through collaboration with mobile operators to raise awareness of the negative impact of marine litter; limit or completely ban the use of single-use plastic bags and certain other plastic products found to be among the "top 10" products on the beach litter (straws).

Manufacturers who can prevent the generation of waste at source also have a significant responsibility for prevention by designing products that send a mandatory environmental message. Promoting new eco-designs, using fewer polluting materials – through public calls or subsidies is one possible preventive measure. This preventive measure is directly in line with the EU Framework Directive on Waste, which emphasizes extended producer responsibility taking into account the full life cycle of the product. The mention Directive encourages Member States to take all legislative or non-legislative measures to strengthen the prevention and re-use of waste, recycling and other initiatives to reduce it.

5.1.2 Mitigation measures

Mitigation measures include the proper management and disposal of waste in order to reduce negative impacts on the marine environment and the possibility of waste reaching the sea. Mitigation measures include regulations and control measures. For example, regular inspection of beaches and coastal landfill sites, as well as direct control (for example beach tenants and how they are disposing wastes after tourists visit, especially during the summer season). Also, a good example

of mitigation measures is the ban on the dumping of plastic into the sea or the coastal zone, a complete ban on the disposal of waste in environmentally sensitive areas, the specification of the distance of the waste bins from the sea.

5.1.3 Removal measures

These measures include the removal of marine litter already present in the marine environment. Beach cleaning actions are most commonly used for this purpose; however, such removal of marine litter eliminates only a small portion of the total amount of marine litter from the marine environment. Research has shown that marine litter on beaches is actually the tip of the "iceberg" in relation to the amount of marine litter located below the sea surface.

In addition to beach cleaning, a significant amount of litter can be eliminated through fishing activities, with the mandatory participation of professional fishermen. This activity has significant advantages as it is deposited on shore and then on landfills, along with municipal waste.

One of the measures of marine litter removal is regular monitoring of beaches or seabed. Namely, during the monitoring of categorization, estimation of quantity and distribution of marine litter, it is obligatory to measure the amount of collected litter for the purpose of detailed estimations, so that a significant amount of marine litter from the marine environment is collected over time. Also, monitoring is a good instrument in devising effective management strategies to prevent waste from being dumped into the sea. The long-term monitoring program will provide information on the adequacy and degree of implementation of management measures, the effectiveness of legislation and coastal zone management policy.

5.1.4 Behavioural measures

These measures include efforts to change people's behaviour in terms of greater involvement in activities that help reduce marine litter. These measures are of utmost importance for the development and implementation of all the measures mentioned so far. Encouraging people to accept the fact that waste can also be a resource, to use certain types of products that generate less waste, to use eco-friendly materials, to participate in beach and coastal clean-up activities and to participate in educational activities.

When engaging the general population in the process, it is important to emphasize a certain social recognition and sense of ownership of the practices used, which will further enhance the element of success and personal satisfaction and can act as a strong social stimulus for changing behaviour.

Regional approach to combating this pollution is a step to success since the issues of marine litter transcends national borders. This is especially important for sea floor litter and floating litter reduction measures.

6 Connections with other indicators

Marine litter is one of the biggest threats to the marine ecosystem due to its abundance, durability and persistence in the marine environment. In addition to overfishing, climate change, intensive coastal development, invasive species, marine litter further contributes to the loss of species, fragmentation of habitats, and disruption to the general health of the marine ecosystem.

Although there are a number of scientific studies that address the issue of marine litter, accurate data on the sources and impact of marine litter on biodiversity and marine organisms are still insufficient. There are significant shortcomings in the data on the total amount of litter in the sea, trends of change, degradation processes, vertical fluxes and time scales (Maximenko *et al.*, 2019). Long-term data series are necessary to define the level of impact and mitigating measures of marine litter on the ecosystem.

The impact of marine litter on biodiversity (EO1) is different. It is reflected in ingestion, entanglement, transmission of invasive species by floating litter (as vector), habitat cover and reduction of oxygen due to "suffocation" of certain species by covering, release of chemical compounds into the marine environment and causing sub-lethal or lethal effects on marine organisms.

Scientific research has revealed that many marine species are impacted by marine litter in all known habitat types in the Mediterranean Sea. According to literature, up to 134 species were reported to be affected by marine litter in the Mediterranean region (Deudero and Alomar, 2015).

However, most studies focus on target species of marine organisms – most often endangered or rare species (marine mammals and sea turtles).

Plastic waste makes up about 85% of the total amount of marine litter. Marine organisms are in constant interaction, both with each other and with the environment and all objects that are under the sea surface. Interactions between litter and marine organisms has been described for cetaceans, pinnipeds, marine turtles, birds, fishes including sharks and for many invertebrates both and coastal and deep-sea areas (Cedrian, 2008; Rodriguez *et al.*, 2013; Bo *et al.*, 2014; Tubaux *et al.,* 2015; Colmenero *et al.*, 2017; Vlachogianni *et al.*, 2018).

Floating litter is a favourable vector for the transmission of organisms to the most distant places and it can cause transporting non-indigenous species (EO2) to new locations where they could become invasive and could alter assemblages in receiving habitats (Rech *et al.* 2016).

The impact of marine litter on food chains and commercial fish species is largely reflected in the ingestion of microplastics. Marine organisms may ingest litter deliberately because of their resemblance to prey (Campani *et al.*, 2013; Cole *et al.*, 2011; Romeo *et al.*, 2016; Wright *et al.*, 2013) or accidentally while feeding on their prey, e.g. by filter feeding (Fossi *et al.*, 2014; Fossi *et al.*, 2016) or hunting on shoals (Battaglia *et al.*, 2016; Romeo *et al.*, 2015), or as a result of secondary ingestion (debris already ingested by prey) (Vlachogianni *et al.*, 2018).

The impact of marine litter on commercial species (EO3) of marine organisms and fish stocks is still insufficient, so the level of impact and consequences caused by marine litter cannot be determined with certainty.

In Montenegro, 235 fish individuals were studied for “macro”-litter identification during 2015. Analysis of the gastro-intestinal tracts (guts) of the examined fish revealed that “macro”-litter was present in the guts 61 individuals, 25.9% of the total examined fish individuals. Litter was found in five species (*Mullus barbatus*, *Sardina pilchardus*, *Solea solea*, *Trachurus trachurus* and *Scomber japonicas).* All species examined had ingested litter in their guts; especially the pelagic and mesopelagic species *S. pilchardus*, *S. japonicus* and *T. trachurus* with quite high litter occurrence (50%, 43% and 24% respectively). The percentage of litter frequency of occurrence (F%) was 25.96%, with range between 4 and 50%, and with *S.*

pilchardus showing the highest value (39% of total). The increased fish consumption along with the constant increase of plastic production and the fact that fish constitute significant levels into food chain towards higher trophic levels represent a concern for human health, as well (Anastasopoulou *et al.*, 2018).

And finally, interaction of marine litter with hydrography, it is very important to note the fact that hydrography and bathymetry significantly affect the movement and accumulation of marine litter and the formation of "hot spots". In marine areas where sea currents are strong, where upwelling is present, where bathymetry allows the accumulation and retention of litter, the impact on species and marine ecosystem may be the greatest. In such parts, a larger accumulation of micro-particles is possible, which consequently causes a higher ingestion of litter by marine organisms.

7 Conclusions

Based on the data presented in this document, it can be concluded that, when it comes to marine litter pollution, GES has not been achieved. Given the defined baseline values at the Mediterranean level (Decision IG. 22/7 and UNEP/MED WG.482/23) and the European Union level (Hanke *et al.*, 2019), the process of reducing the total amount of marine litter in Montenegro will be very challenging. Existing data point to a rather worrying situation, which is not only a characteristic of the Montenegrin part of the Adriatic, but of the entire Adriatic Sea. The comparative data presented for other parts of the Adriatic and the Mediterranean Sea point to this conclusion, i.e. to the obligation that strict measures of prevention and reduction of the total amount of marine litter should be introduced at the regional level.

Shortcomings in national legislation (especially in the field of waste management) prevent the introduction of adequate measures for prevention and reduction of marine litter, as well as the introduction of penalty provisions for any dumping of waste into the sea. However, from 2021 the use of single use plastic bags will be banned in Montenegro, which will certainly partially reduce the total amount of marine litter. Poor waste management in general, low recycling rates, insufficient waste disposal infrastructure on the coast and beaches, and a low level of waste disposal control, are just some of the problems that reduce the ability to address marine litter issue in Montenegro.

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Implementation of the ecosystem approach in the Adriatic through marine spatial planning

The GEF-funded project “Implementation of the Ecosystem Approach in the Adriatic Sea through Marine Spatial Planning” (GEF Adriatic) is carried out across the Adriatic-Ionian region with focus on two countries: Albania and Montenegro.

The main objective of the project is to restore the ecological balance of the Adriatic Sea through the use of the ecosystem approach and marine spatial planning. Also, the project aims at accelerating the enforcement of the Integrated Coastal Zone Management Protocol and facilitating the implementation of the Integrated Monitoring and Assessment Program. Eventually, it will contribute to the achievement of the good environmental status of the entire Adriatic. The project is jointly lead by UNEP/MAP, PAP/RAC and SPA/RAC. In Montenegro, the project is being implemented with the coordination of the Ministry of Ecology, Spatial Planning and Urbanism. The project duration is from 2018 to 2021.

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