



**United Nations
Environment Programme
Mediterranean Action Plan**

Distr.: General
29 May 2023

Original: English

Integrated Meeting of the Ecosystem Approach Correspondence Groups (CORMONs)

Athens, Greece, 27-28 June 2023

Agenda Item 1.C.iv: Marine Litter CORMON

2023 Mediterranean Quality Status Report (QSR): Marine Litter Ecological Objective (EO10)

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Note by the Secretariat

In line with the Programme of Work and Budget for 2018-2019 adopted by the 20th Ordinary Meeting of the Contracting Parties to the Barcelona Convention (COP 20) held in Tirana, Albania; the Programme of Work and Budget for 2020-2021 adopted by the 21st Ordinary Meeting of the Contracting Parties to the Barcelona Convention (COP 21) held in Naples, Italy; the Programme of Work and Budget for 2022–2023 adopted by the 22nd Ordinary Meeting of the Contracting Parties to the Barcelona Convention (COP 22) held in Antalya, Türkiye; MED POL Programme prepared a Proposal of the 2023 MED QSR Marine Litter Chapters having a focus on IMAP Ecological Objective 10 (EO10) and its Common Indicators 22 (CI22) and 23 (CI23).

Further to Decision IG.23/6 of COP 20 related to the 2017 Mediterranean Quality Status Report (MED QSR), and Decision IG.24/4 of COP21 providing the 2023 MED QSR Roadmap implementation (Naples, Italy, December 2019), UNEP/MAP – MED POL implemented activities to address key priority needs towards a DPSIR-based GES assessment prepared in the framework of the 2023 MED QSR. This resulted in the preparation of the present proposal of the 2023 MED QSR Marine Litter Chapters by building on the following key achievements within the implementation of the 2023 MED QSR Roadmap:

- a) Developing and establishing assessment criteria (i.e., updated Baseline Values (BV) and Threshold Values (TV)) for IMAP Common Indicators 22 (CI22) and 23 (CI23).
- b) Setting the integration and aggregation rules for monitoring and assessment including: (i) the methodology for proposing the spatial scales of assessment from the scales of monitoring as defined in national IMAP Pollution and Marine Litter Cluster monitoring programmes, as well as by also considering the areas of assessment as defined in national MSFD monitoring strategies by the Contracting Parties which are EU Member States; (ii) the rules for integration of monitoring and assessment areas within the IMAP Pollution and Marine Litter Cluster (EO5, EO9, EO10); (iii) the rules for aggregation – integration of assessments for specific IMAP Common Indicators/Ecological Objectives towards integrated GES assessment for IMAP Pollution and Marine Litter Cluster.
- c) Development, testing and implementation of the following GES and alternative environmental assessment methodologies by applying the above defined integration and aggregation rules along with the scales of assessment, the assessment criteria and the DPSIR approach within the IMAP nested scheme: (i) the CHASE+ assessment methodology for all Mediterranean sub-regions, for IMAP EO10 CI22 and CI23; and (ii) the NEAT IMAP GES assessment methodology for the case of the Adriatic for IMAP EO10 CI22 and CI23.

The proposed chapters on marine litter for the 2023 MED QSR have been based and developed explicitly on data officially uploaded by the Contracting Parties to the Barcelona Convention through IMAP InfoSystem. Despite the significant achievement for having numerous countries uploading data, still efforts are to be strengthened to: (i) increase the number of Contracting Parties submitting data for IMAP EO10 CI22 and 23; (ii) support a timely and quality-controlled process.

The proposed assessment has been undertaken at the level of the Mediterranean region and its four (4) sub-regions, for IMAP EO10 CI22 and 23 and in particular: (i) beach macro-litter; (ii) floating microplastics, and (iii) seafloor macro-litter.

While for IMAP EO10 CI22 the updated BV and the TV were officially endorsed by the Contracting Parties to the Barcelona through Decision IG.25/9 of COP22 (Antalya, Türkiye), the respective values (BV and TV) for IMAP EO10 CI23 have been prepared and revised further to the conclusions and recommendations of the CORMON Marine Litter Meeting held on 3 March 2023. The respective revised values have been used to prepare the GES/nonGES assessment for IMAP EO10 CI22 and CI23.

The preparation of the present Proposal of the 2023 MED QSR Pollution Chapters was undertaken successively further to the conclusions and recommendations of the Meetings of CORMON on Marine Litter Monitoring held on 30 March 2021 and 31 May 2022, as well as the Integrated CORMON held on 1-3 December 2020. The initial version was presented and reviewed during the CORMON Marine Litter Meeting held on 3 March 2023 and further to its conclusions an updated version has been prepared for review to the present Integrated CORMON Meeting (27-28 June 2023).

The present updated Proposal of the Marine Litter Chapter of the 2023 MED QSR is submitted for the review and approval of the present Integrated Meeting of the Ecosystem Approach Correspondence Groups with a view of further incorporated this chapter into the integrated document under preparation for the 2023 MED QSR, its submission to the upcoming EcAp Coordination Group and MAP Focal Points Meetings planned respectively on 11 and 12-15 September 2023.

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List of Abbreviations / Acronyms

ACCOBAMS	Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area
ALDFG	Abandoned, Lost and Discarded Fishing Gear
ASI	ACCOBAMS Survey Initiative
BAT	Best Available Technique
BEP	Best Environmental Practices
BV	Baseline Values
CHASE	Chemical Status Assessment Tool
CI	Common Indicator
COP	Conference of the Parties
CORMON	Ecosystem Approach Correspondence Group on Monitoring
CP	Contracting Party
DPSIR	Driver, pressure, state, impact, response
DS	Data Standard
EcAp MED III	EU-Funded Project “Mediterranean Implementation of the Ecosystem Approach, in Coherence with the EU MSFD”
EO	Ecological Objective
EPR	Extended Producer Responsibility
FAO	Food and Agriculture Organization of the United Nations
FML	Floating Marine Litter
GES	Good Environmental Status
GFCM	General Fisheries Commission for the Mediterranean
GPML	Global Partnership on Marine Litter
GPS	Global Position System
GRID	Green, Resilient, Inclusive Development
ICZM	Integrated Coastal Zone Management
IMAP	Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria
IMO	International Maritime Organization
MAP	Mediterranean Action Plan
MARPOL	International Convention for the Prevention of Pollution from Ships
MED POL	Programme for the Assessment and Control of Marine Pollution in the Mediterranean Sea
MED QSR	Mediterranean Quality Status Report
MEPC	Marine Environment Protection Committee
MPA	Marine Protected Areas
MPAs	Marine Protected Areas
MSFD	Marine Strategy Framework Directive
MTS	Mid-Term Strategy
NAPs	National Action Plans
NEAT	Nested Environmental Status Assessment Tool
nonGES	Not Achieving Good Environmental Status
PET	Polyethylene terephthalate
PPCP	Pharmaceuticals and Personal Care Products
PWP	Plastic Waste Partnership (Basel Convention)
SAU	Special Assessment Unit
SCP	Sustainable Consumption and Production
SOPs	Standard Operations and Procedures
SPAMIs	Specially Protected Areas of Mediterranean Importance
SUDS	Sustainable Urban Drainage Systems
SUPs	Single-Use Plastics
TV	Threshold Value

List of Abbreviations / Acronyms (continued)

UHMWPE	Ultra-high Molecular Weight Polyethylene
UNEA	United Nations Environmental Assembly
UNEP	United Nations Environmental Program
USWM	Urban Storm Water Management
WWTP	Wastewater Treatment Plants

1. Key messages

1. Key messages for IMAP EO10 Common Indicator 22 are listed hereunder:

- a) The monitoring efforts in the Mediterranean region and within each sub-regions vary significantly and further alignment and strengthening of IMAP EO CI22 is required from the Mediterranean Countries.
- b) Overall, 16% of the monitored beaches achieve GES, 79% do not achieve GES of which 29% fall into the poor status class and 25% in to the bad one.
- c) Plastic/polystyrene pieces (2.5 cm – 50 cm) are the most commonly found marine litter items in the Mediterranean, followed by cigarette butts and filters, and plastic caps and lids. These 3 items account for approximately 60% of the recorded marine litter.

2. Key messages for IMAP EO10 Common Indicator 23 are listed hereunder:

A. Floating Marine Litter:

- a) Average floating microplastics concentration on the Mediterranean Sea surface is found equal to 0.36 ± 1.9 items/m².
- b) Almost all stations (99%) that have been monitored do not achieve GES, and most of them fall into the poor (44 %) and bad (49 %) status classes.
- c) The Mediterranean region and its subregions suffer from elevated microplastics concentrations in surface waters, reaching up to 100 times and 1000 times higher than the IMAP TV.
- d) From the recorded floating microplastics, Sheets (37%), followed by Filaments (30%), Pellets (21%), Fragments (7%), Foam (4%), and Granules (1%).
- e) Some 41,000 floating mega-litter were recorded in total during the ACCOBAMS Aerial Survey Initiative, with an average encounter rate of 0.8 mega-debris per km, ranging between 0 and 111 litter items per km.
- f) The total number of floating mega-litter was estimated at 2.9 million items (80% confidence interval was 2.7 to 3.1 million) and average density 1.5 ± 0.1 items per km².
- g) More than two thirds of the mega-litter recorded were identified as plastics (68.5%; e.g., plastic bags, bottles, tarpaulins, palettes, inflatable beach toys, etc.), while 1.7% were fishery debris and 1.9% were anthropogenic wood-trash. The remaining quarter (27.9%) was anthropogenic mega-litter of an undetermined nature.

B. Seafloor Marine litter:

- a) The average seafloor litter concentration on the Mediterranean coastline is found equal to $570 \pm 2,588$ items/km².
- b) The majority (88%) of the seafloor stations monitored do not achieve GES, and most of them fall into the poor and bad status classes (23% and 53% respectively).
- c) Fisheries-related items comprise up to 10% of the total recorded marine litter.
- d) 3 items are the most recorded within the fisheries related items: (i) Synthetic ropes/strapping bands (L1i) with 39%; Fishing nets (polymers) (L1f) with 27%; and Fishing lines (polymers) (L1g) with 25%.

2. Background information and methodology

3. In the context of implementing the Ecosystem Approach Roadmap adopted by the Contracting Parties to the Barcelona Convention and its Protocols in 2008 ([Decision IG.17/6](#)), UNEP/MAP delivered in 2017 the first ever Quality Status Report for the Mediterranean ([2017 MED QSR](#)). The 2017 MED QSR was a region-wide assessment product, endorsed by COP 20 [Decision IG.23/6](#), was fully based on the structure of the Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast (IMAP) and its respective Ecological Objectives (EO) and Common Indicators (CIs).

4. The report was built upon existing data, complemented with inputs from numerous diverse sources and was prepared following a multi-step comprehensive review process, involving all relevant MAP Components, Contracting Parties and key partners. The latter also applied for the marine litter chapters (IMAP EO10), also supplemented by the findings of the UNEP/MAP [2015 Marine Litter Assessment for the Mediterranean](#).

5. The main findings of the 2017 MED QSR set the basis for the evolvement and expansion of marine litter monitoring in the region, as well as for the development of the 2023 MED QSR, and are summarized hereunder:

- a) Information on beach marine litter (CI22) exists but the picture is still fragmented and is geographically restricted to the northern part of the Mediterranean. Plastics are the major components with cigarette butts, food wrappers and plastic bags being the top marine litter items. Land-based sources are predominant, but they have to be further specified. Tourism is directly affecting marine litter generation on beaches.
- b) Information on the distribution, quantities and identification of beach marine litter sources needs to be further advanced. For the moment information and data are inconsistent for the Mediterranean. There is an urgent need to develop and implement the Integrated Monitoring and Assessment Programme for the Mediterranean Sea and Coast (IMAP) related to CI22, and corresponding data are submitted to the Secretariat at national level.
- c) Accumulation rates of floating litter vary widely in the Mediterranean Sea and are subject to factors such as adjacent urban activities, shore and coastal uses, winds, currents, and accumulation areas. Additional basic information is still required before an accurate region wide litter assessment can be provided. Moreover, the available data are geographically restricted in the northern part of the Mediterranean Sea.
- d) The abundance of floating micro-litter (CI23) in Mediterranean waters has been reported at quantities measuring from 0 to over 600 items per square kilometer. The 2015 UN Environment/MAP Marine Litter Assessment report states that approximately 0.5 billion litter items are currently lying on the Mediterranean Seafloor. There is great variability in the abundance of seafloor marine litter items ranging from 0 to over 7,700 items per km² depending on the study area. The information on floating and seafloor marine litter in the Mediterranean is fragmented and is spatially restricted mainly to its northern part and no basin-scale conclusions can be exerted as information is only available at local level. However, there are many areas with significant marine litter densities, ranging from 0 to over 7,700 items per km² depending on the study area. Plastic is the major marine litter component, found widespread in the continental shelf of the Mediterranean, ranging up to 80% and 90% of the recorded marine litter items.
- e) Data on floating and seafloor marine litter are inconsistent and geographically restricted in only few areas of the Mediterranean Sea. In addition to that, the lack of long-term assessment data makes the assessment of trends of the years extremely difficult. Sources need also to be further specified and linked to macro- and micro-litter contribution. Moreover, monitoring and assessment of marine litter should be done in a consistent way, based on common protocols and standardized methods, leading to comparable results at basin scale. Effective management practices are also missing, requiring strong policy will and societal engagement. Further work should also be promoted towards identifying marine litter sources more precisely. Cooperation

and collaboration between the major marine litter partners in the region with common priority actions is also considered important.

6. MAP implementation has since progressed with the establishment of national IMAPs, development of a centralized data collection and management infrastructure (IMAP InfoSystem), refinement of technical specifications on IMAP common indicators, building of knowledge on candidate indicators, and development of methodologies for integrated assessment. A specific Roadmap is currently under implementation for the preparation of a fully-data based Quality Status Report in 2023 (2023 MED QSR), as adopted by the Contracting Parties in 2019, through their COP 21 [Decision IG.24/4](#).

7. The development and review of relevant action plans and programmes under the Ecosystem Approach Roadmap implementation is looked at on a multilayer perspective, covering all the aspects of the legal and policy framework of the UNEP/MAP- Barcelona Convention. In a nutshell, the Ecosystem Approach has been raised by the Contracting Parties to the programmatic level and reaffirmed as an overarching principle of the Barcelona Convention and as such has been integrated into the legal and policy framework of the Barcelona Convention including legally and non-legally binding instruments.

8. In order to ensure an efficient and coordinated implementation of the Ecosystem Approach Roadmap, a multi-level governance mechanism has been established, comprising the Ecosystem Approach Coordination Group composed of Contracting Parties representatives, and three specific correspondence groups, (i.e. on GES and targets: COR GEST, on monitoring: CORMON and on economic and social analysis, COR ESA), which are composed of national experts designated by the Contracting Parties, invited experts and respective MAP components.

9. The Ecosystem Approach Roadmap is implemented through activities included in the biennial UNEP/MAP Programmes of Work, while additional external resources are mobilized to support the different steps of its implementation. Three EU-funded Projects are recently launched, namely the IMAP MPA, ECAP MED III, and Marine Litter MED, which expect to boost the implementation of IMAP towards delivery of the next 2023 MED QSR.

10. Since 2016, the Mediterranean countries with the support of UNEP/MAP and the [EU-funded EcAp MED II Project](#) have supported the Mediterranean Countries to establish national IMAP-based monitoring programmes for the 2 IMAP Common Indicators, i.e., Common Indicator 22 (CI22) and Common Indicator 23 (CI23). The focus for CI22 has been given on monitoring beach macro litter, whereas the focus for CI23 has been given on monitoring seafloor macro-litter and floating microplastics. Monitoring for CI22 has been also supplemented by numerous pilots in the Adriatic and South Mediterranean areas, having as a prerequisite the inclusion and integration of the respective IMAP methodology. Moreover, the regional data repository ([IMAP InfoSystem](#)) has been developed and is operational, including the development of reporting templates for CI22 (M1 Module) and CI23 (M2 and M3 Modules).

11. Two additional EU-funded projects, i.e., the [Marine Litter MED](#) (2016-2019) and [Marine Litter MED II](#) (2020-2023) projects have supported IMAP implementation through the development of knowledge for IMAP Candidate Indicator 24, as well as touching upon, new novel aspects of marine litter monitoring (e.g., monitoring riverine inputs of marine litter and monitoring microplastics coming from wastewater treatment plants).

12. [Decision IG.23/6](#) of COP20 on the 2017 MED QSR recommended the following general directions in order to address several gaps and ensure successful delivery of the 2023 MED QSR:

- a) Harmonization and standardization of monitoring and assessment methods;
- b) Improvement of availability and ensuring of long time series of quality assured data to monitor the trends in the status of the marine environment;

- c) Improvement of availability of the harmonized datasets for marine environment state assessment, including use of data stored in other databases where some of the Mediterranean countries regularly contribute;
- d) Improvement of data accessibility with the view to improving knowledge on the Mediterranean marine environment and ensuring that Info-MAP System is operational and continuously upgraded, to accommodate data submissions for all the Integrated Monitoring and Assessment Programme (IMAP) Common Indicators.

13. In line with the aforementioned decisions, UNEP/MAP and its MED POL Programme implemented activities to address the following key priority needs towards a DPSIR-based GES assessment of the 2023 MED QSR, including the following:

- a) Development of scale(s) of monitoring, assessment and reporting, to enable comparable data sets and assessments.
- b) Development of the necessary methodological tools and assessment criteria to be agreed on to allow and promote integrated assessment of GES;
- c) Development of monitoring protocols and data quality assurance and quality control for IMAP Common Indicators are to be made available to guide Contracting Parties.
- d) Supporting national capacities and address knowledge gaps to ensure region-wide coherence and data availability; and
- e) Join forces with regional partners and streamline project implementation based on IMAP criteria to enable input process in a coordinate manner.

2.1 Assessment Criteria for IMAP Ecological Objective 10

14. UNEP/MAP established in 2016 Baseline Values (BV) and environmental targets for IMAP EO10 Common Indicators (COP19, [Decision IG.22/10](#)). Further to the advancement of marine litter monitoring within IMAP EO10 and the acquisition of relevant data, UNEP/MAP, in cooperation with the Contracting Parties of the Barcelona Convention, undertook an update for the 2016 BV and established Threshold Values (TV) for the IMAP Common Indicators 22 and 23.

2.1.1 Assessment Criteria for Common Indicator 22

15. For the elaboration and determination of the Baseline and Threshold Values for IMAP Common Indicator 22 (beach macro litter), data were used from the Contracting Parties to the Barcelona Convention between 2016 and 2018 deriving from monitoring programmes, projects and initiatives, after taking into consideration the comparability of the submitted data sets. The selection of the 2016-2018 period is due to the availability of full years data in a significant number of countries.

16. For IMAP Common Indicator 22 (beach marine litter), thirteen (13) Countries have contributed with data during the exercise for updating the BV and establishing TV. All the surveys have been collected in a database in accordance with the IMAP reporting templates for IMAP CI22. The extreme values that have been observed (outliers) were retained in the datasets and were checked and verified case by case. The number of surveys conducted in each country and the year when it was undertaken for beach marine litter (IMAP CI22) are presented per 4 Mediterranean subregions (Western Mediterranean (WM); Central Mediterranean (CM); Adriatic Sea (AS); Eastern Mediterranean (EM)) in Table 1 hereunder.

Table 1: Number of surveys by country (beach litter) used for the elaboration of the updated BV and the establishment of TV for IMAP CI22 as adopted in 2021 by COP22.

Sub-regions	Country	Surveys	Years	Sources
WM	Algeria	111	2018	SWIM H2020 Support Mechanism
	France	88	2016, 2017, 2018	MED POL Focal Point France
	Italy	162	2016, 2017, 2018	MEDPOL Focal Point Italy
	Malta	24	2017, 2018	MED POL Focal point Malta
	Morocco	16	2018	MED POL Focal point Morocco
	Spain	139	2016, 2017, 2018	MED POL Focal Point Spain
CM	Greece	3	2018	MED POL Focal Point Greece
	Italy	66	2016, 2017, 2018	MED POL Focal Point Italy
	Libya	12	2018	MED POL Adopt-a-Beach Pilots in Libya
AD	Italy	132	2016, 2017, 2018	MED POL Focal Point Italy
	Slovenia	16	2017	MED POL Focal Point Slovenia
	Montenegro	4	2018	MED POL Adopt-a-Beach Pilots in Montenegro
	Albania	4	2018	MED POL Adopt-a-Beach Pilots in Albania
	Croatia	6	2017, 2018	MED POL Focal Point Croatia
EM	Cyprus	31	2016, 2018	EMODnet
	Israel	8	2017, 2018	MED POL Focal Point Israel

17. The BV for IMAP CI22 was based on the calculation of the median values for the Mediterranean sub-regions, whereas the TV for IMAP CI22 was calculated based on the 15th percentile of the BV. The respective BV and TV that were approved by COP22 ([Decision IG.25/9](#)) for IMAP CI22 are reflected under Table 2 hereunder:

Table 2: 2021 Baseline Values (BV) and Threshold Values (TV) as adopted in 2021 by COP22.

IMAP Indicators	Categories of Marine Litter	BV-2021	TV-2021
CI22	Beach Marine Litter	369 items/100m	130 items/100m

18. The said assessment criteria comprising of the baseline and threshold values for IMAP Common Indicator 22 are used for the needs of the present 2023 MED QSR.

2.1.2 Common Indicator 23

19. For the elaboration and determination of the Baseline and Threshold Values for IMAP Common Indicator 23 (seafloor macrolitter and floating microplastics), the data used correspond to data collected from the Contracting Parties to the Barcelona Convention between 2016 and 2022 in the framework of the respective IMAP-based national monitoring programmes, and officially submitted and validated through the IMAP InfoSystem. The selection of the 2016-2022 period is due to the availability of full years data in a significant number of countries.

20. For IMAP Common Indicator 23 (seafloor macrolitter and floating microplastics), fifteen (15) countries have contributed with data. The data were submitted by the respective Focal Points through an official submission through IMAP InfoSystem, and have undergone thorough quality checks, and thus do not contain erroneous data.

21. All data from for the total number of surveys have been collected for the current exercise into the IMAP InfoSystem, in accordance with the region-wide reporting templates (i.e., DS and DD) as proposed by UNEP/MAP and adopted by its institutional meeting (i.e., CORMON Marine Litter, MED POL Focal Points, and EcAp Coordination Group Meetings). As also applied for the case of elaboration of BV and TV for IMAP CI22, the extreme values that were observed (outliers) were

retained in the datasets and were checked and verified case by case. The number of surveys conducted in each country and the year when it was undertaken for seafloor macrolitter and floating microplastics (IMAP CI23) are presented in Table 3 hereunder.

Table 3: Number of surveys per respective Contracting Party used for the elaboration of updated BV and proposal of TV for IMAP CI23 (seafloor macrolitter and floating microplastics), as proposed in 2023 by UNEP/MAP.

Country	Seafloor Macro-litter		Floating Microplastics	
	Trawl Surveys (Number)	Years	Surveys (Number)	Years
Bosnia and Herzegovina			3	2019, 2021
Croatia	27	2017, 2018, 2019, 2020	30	2017, 2018, 2019, 2020
Cyprus	130	2016, 2017, 2018, 2019, 2020		
France	332	2016, 2017, 2018, 2019, 2020, 2021	52	2017, 2018, 2020, 2021
Greece			26	2017, 2019, 2020
Israel	11	2020, 2021, 2022	21	2019, 2020, 2021
Italy			1,839	2016, 2017, 2018, 2019, 2020
Lebanon			14	2019
Malta	48	2016, 2017		
Montenegro	5	2019, 2020		
Morocco	15	2018, 2019, 2022		
Slovenia	32	2017, 2018, 2019, 2020	32	2019, 2020
Spain	639	2016, 2017, 2018, 2019, 2021, 2022	426	2017, 2018, 2019, 2020, 2021, 2022
Tunisia	10	2018, 2020	6	2017, 2019, 2020
Türkiye	55	2016, 2019		
TOTAL	1,320		2,449	

22. The BV for IMAP CI23 was based on the calculation of the median values for the Mediterranean sub-regions, whereas the TV for IMAP CI23 was calculated based on the 15th percentile of the BV for floating microplastic and seafloor macrolitter. The respective BV and TV were reviewed and agreed by the Integrated Meeting of the Ecosystem Approach Correspondence Groups (CORMONs) (Athens, Greece, 27-28 June 2023), and are presented under Table 4:

Table 4: Baseline Values and Threshold Values for IMAP CI23, seafloor macrolitter and floating microplastic, 2016 (Agreed) and 2023 (Proposed/Updated).

IMAP Indicators	Categories of Marine Litter	BV-2016	Updated BV-2023	Proposed TV-2023
CI23	Seafloor Macro-litter	130-230 items/km ²	135 items/km ²	38 items/km ²
CI23	Floating Microplastics	0.2–0.5 items/m ²	0.044338 items/m ²	0.000845 items/m ²

2.2 Methodology for GES Assessment for IMAP Ecological Objective 10

23. All quality status environmental assessment methods, require two assessment criteria: (i) a threshold value for each parameter/element monitored, which defines the quality status; and (ii) a decision rule regarding the spatial extent within an assessment area, that achieves such quality status. Then the GES assessment follows specific methods (i.e., numeric calculations) which aggregate and integrate the monitoring data at the appropriate assessment scales, as explained in UNEP/MED WG.492/13. For example, it is possible that an element/parameter measured across an assessment area gets values both above and below the threshold value (e.g., beach litter concentrations measured in 10 beaches is found above threshold in 3 of them and below threshold in 7 of them), so a decision needs to be taken regarding the achievement or not of GES for the particular assessment area or Spatial Assessment Unit.

24. Upgrading the baselines and threshold values for IMAP CI22 and CI23 in the Mediterranean Sea is an ongoing process and UNEP/MAP has undertaken important steps in this regard. The assessment criteria used in the present assessment analysis, i.e., the GES and nonGES boundaries are based on the TV values defined under Chapter 2.1 to the present document. Monitoring data for each station and for each CI are compared against the respective TV to provide a classification between the GES and nonGES status.

25. After setting/upgrading the threshold values, a decision rule is needed on how to assess GES not on monitoring stations but on optimal spatial scale of assessment. As stated in UNEP/MAP (2019b) and recommended by the EU MSFD (SWD (2020) 62 final), it is considered more appropriate, to define the proportion of the assessment area that needs to achieve the threshold value in order to consider the assessment area in GES. For example, if for a specific parameter 95% of stations sampled in an assessment area get values below threshold then the area is considered in GES. The value of the proportion, whether it will be 95% or lower is considered the decision rule. For the purposes of IMAP CI17 in areas with limited data availability the rule of 75% of stations classified in GES has been applied to define the classification of the whole area in GES. For EO10 the same rule is proposed on the subdivision and/or subregion level.

26. Apart from the spatial integration of the assessment results on the level of Common Indicator, the quality status assessment of a specific area can be conducted also at the level of Ecological Objective. In this case aggregation methods need to be applied. The choice of the most appropriate aggregation method is critical and is dependent on the type of the EO whether it is related to pressure/impact or state.

27. Aggregation methods should ensure that information within an EO is not lost so that progress towards GES, and additional information on the effectiveness of measures are in place. There are several aggregation methods proposed in the literature. Usually these combine a methodology for the aggregation of the information from the parameter level to higher levels of CIs and EOs and a decision rule for the assignment of GES on the appropriate spatial scale. For aggregating CIs within the same EO it is important that all CIs have the same level of maturity and that sufficient monitoring data are available. The methods should allow for transparency of the various steps of aggregation-integration. This means that details on the assessment results which are relevant for management purposes can be unfolded.

28. Several assessment methods have been developed for contaminants. In particular, the adapted CHASE+ and the NEAT aggregation-integration methodologies have been applied for EO9- CI17 UNEP/MED WG.533/5³ and can be considered relevant also for EO10 and its CI22 and CI23. In both cases the aggregation per contaminant's data is based on averaging station data for all sampling dates. Then this value is compared against the threshold, i.e., a score ratio of concentration value to the TV is calculated. For GES, status scores are ≤ 1 and for non-GES >1 . Aggregation of all CIs data on the EO level for each station is further conducted by averaging the individual score ratios. The score result,

whether it falls above or below 1 determines the status of a specific station regarding the EO in question.

29. For the assessment of an area (from monitoring stations to spatial assessment) the CHASE+ methodology considers the rule of a predefined percentage of stations (i.e., 75%) that should be in GES i.e., with score ratio of ≤ 1 . The NEAT methodology on the other hand, requires information on spatial assessment units and integrates the score ratios of individual stations following a methodology of weighting averages; the weights are based on the spatial assessment surface area and its position within a hierarchical nesting scheme (i.e., from finest assessment units to the sub-division and sub-region levels). Furthermore, both methodologies consider two status classes under GES (high, good) and three status classes under the non-GES (moderate, poor, bad) depending on distance of the score ratio from 1.

30. It is very important to note that for a sound quality status assessment using the above-described methodologies on aggregation-integration of data, substantial spatial data coverage for all CIs is required. Otherwise, any attempt to aggregate variable amount of data per CI and /or spatially integrate results from limited data or uneven distribution of monitoring stations is prone to meaningless assessments. The latter applies also for the application of stations percentage decision rules for spatial assessments.

31. Given the assessed data availability for EO10 CI22 and CI23 for the Mediterranean Sea as described in Chapters 2.1 and 2.2 the following approach is followed for the quality status assessment. For each CI and each measured parameter (Beach litter, Seafloor Litter, Floating Microplastics) temporal data are averaged per monitoring station. The resulting average value is compared against the respective TV and the score ratio is calculated. Classification of stations is conducted following the status classes described in Table 5. No further aggregation on the EO 10 level or spatial integration is conducted for the Mediterranean region as a whole. For the Adriatic sub-region, for which spatial assessment units have been defined in 2022 for the Eutrophication-Pollution and Marine litter cluster, the application of the NEAT methodology was made possible for the 2 IMAP Common Indicators on marine litter (CI22 and CI23).

2.3 Monitoring Floating marine litter with aerial observation survey (ACCOBAMS)

32. Context: As an answer to the crucial need of monitoring marine biodiversity dynamics in a changing world, standardized aerial visual observation surveys have become prevalent in the biologist, ecologist and conservationist toolbox. They are particularly useful to monitor highly mobile, cryptic and elusive marine species, whose distributional ranges can span entire ocean basins, and which are otherwise very difficult to observe at the population scale. These characteristics of large-sized pelagic species largely entails their important exposition to anthropogenic threats, from shipping noise and collisions, habitat alteration, resource depletion, to pollution.

33. Aerial surveys are recognized opportunities to implement multi-target monitoring in the marine environment, and such surveys are increasingly used to routinely monitor all visible wildlife (primary targets: cetaceans, seabirds, fishes, turtles), but also anthropogenic activities and pollutions (litter, oil; see for example, Laran et al., 2017; Pettex et al., 2017; Rogan et al., 2018; ACCOBAMS, 2021; Hammond et al 2017). Such an approach subsequently permits us to analyze and assess the potential exposition of wildlife to particular threats.

34. This kind of approach is particularly appealing when it comes to study, understand and monitor the natural populations living in environments strongly impacted by human activities, as is the case with the Mediterranean and Black Sea (Micheli et al., 2013; Halpern et al., 2015, 2019; Rodríguez-Rodríguez et al., 2015).

35. In this context, the ACCOBAMS Survey Initiative (ASI) project was launched in 2016 and carried out large-scale surveys in summers 2018 and 2019 (ACCOBAMS, 2021). Its primary aim was to establish an integrated, collaborative and coordinated monitoring system for the status of cetaceans and other species of conservation concern at the whole ACCOBAMS area level (sea turtles, seabirds, fishes). Yet, since a crucial part of conservation management lies in mediating the interactions between nature and human activities (Johnson et al., 2017), the ASI project also aimed at better understanding the presence and distribution of anthropogenic activities (ships), as well as of floating marine litter (FML), known to acutely plague the Mediterranean.

36. The ASI was composed of two parts (ACCOBAMS, 2021): an aerial survey conducted in summer 2018, and a boat-based survey carried out in summers 2018 and 2019. The monitoring of floating marine litter was implemented for the aerial component of the survey. The methodology applied, including survey design and implementation, the observation protocol as well as the post-survey analysis of FML abundance and distribution, is presented hereafter.

37. Survey design and implementation: Following distance sampling (DS) principles, the layout of a survey design is of utmost importance, as it conditions the validity of the recorded data to reliably estimate abundance and distribution of target species (Buckland et al., 2015). The main requirement is to ensure a representative sampling of the study area with uniform coverage. Given the Mediterranean is wide and composed of several ecoregions with particular biotic and abiotic characteristics, these requirements imply a stratified design must be used.

38. The Mediterranean was divided into large blocks, subsequently divided into sub-blocks within which the observation transects were laid out. The organisation of blocks (and resulting transects) was first designed to create ecologically relevant units, with blocks of homogeneous oceanographic and physiographic conditions. This original design was then modified to incorporate political or jurisdictional constraints, and logistic issues regarding fuel availability, plane endurance, airport locations and issuing of flight permits.

39. Inside the blocks, transects were laid out to ensure the most uniform coverage possible (Buckland et al., 2015; Strindberg and Buckland, 2004). Different designs are available: transects can either be parallel to each other or set up in a zigzag layout. The type and the final layout of transects (angles, spacing...) condition the final coverage of the study area, but also the amount of off-effort transit time. These parameters must be fine-tuned to find the best compromise between logistic constraints (fueling, airport locations) and maximizing the coverage uniformity. Dedicated tools exist in the DS toolbox to help the survey designers achieve such goals.

40. Following all these principles and constraints, the final block design for the ASI divided the Mediterranean into 32 large blocks, within which transects were located with a zigzag layout.

41. Observation protocol and data collection: All observers were distributed into eight observation teams, based on previous experience in leading and participating to aerial surveys, resulting in teams of equivalent overall experience. They all participated in common theoretical and practical training sessions focused on familiarizing them to field work activities, species to be encountered, protocols and data collection. Training flights were also operated to simulate real field conditions and ensure all observers follow the same principles and carry out the protocol similarly.

42. Each team was associated to a plane, operating in a predefined sector of the survey. Three different models of plane were used, all high-winged, double-engine and equipped with bubble-windows to ensure observation under the plane: four Partenavia, two Britten Norman Islander and two Cessna Skymaster O-2 push-pull. The crew was composed of the pilot plus three observers. Following common practice, the altitude during observation sessions was set to 183 m, with a constant speed of 10 knots (Laran et al., 2017; Pettex et al., 2017; Rogan et al., 2018; ACCOBAMS, 2021; Hammond et al 2017). Data collection was done with a software specifically designed for aerial surveys – the SAMMOA software (Observatoire Pelagis, 2018). The software is connected to a GPS, recording the

precise location of the plane track, and to an audio recording system, ensuring the whole flight is audio-saved for future data validation. The teams used this software to record the flight plan, the observers position inside the plane, the environmental conditions of observation (sea state, cloud cover, sun glare, etc.) and all sightings made. Every day after the flights, data were validated with the voice recording.

43. The main target of the survey were marine mammals and large fishes (elasmobranchs, tunas, swordfish). For those, observers followed a line-transect protocol: for every sighting, they recorded the declination angle to the track line when the animal or its group were abeam of the plane (Figure 1). As specified above, the multi-target protocol also included the recording of seabirds, sea turtles, sunfish as well as floating marine litter (FML) and boats but following a strip-transect protocol (Figure 1): all sightings made within a strip of 200 m (birds, turtles, sunfish and FML) or 500 m (boats) on each side of the track line were recorded. For the particular case of FML, observers recorded the type of the items (fishing trash, plastic trash, etc.) whenever possible. When the item was reliably recognizable, its nature was also recorded (inflatable mattress, fish box or balloons, for example).

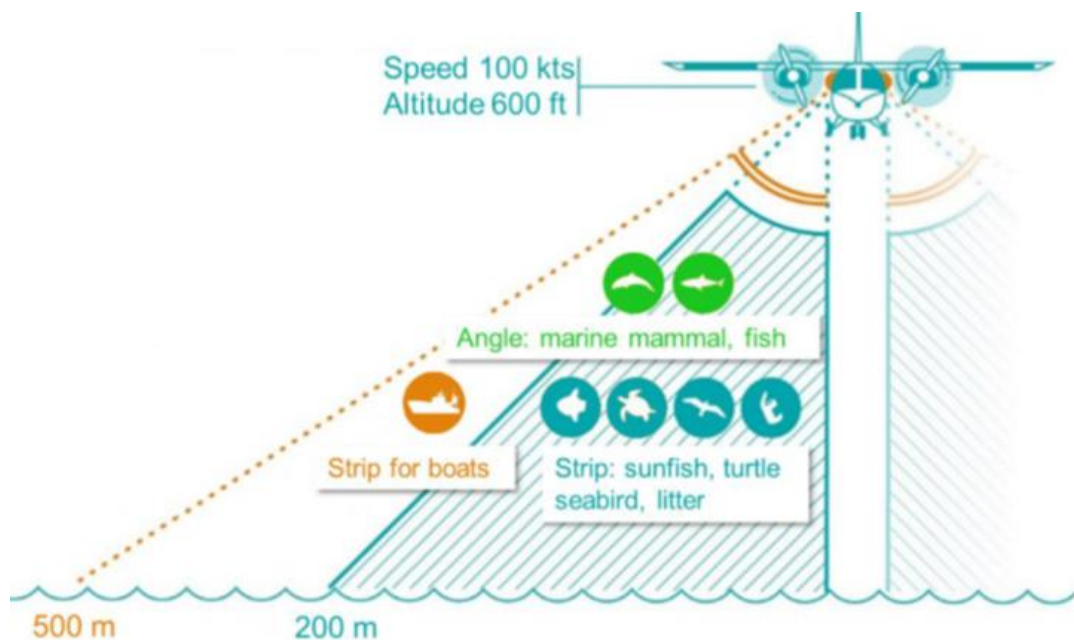


Figure 1: Data collection protocol. Observers scanned the sea surface and subsurface as well as the air column below the aircraft and recorded all sighted items: seabirds, turtles, sunfish and FML were recorded within a band of 200 m, boats within a band of 500 m, cetaceans and large fish were recorded without distance limit but with a detection angle.

44. Alongside target sightings, observers recorded all observation conditions potentially affecting the detection of targets, such as sea state, glare severity, turbidity, cloud coverage, and derived an overall subjective assessment of the detection conditions (from poor to excellent), estimating the likelihood of seeing a small cetacean present within the searching area. Since the weather directly affects the detectability of target species, flights were only done in good weather.

45. Post-survey analysis of FML: As said above, FML were recorded following a strip transect methodology. Such method estimates the abundance of targets in the study area by relying on the assumption that the detection of all items within the strip around the track line is perfect. Although the flight was restrained to best possible observation conditions, this assumption does not hold true and the effective detection probability of FML is directly dependent upon observation conditions.

46. Therefore, FML data necessitated building a dedicated analytical method to correct for this bias. This was achieved with a hierarchical Species Distribution Model in the Bayesian framework (Lambert et al., 2020), which permits modelling both the measurement process (here, the detectability) and the process of interest (here, presence). The idea was to first estimate the detection probability

based on sampling units where FML were sighted, as a function of observation conditions. Second, we modelled the presence of FML based on corrected detection and estimated it spatially throughout the study area. Thanks to the Bayesian approach, the uncertainty around estimated parameters (detection and presence probabilities) were easily extracted.

47. Finally, the total abundance of FML was derived from this presence probability map (Lambert et al., 2020). Assuming the presence probability was linked to abundance through a Poisson process, the number of FML present in each cell was estimated from the presence probability and the average number of sighted items (corrected for detection). The abundance was also estimated at the block scale, using a bootstrap procedure on the number of items sighted per transect, for both surveyed and un-surveyed blocks. Again, uncertainties were duly propagated through the analysis, from which was derived the 80% credibility interval around the total estimated abundance of FML.

3. Drivers, Pressures, State, Impact, Response (DPSIR)

48. The methodology for integration of assessment results within the DPSIR approach was elaborated further to the discussion that took place during the Meetings of CORMON Marine litter and MED POL Focal Points in 2021. The two approaches were introduced to guide comparison/connecting the known pressures/drivers already defined by expert judgment for a specific assessment with the GES assessment results obtained by applying the GES/Environmental assessment methodologies tested and agreed for application for the specific Common Indicators.

49. The methodology builds on the work undertaken to map the interrelations between sectors, activities, pressures, impacts and state of marine environment for EO10, within the preparation of the working document UNEP/MED WG.490/3 “Addressing Interrelation of Pressures-Impacts of Marine Litter and the Status of Marine Ecosystem Components”.

50. Pressures for marine litter can be considered in the two following ways: (i) at source, i.e. focusing on the primary and main activities generating the pressure; this aspect is relevant for setting environmental targets and defining measures aiming at reducing the pressures in order to achieve or maintain GES; and (ii) at sea, i.e. the level of pressure in the marine environment to which the different elements of the ecosystem are subjected; this aspect is particularly relevant for determining GES for both IMAP pressure-based and status-based Common Indicators.

51. The Intensity of natural and anthropogenic pressures have been evaluated according to the following color code and ordered by the worst result obtained (Table 5).

Table 5: Intensity of natural and anthropogenic pressures

3	Significant Contribution of the Activity to Pressure
2	Minor Contribution of the Activity to Pressure
1	No Activity but Possible Development of the Activity
0	No Contribution to Pressure

52. The interactions between pressures and impacts for EO10, as measured by IMAP Common Indicators, are shown here below in Tables 6 and 7. They are presented in the GRID/Table approach that takes into account the geographical scales for the assessment to the sub-division level. The proposed interrelations were agreed further to the discussion that took place during the Meeting of the Ecosystem Approach Correspondence Group on Marine Litter Monitoring (30 March 2021).

53. The introduced table cross-maps all the anthropogenic activities with significant contribution to pressures with the Common Indicators used for IMAP EO10 marine litter monitoring and assessment. Expert judgment, including inputs received from 6 Contracting Parties, contributed to better refine the specific interactions, for these activities contributing to pressures at Common Indicator level considering sub-regions, or, if relevant and appropriate, sub-divisions or lower

geographical units (using as appropriate the nested approach). Certainly, additional expert input is required for a more accurate regional representation, however Tables 6 and 7 already include a very useful analysis which could facilitate setting the scene for the way forward.

54. Pressure analysis for IMAP Common Indicator 22 (CI22): The assessed greatest pressure in all sub-areas is generated by the sector of tourism, followed by other sectors i.e., coastal urbanization, solid waste management, and agricultural and forestry practices (Table 6).

55. Renewable energy facilities are those that produce the least important pressure, followed by the extraction of genetic resources, research and activities, defense activities, and cables and pipes installation.

56. There are some differences between sub-regions: in the Western Mediterranean, tourism stands out as the greatest pressure in all its sub-areas. However, in the Adriatic, coastal construction, aquaculture, and solid waste management are also highlighted as important pressures.

57. As far as the Central and Eastern Mediterranean are concerned, the most important pressures coincide, i.e., agricultural and forestry activities, cruises, coastal urbanization, fishing (including recreational fishing), and solid waste management. In general, the variations between the sub-regions are small, although resulting in the same greatest pressures in all of them.

58. Pressure analysis for IMAP Common Indicator 23 (CI23): The greatest pressure in all sub-areas is generated by the fishing sector, followed by aquaculture (Table 7). Renewable energy facilities, energy extraction, research and education activities, and the extraction of genetic resources are the ones that produce the least pressure.

59. However, there are some differences between sub-regions. In Western Mediterranean, tourism, wastewater discharge, and fishing stand out as those that produce the most pressure; while in the Adriatic, fishing and aquaculture stand out as important pressures.

60. As far as the Central and Eastern Mediterranean are concerned, the most important pressures coincide, i.e., agricultural and forestry activities, cruises, coastal urbanization, fishing (including recreational fishing), and solid waste management. This is also the case for IMAP CI22 where the same types of pressures are highlighted as important.

61. In general, the fundamental and main pressures for IMAP EO10 CI22 and CI23 are not the same. While tourism and coastal construction are the most important for IMAP EO10 CI22; fisheries and aquaculture are those that mostly affect IMAP EO10 CI23.

Table 6: Interrelation of natural and anthropogenic pressures (selected based on the main activities in terms of pressures as provided by ICZM Protocol and other Barcelona Convention`s Protocols) affecting the marine ecosystems and the measurement IMAP Common Indicator 22.

Pressures vs. measures IMAP EO10 Common Indicator 22	Common Indicator 22 (Ecological Objective 10)																														
	Sub-Regions	Non-Construction Zone	Natural Hazards	Natural disasters	Climate Change	Agric. and forestry runoff	Coastal Urbanization	Damming (demand on water)	Waste-water discharges	Industry	Tourism frequentation	Yachting	Marine mining	Dredging	Desalinization	Coastal artificialization.	Port operations	Offshore structures	Cables and pipelines	Shipping	Oil and gas extraction	Renewable energy	Fishing (incl. recreational)	Sea-based food harvesting	Extraction of genetic resources	Aquaculture	Solid waste disposal	Storage of gases	Research and education	Defense operations	Damping of munitions
	Western Med. Sea		Yellow	Red	Green	Red	Red		Yellow	Yellow	Red									Red			Yellow			Yellow					
	Adriatic Sea	Green	Yellow	Yellow	Yellow	Red	Red	Red	Yellow	Yellow	Red	Yellow	Yellow	Yellow	Green	Yellow	Yellow	Yellow	Green	Yellow	Yellow	Green	Red	Yellow	Green	Red	Red	Green	Yellow	Green	Red
	Central Med. Sea		Green		Green	Red	Red	Green	Yellow	Yellow	Red	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Yellow	Yellow	Green	Red	Green	Green	Red	Red	Green	Green	Green	Red
	Aegean and Levantine Sea	Yellow	Yellow	Yellow	Yellow	Red	Red	Green	Red	Red	Red	Red	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Red	Yellow	Green	Red	Red	Yellow	Green	Yellow	Red
	Mediterranean Average	Yellow	Yellow	Yellow	Yellow	Red	Red	Yellow	Red	Red	Red	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Yellow	Yellow	Green	Red	Yellow	Green	Red	Red	Yellow	Yellow	Yellow	Red

Table 7: Interrelation of natural and anthropogenic pressures (selected based on the main activities in terms of pressures as provided by ICZM Protocol and other Barcelona Convention`s Protocols) affecting the marine ecosystems and the measurement IMAP Common Indicator 23.

Pressures vs. measures IMAP EO10 Common Indicator 23	Sub-Regions	Common Indicator 23 (Ecological Objective 10)				
		Mediterranean	Aegean and Levantine Sea	Central Med. Sea	Adriatic Sea	Western Med. Sea
Non-Construction Zone						
Natural Hazards						
Natural disasters						
Climate Change						
Agric. and forestry runoff						
Coastal Urbanization						
Damming (demand on)						
Waste-water discharges						
Industry						
Tourism frequentation						
Yachting						
Marine mining						
Dredging						
Desalination						
Coastal artificialization.						
Port operations						
Offshore structures						
Cables and pipelines						
Shipping						
Oil and gas extraction						
Renewable energy						
Fishing (incl. recreational)						
Sea-based food harvesting						
Extraction of genetic						
Aquaculture						
Solid waste disposal						
Storage of gases						
Research and education						
Defense operations						
Damping of munitions						

62. Results for both indicators integrating the most significant contribution of the corresponding sectors/ activity(ies) to pressure for the four Mediterranean Subregions (red colour; Tables 1 and 2) give us information on those that mostly contribute to generation of marine litter impacts in the Mediterranean Basin (Table 8).

Table 8: The most significant contribution of corresponding sectors/ activity(ies) to pressures on marine ecosystem from marine litter in the four Mediterranean Subregions

	CI22	CI23
Agricultural and Forestry Runoffs	✓	✓
Coastal Urbanization	✓	✓
Waste-Water Discharges	✓	✓
Tourism Frequentation	✓	✓
Yachting	✓	✓
Fishing	✓	✓
Aquiculture	✓	✓
Solid Waste Disposal	✓	✓
Damping of Munitions	✓	✓

63. Further to the interrelation of IMAP EO10-Marine Litter and its respective Common Indicators 22 and 23 with the relevant natural and anthropogenic pressures, by applying GRID approach, as provide above in Tables 6 and 7, a Scoreboard method was applied in order to initially quantify the magnitude of impacts of the pressures with the most significant contribution over the ecosystem components.

64. The approach applied is based on Excel tool used for an expert-based evaluation both of category of pressures and impact scores. It allows estimating (in %) how many categories of pressures have the potential to threaten the marine ecosystem regarding marine litter. Experts involved in such evaluation provide an assessment for each pressure type through a 0/1 score: 1 indicating the presence of the potential risk and 0 its absence. The final score is than expressed in percentage, dividing the sum of all scores for the number of scored pressured (activity types)/

65. The same Excel tool enables to estimate the magnitude of impacts (in %) by adapting its conceptual objective. Thus, for each category of pressures the experts involved in the evaluation are invited to express a 0 to 3 score: 0 indicating the absence of the impact, while 1, 2 and 3 respectively indicating the presence of an impact with low, moderate and high magnitude. Similarly, to the analysis on the occurrence of potential threats, the final score is expressed in percentage and is obtained by dividing the sum of all scores by the maximum theoretical score (equal to the number of scored items i.e., category of pressures multiplied by 3).

66. The quantitative estimation of the overall impacts of pressures related to IMAP CI22 (Table 6) was provided for inland and coastal areas, while quantification of impacts of pressures of relevance for IMAP CI23 (Table 7) was provided in offshore areas. The value of the % of total impact on the Mediterranean is considered as the current average situation (Table 9), the higher values for each subregion can be considered high and the lower values as moderate.

Table 9: Scoreboard approach results

	Overall, of Pressure-Impact (%)	Inland % of total impact	Coastal Area % of total impact	Offshore % of total impact
WM	16	6	17	23
AD	32	24	30	41
CM	23	18	23	28
EM	23	13	25	28
Mediterranean Sea	22	12	24	27

67. Accordingly, it can be concluded that 22% of pressure categories recorded in Mediterranean against the list of main activities in terms of pressures as provided by ICZM Protocol and other Barcelona Convention's Protocols, contribute to generation of marine litter impacts on ecosystem components. The 24% and 27 % of all pressures categories related to marine litter generate impacts over ecosystems in coastal and offshore areas respectively. Moreover, 12% of all pressures categories related to marine litter generate impacts over ecosystems from inland areas (Table 9).

68. In order to reach the GES, efforts should be focused in decreasing the impact of the 3 specific activities as identified the most important on marine litter generation (Table 8). This would allow the decrease of the total amount of marine litter recorded in the surveys. If the implementation of key/selected reduction and prevention measures in the Mediterranean is applied in a coherent way across the region, there is an indication for WM, AD and CM reaching GES, while EM will reach a moderate colour status, decreasing the effects and impacts on marine and coastal environment.

69. A number of measures can be proposed (listed hereunder) to be applied at national level, focusing on the activities that are contributing with a high level of interaction in the respective sub-regions (Tables 6 and 7): i.e., urbanization, tourism, fishing and agriculture. The other activities with high impact in the Mediterranean (Table 8) have an irregular relevance depending on the subregion:

- Coastal Urbanization:
 - Control of new urban development and their proximity to the coastline.
 - Control of waste management in coastal urbanizations (litter bins distribution, collection schedule and location of final waste disposal).
 - Promotion of prevention policies against waste generation (limitation of the single-use items and containers sale).
 - Promotion of recycling projects that generate added value from the reutilization of waste as new materials (Circular Economy).
- Tourism:
 - Control of waste generation in hotels, commercial, and recreational facilities. Incentives for the prevention of waste generation.
 - Promoting the elimination of single-use products in hotels, commercial, and recreational activities sectors.
 - Incentives for the creation of practices related to collection and recycling of the waste generated by hotels and commercial facilities.
- Fishing:
 - Education and awareness of the fisheries sector regarding the environmental improvement (e.g., zero waste into seas).
 - Promotion of "Fishing for litter" activities among the fishing fleet.
 - Education and awareness of the stakeholders regarding the benefits achieved by the removal of marine litter from the environment (practices improvements derived from the habitat improvements of the commercial target species, reduction of vessel accidents and breakdowns due to the presence of marine litter).
 - Promoting the implementation of storage areas for marine litter collection in ports.
- Agriculture:
 - Education and awareness of the stakeholders about the benefits derived from proper waste management.
 - Promoting the creation of waste management systems derived from agricultural practices.

4. Good environmental status (GES) / alternative assessment

4.1 Theme selected for GES assessment

70. The theme selected for GES assessment under the present chapter on marine litter in the framework of 2023 MED QSR is IMAP Ecological Objective 10 and its two Common Indicators:

- a) EO10: Common Indicator 22 (CI22): Trends in the amount of litter washed ashore and/or deposited on coastlines (including analysis of its composition, spatial distribution and, where possible, source).
- b) EO10: Common Indicator 23 (CI23): Trends in the amount of litter in the water column including microplastics and on the seafloor

71. The assessment for IMAP EO10 CI22 mainly focuses on marine litter items found deposited on beaches (beach marine litter), and for IMAP EO CI23 focused on seafloor macro-litter and floating microplastics. For the current assessment data explicitly deriving from IMAP InfoSystem have been used.

72. The assessment focuses on 3 main elements: (a) GES – nonGES assessment; (b) quantitative findings and assessment, and (c) qualitative findings and assessment.

4.2 GES Assessment for CI/ alternative assessment for CI

4.2.1 GES Assessment / Alternative Assessment for IMAP EO10 Common Indicator 22

Geographical scale of the assessment	Regional and Sub-regional
Contributing countries	Bosnia-Herzegovina, Cyprus, Croatia, France, Greece, Israel, Italy, Lebanon, Montenegro, Morocco, Spain, Slovenia, Türkiye
Mid-Term Strategy (MTS) Core Theme	Enabling Programme 6: Towards Monitoring, Assessment, Knowledge and Vision of the Mediterranean Sea and Coast for Informed Decision-Making
Ecological Objective	EO10: Marine and coastal litter do not adversely affect coastal and marine environment
IMAP Common Indicators	Common Indicator 22 (CI22): Trends in the amount of litter washed ashore and/or deposited on coastlines (including analysis of its composition, spatial distribution and, where possible, source)
GES definition	Number/amount of marine litter items on the coastline do not have negative impact on human health, marine life and ecosystem services
Related Operational Objective	10.1 The impacts related to properties and quantities of marine litter in the marine environment and coastal environment are minimized
GES Target(s)	Decreasing trend in the number of/amount of marine litter (items) deposited on the coast
Baseline and Threshold Values	BV: 369 items/100m TV: 130 items/100m

73. **Beach Litter (CI22)** data are reported in the IMAP InfoSystem from 13 CPs covering all 4 sub-divisions (ADR, CEN, EM, WM). In total 191 beaches are monitored during the period 2017-2021 in the following countries: Bosnia-Herzegovina, Croatia, Cyprus, France, Greece, Italy, Israel, Lebanon, Morocco, Montenegro, Spain, Slovenia, Türkiye. A total of 931 surveys were stored and uploaded to IMAP InfoSystem reflecting the collection and removal of ~300,000 marine litter items from the Mediterranean coastline. In line with the agreement of the Contracting Parties in 2021¹ on a unified list of marine litter items under IMAP, the Secretariat for the purpose of this report discarded those items which could not be categorized in accordance with the IMAP/ MED POL list for beach marine litter items.

74. Concentrations of Beach Litter (items/100m) are highly variable fluctuating between 8 and 47,361 items /100m. Average beach litter concentration on the Mediterranean coastline is found equal to 961 ± 3664 items/100 m.

75. Following the assessment methodology explained in Chapter 2.2, and using the TV of 130 items/100m, temporal average data from the 191 beaches are compared against the threshold, resulting in their classification under 5 status classes (high, good, moderate, poor, bad) shown in Table 10. Overall, 79% of the beaches monitored do not achieve GES, and most of them fall into the moderate (24 %) and poor (29 %) and bad (25 %) categories, i.e., beach litter concentrations are up to two to five times higher than the TV. In Table 11 the classification results are given for each sub-Region separately.

Table 10: The GES – nonGES classification of the 192 monitored beaches in the Mediterranean Region.

Mediterranean Region			
Boundary limits	GES- nonGES classes	No of Beaches	% of Beaches
$\leq 0.5xTV$	HIGH	10	5
$0.5xTV < \leq 1xTV$	GOOD	23	11
$1xTV < \leq 2xTV$	MODERATE	49	24
$2xTV < \leq 5xTV$	POOR	59	29
$> 5xTV$	BAD	51	25
192 beaches			

76. On the sub-Region level, the Central Mediterranean appears the least affected by beach litter with 32 % out for the 22 beaches monitored falling into the GES category. The Adriatic, Eastern and Western Mediterranean sub-regions show an equal distribution of beaches under GES (14 -16 %) and non-GES (84 -86 %) classes. These results are depicted spatially in the maps of Figures 2 to 5.

¹ Meeting of the Ecosystem Approach Correspondence Group on Marine Litter Monitoring (CORMON Marine Litter), 30 March 2021 (UNEP/MED WG.490/6).

Table 11: The GES – nonGES classification of the monitored beaches in the 4 Mediterranean sub-Regions

Boundary limits	GES- nonGES classes	No of Beaches	% of Beaches	
Adriatic sub-Region				
≤ 0.5xTV	HIGH	3	7	16% GES
0.5xTV < ≤ 1xTV	GOOD	4	9	
1xTV < ≤ 2xTV	MODERATE	11	24	84 % nonGES
2xTV < ≤ 5xTV	POOR	17	38	
> 5xTV	BAD	10	22	
45 beaches				
Central Mediterranean sub-Region				
≤ 0.5xTV	HIGH	0	0	32% GES
0.5xTV < ≤ 1xTV	GOOD	7	32	
1xTV < ≤ 2xTV	MODERATE	8	36	68% nonGES
2xTV < ≤ 5xTV	POOR	3	14	
> 5xTV	BAD	4	18	
22 beaches				
Eastern Mediterranean sub-Region				
≤ 0.5xTV	HIGH	3	5	14% GES
0.5xTV < ≤ 1xTV	GOOD	5	9	
1xTV < ≤ 2xTV	MODERATE	13	22	86% nonGES
2xTV < ≤ 5xTV	POOR	16	28	
> 5xTV	BAD	21	36	
58 beaches				
Western Mediterranean sub-Region				
≤ 0.5xTV	HIGH	4	6	16% GES
0.5xTV < ≤ 1xTV	GOOD	7	10	
1xTV < ≤ 2xTV	MODERATE	17	25	84% nonGES
2xTV < ≤ 5xTV	POOR	23	34	
> 5xTV	BAD	16	24	
67 beaches				

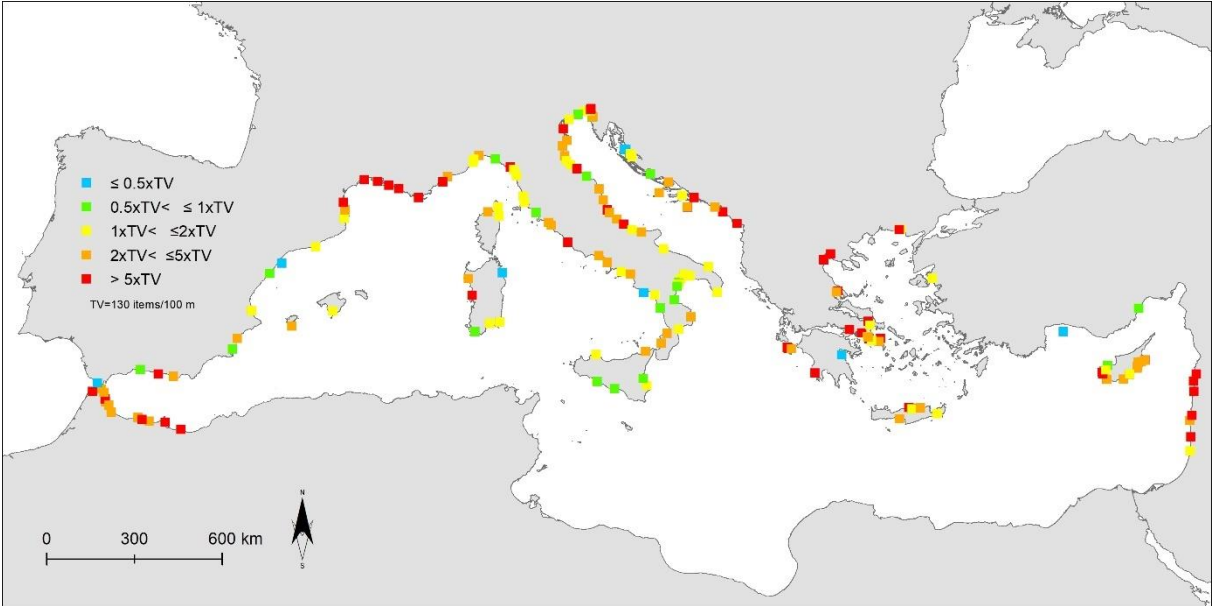


Figure 2: GES assessment classification of the beaches monitored for marine litter in the Mediterranean Region.

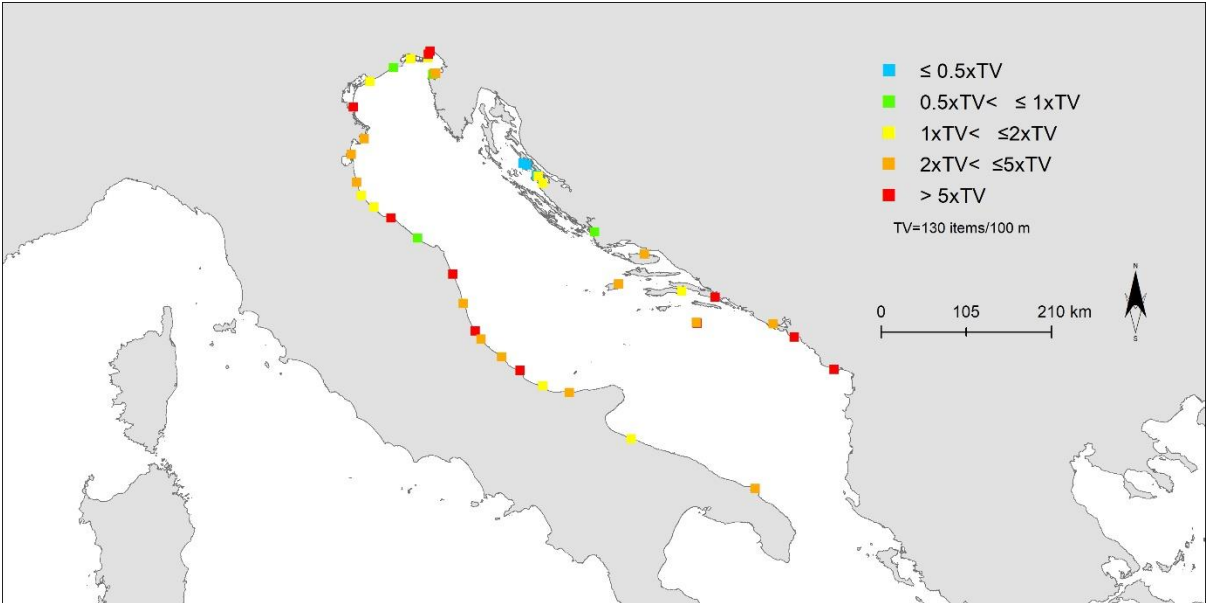


Figure 3: GES assessment classification of the beaches monitored for marine litter in the Adriatic and Central Mediterranean sub-regions.

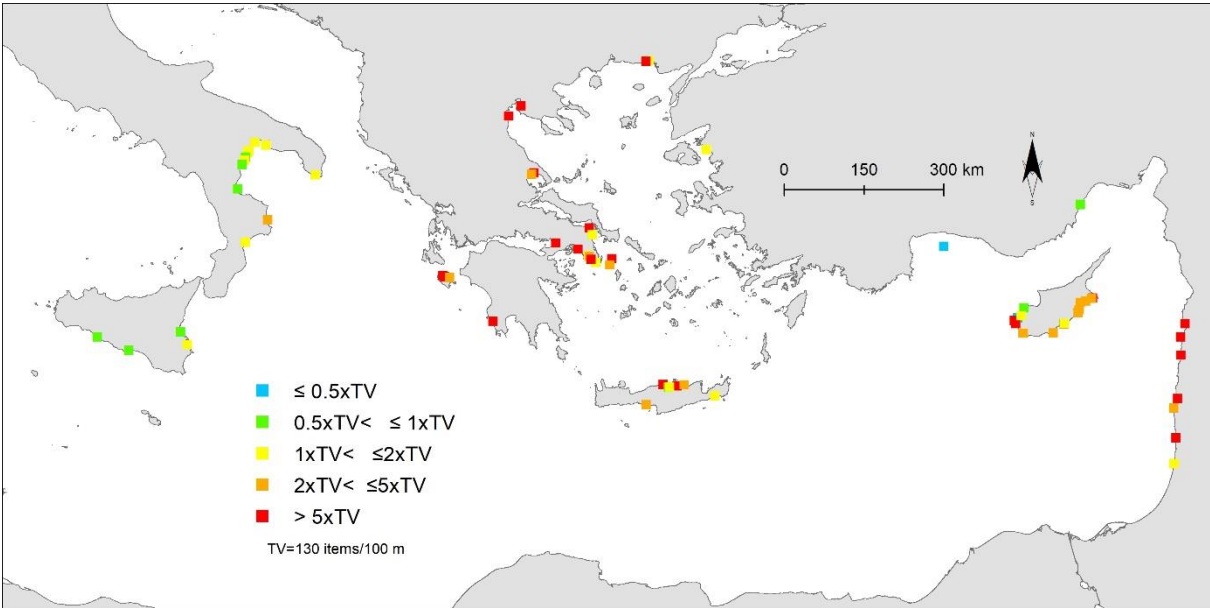


Figure 4: GES assessment classification of the beaches monitored for marine litter in the Eastern and Central Mediterranean sub-Regions.

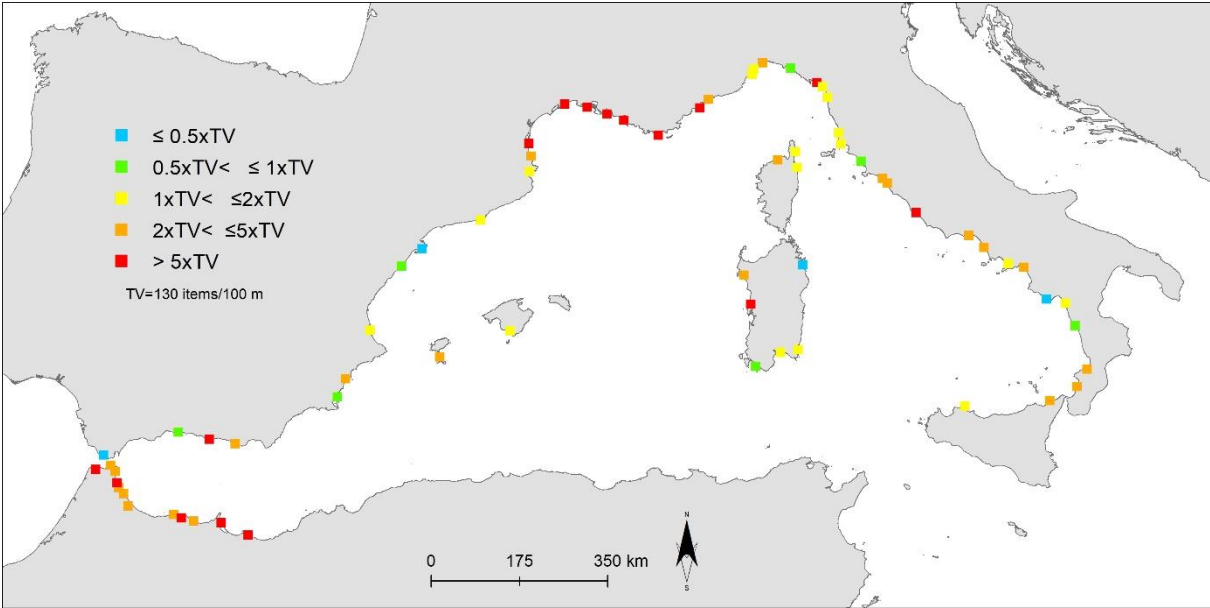


Figure 5: GES assessment classification of the beaches monitored for marine litter in the Western Mediterranean sub-Region.

77. The average beach marine litter density from the 10 countries varied between a maximum of 5,716 to 105 items/100m. The average beach marine litter densities are presented hereunder (Table 12).

Table 12: Average beach marine litter densities in the Mediterranean Countries

Country	Average Density (items/100m)
Bosnia & Herzegovina (BA)	1,443 (\pm 1743) items/100m
Croatia (HR)	258 (\pm 1743) items/100m
Cyprus (CY)	396 (\pm 301) items/100m
France (FR)	1,499 (\pm 1,253) items/100m
Greece (GR)	1,232 (\pm 1,203) items/100m
Israel (IL)	483 (\pm 251) items/100m
Italy (IT)	435 (\pm 1352) items/100m
Lebanon (LB)	5,716 (\pm 3252) items/100m
Montenegro (ME)	680 (\pm 106) items/100m
Morocco (MA)	697 (\pm 343) items/100m
Slovenia (SI)	436 (\pm 240) items/100m
Spain (ES)	265 (\pm 267) items/100m
Türkiye (TR)	105 (\pm 46) items/100m

78. An analysis was undertaken on the Top-10 items that have been recorded in the respective countries. For 11 countries, the top-10 item list represents more than 70% of the collected litter items, and for 2 Countries represents slightly lower share (approximately 68-69%) of the collected litter items. Bosnia and Herzegovina gave an extreme value of 97.4%, followed by Lebanon (86.9%), Slovenia (81.6%), Croatia (81.1%), Italy (79.2%), France (78%), Cyprus (77.1%), Montenegro (73.8%), Greece (72.2%), Israel (72.0%), Türkiye (71.5%), Spain (68.9%), and Morocco (67.7%). The analysis and detailed list of the Top-10 item list per country is provided hereunder (Table 13).

Table 13: Top-10 item list of beach marine litter found in the Mediterranean Countries

Bosnia and Herzegovina				Croatia			
Top 10	Beach Litter Item	Total Items	%	Top 10	Beach Litter Item	Total Items	%
1	G27	4,864	56.2%	1	G76	3,331	26.6%
2	G178	1,080	12.5%	2	G27	1,938	15.5%
3	G76	677	7.8%	3	G95	1,719	13.7%
4	G21/24	646	7.5%	4	G21/24	1,380	11.0%
5	G5	514	5.9%	5	G3	540	4.3%
6	G30/31	231	2.7%	6	G30/31	318	2.5%
7	G145	151	1.7%	7	G35	313	2.5%
8	G158	104	1.2%	8	G50	235	1.9%
9	G165	96	1.1%	9	G7/G8	201	1.6%
10	G53	68	0.8%	10	G124	193	1.5%

France				Greece			
Top 10	Beach Litter Item	Total Items	%	Top 10	Beach Litter Item	Total Items	%
1	G76	74,288	36.03%	1	G76	5465	25.1%
2	G21/24	15,046	7.30 %	2	G124	2,661	12.2%
3	G124	13,198	6.40 %	3	G21/24	2,128	9.8%
4	G30/31	12,349	5.99 %	4	G7/G8	1,643	7.5%
5	G95	11,672	5.66 %	5	G27	1,313	6.0%
6	G27	10,550	5.12 %	6	G45	1,157	5.3%
7	G208a	9,818	4.76 %	7	G35	738	3.4%
8	G200	5,608	2.72 %	8	G210a	708	3.2%
9	G73	4,351	2.11 %	9	G50	687	3.2%
10	G145	3,680	1.78 %	10	G171	606	2.8%

Israel			
Top 10	Beach Litter Item	Total Items	%
1	G76	6,202	18.3%
2	G4	3,648	10.7%
3	G21/24	2,867	8.4%
4	G33	2,755	8.1%
5	G37	2,014	5.9%
6	G10	1,590	4.7%
7	G30/31	1,540	4.5%
8	G27	1,535	4.5%
9	G35	1,433	4.2%
10	G50	876	2.6%

Morocco			
Top 10	Beach Litter Item	Total Items	%
1	G27	17,539	25.1%
2	G30/31	9,619	13.8%
3	G21/24	8,189	11.7%
4	G7/G8	3,526	5.0%
5	G124	2,875	4.1%
6	G5	1,929	2.8%
7	G76	1,525	2.2%
8	G33	1,512	2.2%
9	G4	1,442	2.1%
10	G19	1,198	1.7%

Spain			
Top 10	Beach Litter Item	Total Items	%
1	G27	12,116	15.8%
2	G76	9,235	12.0%
3	G50	7,868	10.3%
4	G21/24	6,876	9.0%
5	G95	4,701	6.1%
6	G124	4,260	5.6%
7	G30/31	3,092	4.0%
8	G73	2,112	2.8%
9	G3	1,506	2.0%
10	G204	1,148	1.5%

Italy			
Top 10	Beach Litter Item	Total Items	%
1	G76	89,895	51.2%
2	G21/24	9,393	5.4%
3	G27	7,976	4.5%
4	G95	5,884	3.4%
5	G67	5,755	3.3%
6	G73	5,147	2.9%
7	G45	3,999	2.3%
8	G30/31	3,712	2.1%
9	G124	3,638	2.1%
10	G3	3,531	2.0%

Lebanon			
Top 10	Beach Litter Item	Total Items	%
1	G27	5,975	34.8%
2	G76	2,029	11.8%
3	G21/24	1,654	9.6%
4	G208a	1,619	9.4%
5	G124	1,322	7.7%
6	G30/31	1,182	6.9%
7	G35	451	2.6%
8	G--	387	2.3%
9	G7/G8	382	2.2%
10	G3	368	2.1%

Slovenia			
Top 10	Beach Litter Item	Total Items	%
1	G27	1,334	25.5%
2	G76	886	16.9%
3	G4	377	7.2%
4	G21/24	354	6.8%
5	G45	324	6.2%
6	G30/31	270	5.2%
7	G95	258	4.9%
8	G10	176	3.4%
9	G124	161	3.1%
10	G50	133	2.5%

Türkiye			
Top 10	Beach Litter Item	Total Items	%
1	G21/24	123	26.3%
2	G7/G8	60	12.8%
3	G76	31	6.6%
4	G30/31	20	4.3%
5	G152	19	4.1%
6	G3	18	3.9%
7	G178	18	3.9%
8	G50	17	3.6%
9	G33	15	3.2%
10	G49	13	2.8%

Cyprus			
Top 10	Beach Litter Item	Total Items	%
1	G27	9,338	22.5%
2	G21/24	7,610	18.4%
3	G26	3,844	9.3%
4	G4	3,490	8.4%
5	G30/31	1,616	3.9%
6	G35	1,542	3.7%
7	G7/G8	1,273	3.1%
8	G50	1,253	3.0%
9	G3	1,087	2.6%
10	G158	909	2.2%

Montenegro			
Top 10	Beach Litter Item	Total Items	%
1	G27	2043	36.8%
2	G76	511	9.2%
3	G21/24	419	7.5%
4	G30/31	318	5.7%
5	G7/G8	230	4.1%
6	G124	190	3.4%
7	G175	102	1.8%
8	G154	101	1.8%
9	G198	101	1.8%
10	G3	97	1.7%

79. The aforementioned analysis provides very interesting results for the top item list at the level of the Mediterranean. The Top-item lists from the 13 countries, extracts into 39 common items of which:

- 3 items have a share of more than 10%, respectively: *Plastic/polystyrene pieces 2.5 cm > < 50 cm* (G76) with 38.6%, *Cigarette butts and filters* (G27) with 13.4%, and *Plastic caps and lids* (including rings from bottle caps/lids) (G21/24) with 10.7%.
- 2 items have a share between 5-10%, respectively: *Crisps packets/sweets wrappers/Lolly sticks* (G30/31) with 6.2% and *Other plastic/polystyrene items (identifiable) including fragments* (G124) with 5.0%.
- 10 items have a share between 5-1%: *Cotton bud sticks* (G95) with 4.8%, *Foam sponge [items (i.e. matrices, sponge, etc.)]* (G73) with 2.4%, *Glass fragments >2.5cm* (G208a) with 2.4%, *String and cord (diameter less than 1 cm)* (G50) with 2.1%, *Small plastic bags, e.g. freezer bags incl. pieces* (G4) with 1.7%, *Shopping bags incl. pieces* (G3) with 1.5%, *Straws and stirrers* (G35) with 1.2%, *Sheets, industrial packaging, plastic sheeting* (G67) with 1.2%, *Glass Bottles (including identifiable fragments)* (G200), and *Drink bottles* (G7/G8) with 1.0%.
- 24 items have a share of less than 1%, respectively: G45, G33, G26, G145, G5, G10, G37, G95, G100, G204, G178, G158, G153, G70, G--, G28, G158, G175, G154, G198, G165, G53, G152, G49.

4.2.2 GES Assessment / Alternative Assessment for IMAP EO10 Common Indicator 23

Geographical scale of the assessment	Regional and Sub-regional
Contributing countries	Bosnia-Herzegovina, Croatia, Cyprus, France, Greece, Israel, Italy, Lebanon, Malta, Slovenia, Spain, Tunisia and Türkiye
Mid-Term Strategy (MTS) Core Theme	Enabling Programme 6: Towards Monitoring, Assessment, Knowledge and Vision of the Mediterranean Sea and Coast for Informed Decision-Making
Ecological Objective	EO10: Marine and coastal litter do not adversely affect coastal and marine environment
IMAP Common Indicators	Common Indicator 23 (CI223): Trends in the amount of litter in the water column including microplastics and on the seafloor
GES definition	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
Related Operational Objective	10.1. The impacts related to properties and quantities of marine litter in the marine and coastal environment are minimized
GES Target(s)	Decreasing trend in the number/amount of marine litter items in the water surface and the seafloor
Baseline and Threshold Values	a) Floating Microplastics: BV: 0.044338 items/m ² TV: 0.000845 items/m ² b) Seafloor Macrolitter: BV: 135 items/km ² TV: 38 items/km ²

4.2.2.1 GES Assessment for Floating Microplastics (IMAP EO10 CI23)

80. **Floating microplastics (CI23)** data are reported in the IMAP InfoSystem from 10 CPs covering all sub-divisions of the Mediterranean region (ADR, CEN, EM, WM). In total 679 surface manta net trawls/stations are monitored during the period 2016-2022 in the following countries: Bosnia-Herzegovina, Croatia, France, Greece, Israel, Italy, Lebanon, Türkiye, Slovenia, Spain.

81. Concentrations of Floating Microplastics (items/m²) are highly variable fluctuating between 0 and 31 items /m². Average floating microplastics concentration on the Mediterranean Sea surface is found equal to 0.355 ± 1.99 items/m².

82. Following the assessment methodology explained in Chapter 2.2 and using the TV of 0.000845 items/m², temporal average data from the 679 stations are compared against the TV, resulting in their classification under 6 status classes (high, good, moderate, poor, bad, very bad) shown in **Table 14**. Practically all stations monitored (99%) do not achieve GES, and most of them fall into the poor (5244 %) and bad (45 %) classes, i.e., floating microplastics litter concentrations are up to 100 and 1000 times higher than the TV respectively. In Table 15 the classification results are given for each sub-Region separately.

Table 14: The classification of the 679 stations monitored for surface floating microplastics in the Mediterranean Region

Mediterranean Region			
Boundary limits	GES- nonGES classes	No of stations	% of stations
$\leq 0.5xTV$	HIGH	4	1
$0.5xTV < \leq 1xTV$	GOOD	1	0
$1xTV < \leq 10xTV$	MODERATE	40	6
$10xTV < \leq 100xTV$	POOR	297	44
$100xTV < \leq 1000xTV$	BAD	306	45
$>1000x TV$	VERY BAD	31	5

1 % GES

99 % non-GES

83. It is clear from Table 15 that all Mediterranean subregions suffer from elevated microplastics concentrations in surface waters 100 times and 1000 times higher than the IMAF TV. In particular, in the EM, the 44% of monitored stations exceed the bad class with concentrations more than 1000 times the TV and are classified as 'very bad'. In the ADR and WM only 1% and 2 % of stations respectively are found above 1000xTV. These results are depicted spatially in the maps of Figures 6 to 9.

Table 15: The classification of the monitored stations for surface floating microplastics in all Mediterranean sub-Regions

Boundary limits	GES- nonGES classes	No of station	% of Beaches	
Adriatic sub-Region				
≤ 0.5xTV	HIGH	2	3	3 % GES
0.5xTV < ≤ 1xTV	GOOD	0	0	
1xTV < ≤ 10xTV	MODERATE	0	0	97 % non-GES
10xTV < ≤ 100xTV	POOR	23	32	
100xTV < ≤ 1000xTV	BAD	45	63	
>1000x TV	VERY BAD	1	1	
71 stations				
Central Mediterranean sub-Region				
≤ 0.5xTV	HIGH	0	0	0 % GES
0.5xTV < ≤ 1xTV	GOOD	0	0	
1xTV < ≤ 10xTV	MODERATE	0	0	100 % non-GES
10xTV < ≤ 100xTV	POOR	4	36	
100xTV < ≤ 1000xTV	BAD	7	64	
>1000x TV	VERY BAD	0	0	
11 stations				
Eastern Mediterranean sub-Region				
≤ 0.5xTV	HIGH	0	0	0 % GES
0.5xTV < ≤ 1xTV	GOOD	0	0	
1xTV < ≤ 10xTV	MODERATE	0	0	100 % non-GES
10xTV < ≤ 100xTV	POOR	4	11	
100xTV < ≤ 1000xTV	BAD	16	44	
>1000x TV	VERY BAD	16	44	
36 stations				
Western Mediterranean sub-Region				
≤ 0.5xTV	HIGH	2	0.4	0.6 % GES
0.5xTV < ≤ 1xTV	GOOD	1	0.2	
1xTV < ≤ 10xTV	MODERATE	40	7	99.4 % non-GES
10xTV < ≤ 100xTV	POOR	266	47	
100xTV < ≤ 1000xTV	BAD	238	42	
>1000x TV	VERY BAD	14	2	
561 stations				

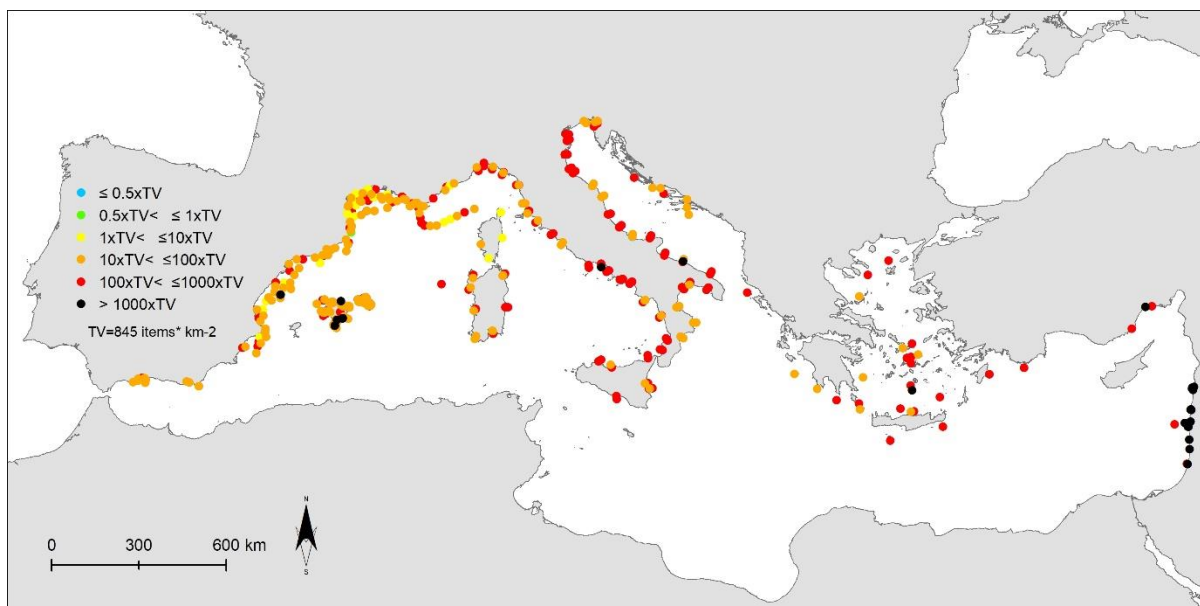


Figure 6: GES assessment classification of the monitored stations for sea surface floating microplastics CI23 in the Mediterranean Region.

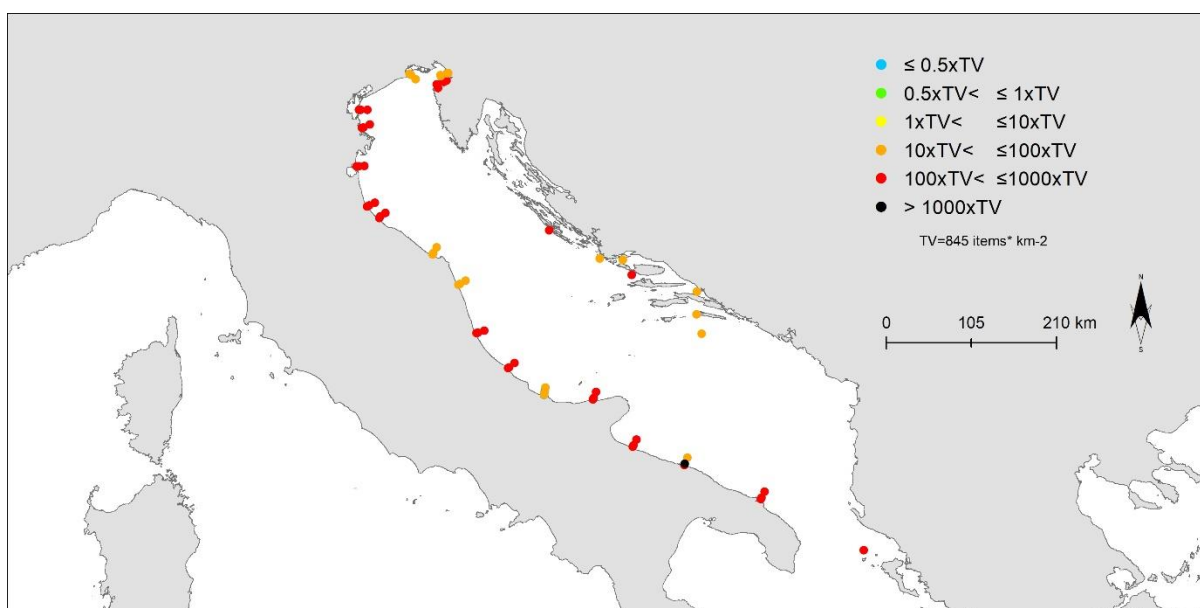


Figure 7: GES assessment classification of the monitored stations for sea surface floating microplastics CI23 in the Adriatic Mediterranean sub-region.

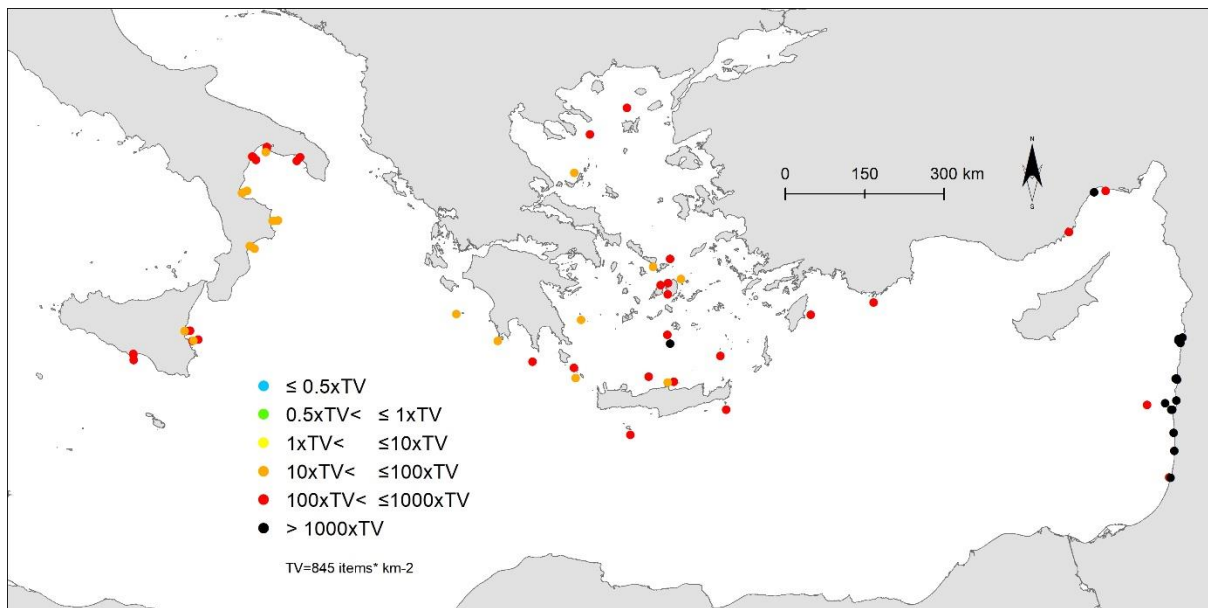


Figure 8: GES assessment classification of the monitored stations for sea surface floating microplastics CI23 in the Eastern and Central Mediterranean sub-regions.

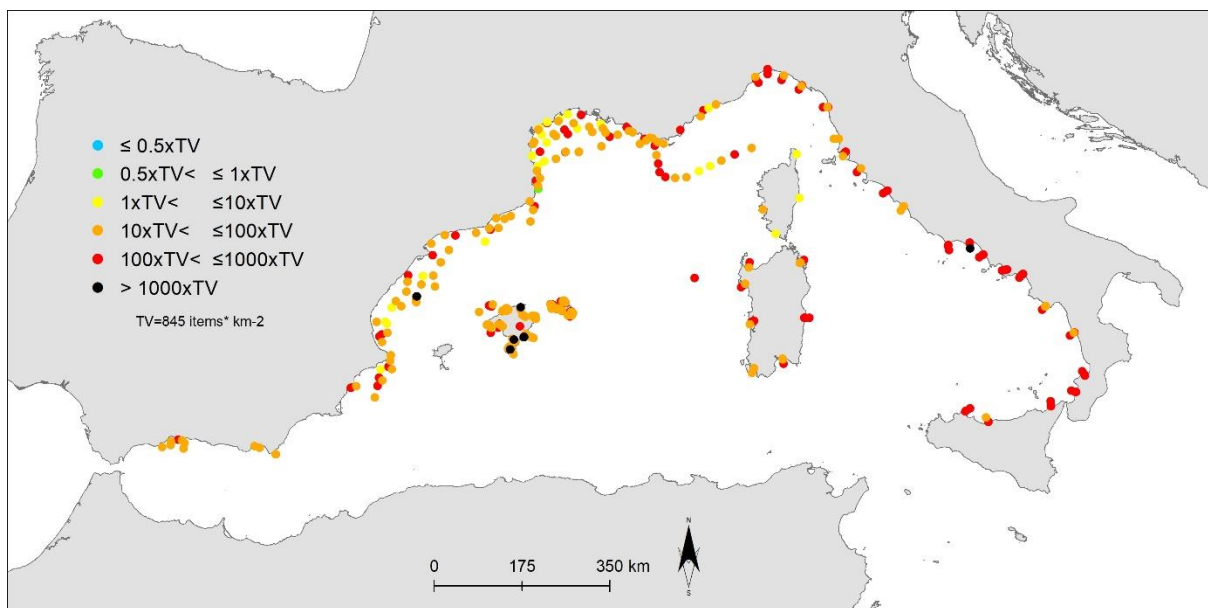
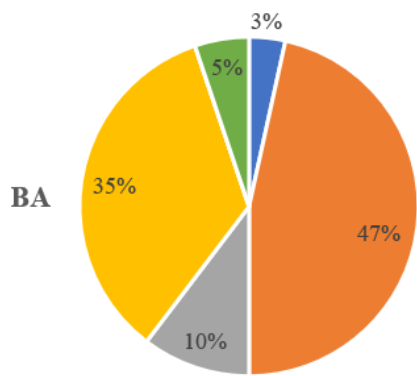


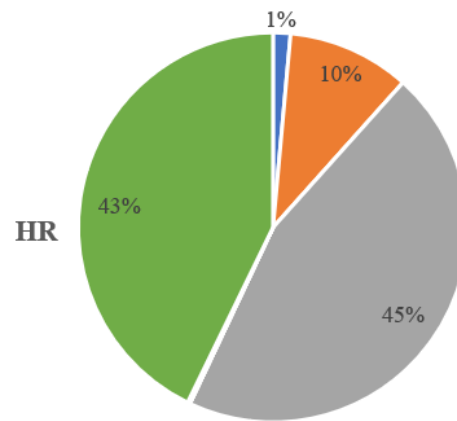
Figure 9: GES assessment classification of the monitored stations for sea surface floating microplastics CI23 in the Western Mediterranean sub-region.

84. The data submitted for floating microplastics from the 10 countries, also provide interesting results regarding the qualitative composition and the different types of microplastics. Predominant in abundance are the Sheets (37%), followed by Filaments (30%), Pellets (21%), Fragments (7%), Foam (4%), and Granules (1%).

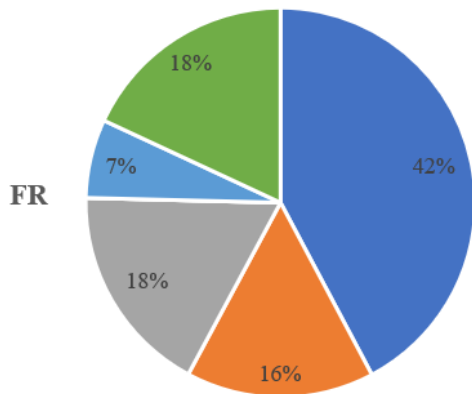
85. The graphs below are representing the qualitative composition (different types of microplastics) per respective country:



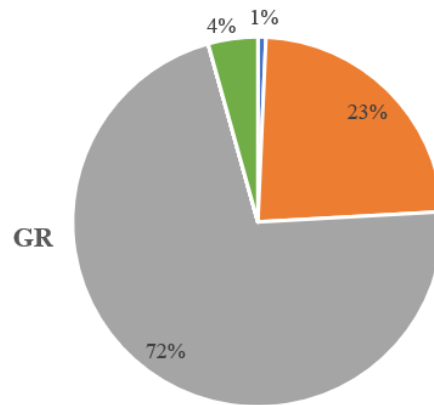
■ Foam ■ Filament ■ Fragment ■ Granule ■ Sheet



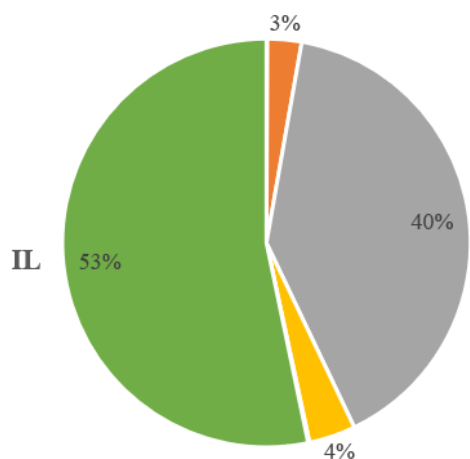
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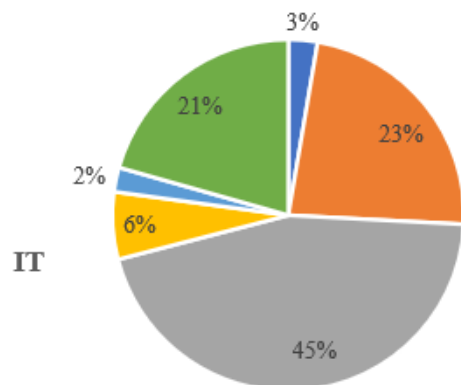
■ Foam ■ Filament ■ Fragment ■ Pellet ■ Sheet



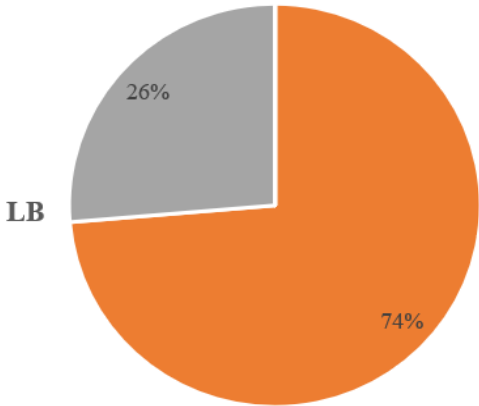
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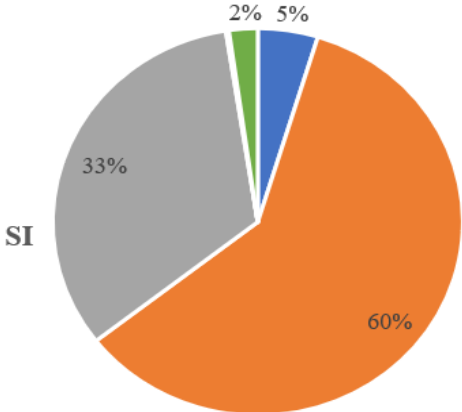
■ Filament ■ Fragment ■ Granule ■ Sheet



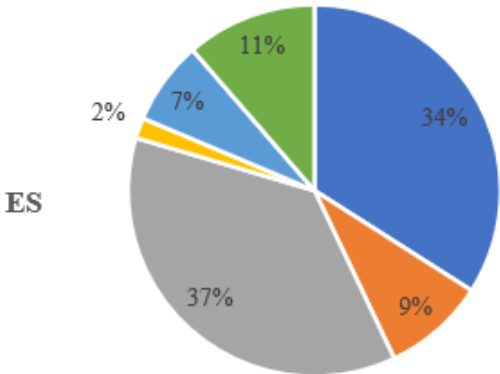
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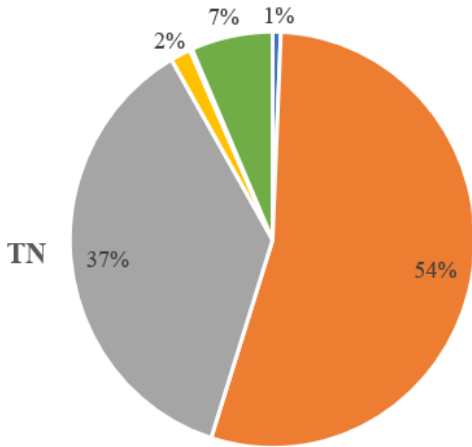
■ Filament ■ Fragment



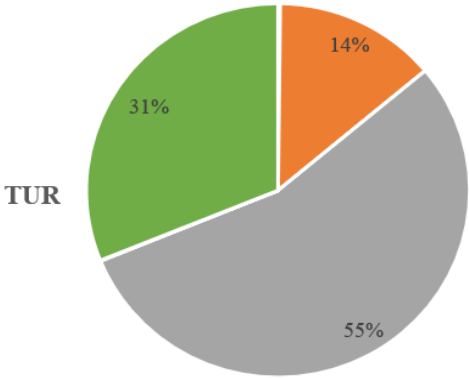
■ Foam ■ Filament ■ Fragment ■ Sheet



■ Foam ■ Filament - Fibers ■ Fragment
■ Granule ■ Pellet ■ Sheet



■ Foam ■ Filament ■ Fragment ■ Granule ■ Sheet



■ Filament ■ Fragment ■ Pellet ■ Sheet

4.2.2.2 The Mediterranean litterscape assessed from the air during the ACCOBAMS survey initiative.

86. Garbage patches in the world's oceans are well documented, but quantitative assessments of floating debris are still lacking in some major areas. The Mediterranean Sea is one such area, despite being recognized as one of the most plastic polluted environments. Coordinated by the ACCOBAMS Secretariat between 2017 and 2022, the ACCOBAMS Survey Initiative (ASI), was the first international basin-wide survey of the Mediterranean Sea primarily aiming at estimating cetacean abundance and distribution. Additional objectives of this project were to provide the first basin-wide estimate of other marine megafauna, including seabird, sea turtles and other large vertebrates, as well as of floating mega-litter (>30 cm) and their distribution across the entire Mediterranean Sea.

87. The aerial component of the ASI was conducted from June to August 2018 over most of the Mediterranean Sea (Figure 10). Data collection followed a strip-transect protocol and coverage of the study area was optimized using a zig-zag layout for transects. High-wing double-engine aircrafts were used during the ASI survey, fitted with bubble-windows to offer better observation condition at the vertical of the aircraft. Observers were trained to search for all mega-debris larger than 30 cm in size present in a 200 m strip on both side of the aircraft, distinguishing between fishery, plastic and processed wood debris when possible. The aircraft flew at a constant speed of c.167 km/h (90 knots) at a height of c.183 m (600 feet) above sea level. Observation conditions (e.g., sea state, turbidity, cloud cover, glare severity, glare orientation) were systematically recorded during active survey effort. A total distance of 55 738 km was flown during the ASI.

88. Detection and presence probabilities of mega-debris were estimated over the entire Mediterranean Sea and abundance estimate was eventually derived from the presence probability. Some 41,000 floating mega-litter items were recorded in total during the ASI (Figure 11), with an average encounter rate of 0.8 mega-litter per km (standard deviation 3.2), ranging between 0 and 111 debris per km. More than two thirds of the mega-litter recorded were identified as plastics (68.5%; e.g., plastic bags, bottles, tarpaulins, palettes, inflatable beach toys, etc.), while 1.7% were fishery debris and 1.9% were anthropogenic wood-trash. The remaining quarter (27.9%) was anthropogenic mega-debris of an undetermined nature. Plastic litter was largely dominant in all blocks. Beaufort sea state, turbidity and glare extent had a negative effect on detection, whereas subjective conditions had a positive one and detection probability differed among the eight observer teams. Overall, the estimated probability of detecting floating mega-litter during the ASI ranged from 0.1 in the worst conditions to 0.9 in optimal observation conditions: i.e., about 90% of debris actually present are not detected when seas are rough, while near perfect detection is probable when seas are calm, which was the case in 73% of the total survey effort.

89. During the ASI, only 20% of the Mediterranean was free of floating mega-litter. The estimated presence probability was highest in the central and western Mediterranean, in the Tyrrhenian, northern Ionian, and Adriatic Seas and in the Gulf of Gabes (> 80%). The lowest presence probabilities occurred in the Levantine basin, in the southern Ionian Sea and in the Gulf of Lion (< 50%). The total number of floating mega-litter was estimated at 2.9 million items (80% confidence interval was 2.7 to 3.1 million and average density 1.5 ± 0.1 items per km^2), taking into account imperfect detection. Considering that items larger than 30 cm represent only one fourth of the complete load of anthropogenic debris (>2 cm) in the Mediterranean, it scales up the estimate to 11.5 million floating debris.

90. The spatially explicit modelling of mega-litter presence revealed a very heterogeneous distribution of floating mega-debris during summer: highest densities of litter were observed in the central Mediterranean (Tyrrhenian Sea, Adriatic Sea, northern Ionian Sea, off north-eastern Algeria and the Gulf of Gabes; Fig.11), while the lowest densities were found in the eastern basin. Highest densities occurred along the Tyrrhenian coast of Italy and in the Adriatic Sea, with up to 20 items per km^2 . This acute marine pollution might disrupt entire ecosystems through its impact on marine fauna (entanglement, ingestion, contamination), eventually impacting associated ecosystem services such as

the tourism industry and the well-being of Mediterranean populations. The higher prevalence of litter in the western and central basin compared to the relatively spared eastern basin mimics that of the megafauna, which is both more abundant and more diversified in the western basin. This general overlap suggests that the threat to Mediterranean fauna would be maximum in the western Mediterranean.

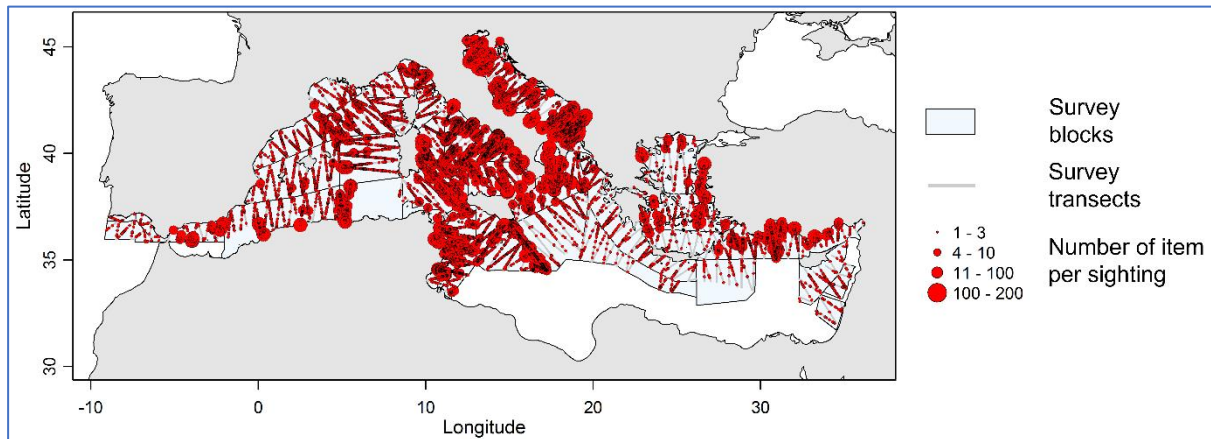


Figure 10: ACCOBAMS Survey Initiative (ASI) blocks, sampled transects and distribution of sighted floating mega-litter. Transects were sampled once by 14 different teams operating 8 planes simultaneously in different areas. There was no aerial survey effort off the coasts of Morocco, Libya, Egypt and east of Cyprus where the ASI survey was conducted by boat.

91. Many endangered or vulnerable species, some of them endemic to the area, are at risk of entanglement or of ingesting debris. This work sets a reference situation allowing the efficiency of future plastic pollution remediation strategies to be assessed. It constitutes the first ground-truthing of previous numerical simulations based on surface debris drifting simulations. On a methodological point of view, the present work showed that departing from sea-state 0 to 3 resulted in a drop of c. 31% in the detection probability of mega-debris, violating the assumption, inherent to strip transect approaches, that detection is perfect across the sampled strip.

92. Therefore, accounting for imperfect detection in density estimation procedure based on strip-transect visual surveys is crucial. The line-transect protocol, which is the standard methodology to be used in case of varying detectability of objects with distance from the transect line and observations conditions, cannot readily be implemented in aerial surveys for floating mega-debris, because those are too numerous to allow the necessary distance data to be collected without disrupting the observers' observation capabilities. The use of strip-transect protocol has proven to be operationally effective for collecting debris along with marine fauna and anthropogenic activities, provided that the analytical procedure can take imperfect detection into account.

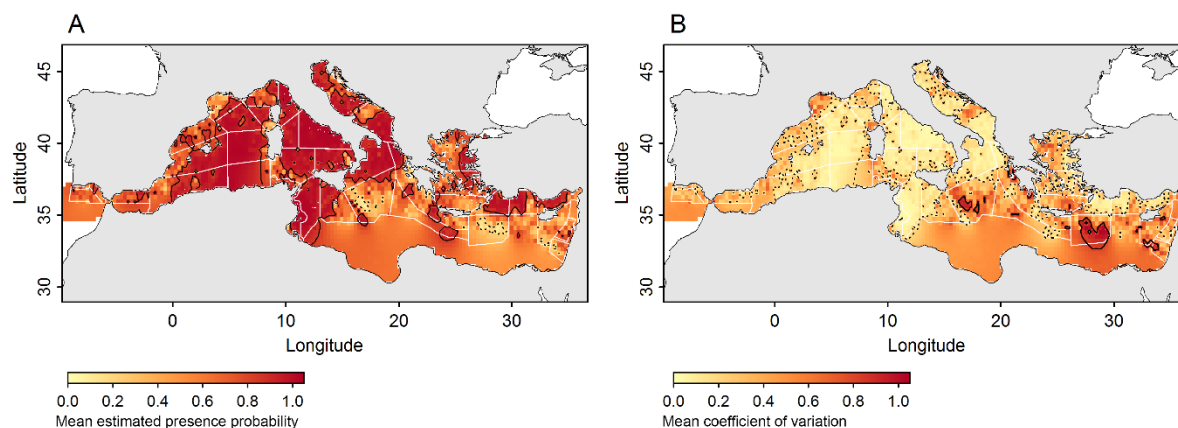


Figure 11: (A): Estimated presence probability (posterior mean) of floating mega-debris. (B): Uncertainty in estimated presence probability (coefficient of variation). Isolines corresponding to contours 20% probabilities are shown in dotted black lines and 80% contours in solid black lines. ASI survey blocks are shown in solid white lines.

4.2.2.3 GES Assessment for Seafloor Macrolitter (IMAP EO10 CI23)

93. **Seafloor marine litter (CI23)** data are reported in the IMAP InfoSystem from 11 CPs covering all sub-divisions of the Mediterranean region (ADR, CEN, EM, WM). In total 367 seafloor trawls/stations are monitored during the period 2017-2021 in the following countries: Croatia, Cyprus, France, Israel, Malta, Montenegro, Morocco, Slovenia, Spain, Tunisia, Türkiye. Most samplings (364) are situated on fishing grounds and were conducted by fishing trawls, thus in most of the cases in soft-bottom grounds, and only 3 samplings in Morocco were conducted by scuba diving in sub-littoral seafloor and correspond to maximum outlier seafloor macro-litter concentrations.

94. Concentrations of seafloor marine litter (items/km²) excluding the scuba diving outlier data are highly variable fluctuating between 0 and 28,228 items /km². Average seafloor litter concentration on the Mediterranean coastline is found equal to 570 ± 2,588 items/km². The outlier seafloor concentrations are 662,500 items/km², 1,882,500 items/km², and 372,500 items/km² and are not included in the analysis below because they are based on a different monitoring methodology.

95. Following the assessment methodology explained in Chapter 2.2 and using the TV of 38 items/km², temporal average data from the 367 seafloor stations are compared against the threshold, resulting in their classification under 5 status classes (high, good, moderate, poor, bad) shown in Table 16. Overall, 88% of the seafloor stations monitored do not achieve GES, and most of them fall into the bad (53 %) and moderate (23 %) categories, i.e., seafloor litter concentrations are up to five times higher than the TV. In Table 17 the classification results are given for each sub-Region separately.

Table 16: The classification of the 364 seafloor stations monitored in the Mediterranean Region

Mediterranean Region			
Boundary limits	GES- nonGES classes	No of stations	% of stations
≤ 0.5xTV	HIGH	23	6
0.5xTV < ≤ 1xTV	GOOD	19	5
1xTV < ≤ 2xTV	MODERATE	44	12
2xTV < ≤ 5xTV	POOR	85	23
> 5xTV	BAD	193	53
			11 % GES
			88 % nonGES

96. On the sub-region level the Western Mediterranean appears highly affected by seafloor marine litter since all stations monitored (100%) are classified in the nonGES category. The Central Mediterranean sub-region appears also highly affected with 81% of stations monitored classified under nonGES. The Adriatic and Eastern Mediterranean sub-regions follow with 65 and 68% of the stations monitored falling into the nonGES class respectively. The Eastern Mediterranean is the only area where a considerable percentage (24 %) of trawling stations achieve high status. . These results are depicted spatially in the maps of Figures 12 to 16 from where the uneven distribution of stations within each sub-region, attributed to limitations in data submission, can be seen, for example the CEN is covered only by Malta and Tunisia.

Table 17: The classification of the monitored seafloor stations in Mediterranean sub-Regions

Boundary limits	GES- nonGES classes	No of seafloor stations	% of Stations	
Adriatic sub-Region				
≤ 0.5xTV	HIGH	2	9	35 % GES
0.5xTV < ≤ 1xTV	GOOD	6	26	
1xTV < ≤ 2xTV	MODERATE	8	35	65 % non-GES
2xTV < ≤ 5xTV	POOR	1	4	
> 5xTV	BAD	6	26	
23 stations				
Central Mediterranean sub-Region				
≤ 0.5xTV	HIGH	1	2	16% GES
0.5xTV < ≤ 1xTV	GOOD	7	17	
1xTV < ≤ 2xTV	MODERATE	16	38	81 % non-GES
2xTV < ≤ 5xTV	POOR	17	40	
> 5xTV	BAD	1	2	
42 stations				
Eastern Mediterranean sub-Region				
≤ 0.5xTV	HIGH	20	24	32 % GES
0.5xTV < ≤ 1xTV	GOOD	6	7	
1xTV < ≤ 2xTV	MODERATE	17	21	68 % non-GES
2xTV < ≤ 5xTV	POOR	16	20	
> 5xTV	BAD	23	28	
82 stations				
Western Mediterranean sub-Region				
≤ 0.5xTV	HIGH	0	0	0 % GES
0.5xTV < ≤ 1xTV	GOOD	0	0	
1xTV < ≤ 2xTV	MODERATE	3	1	100 % non-GES
2xTV < ≤ 5xTV	POOR	51	24	
> 5xTV	BAD	163	75	
217 stations				

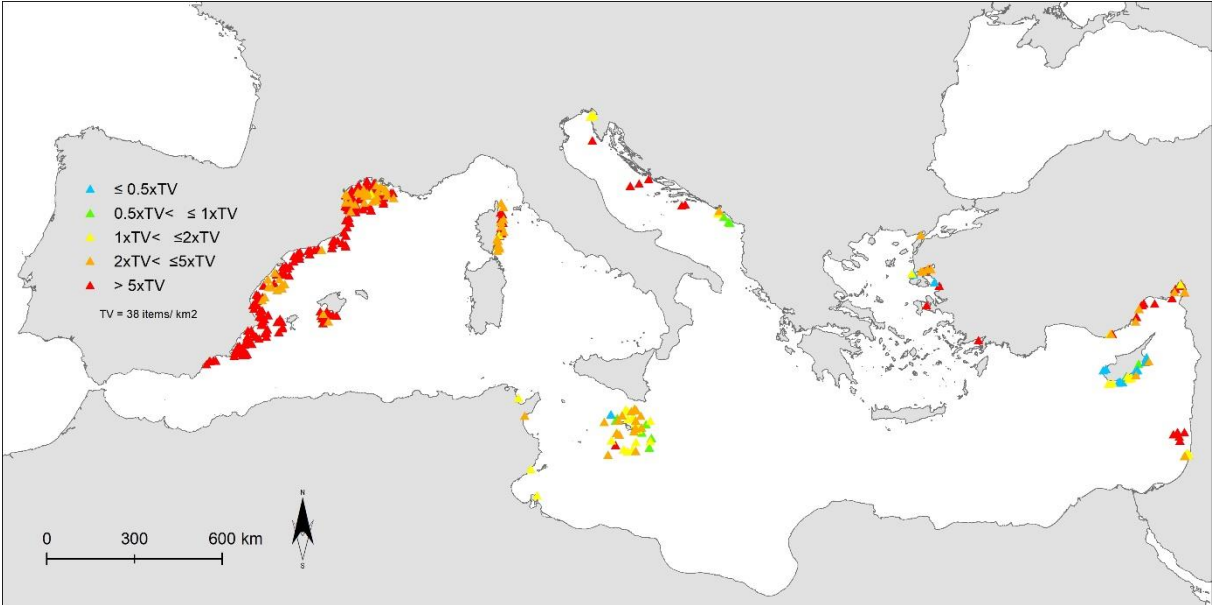


Figure 12: GES assessment classification of the seafloor stations monitored for marine litter in the Mediterranean Region.

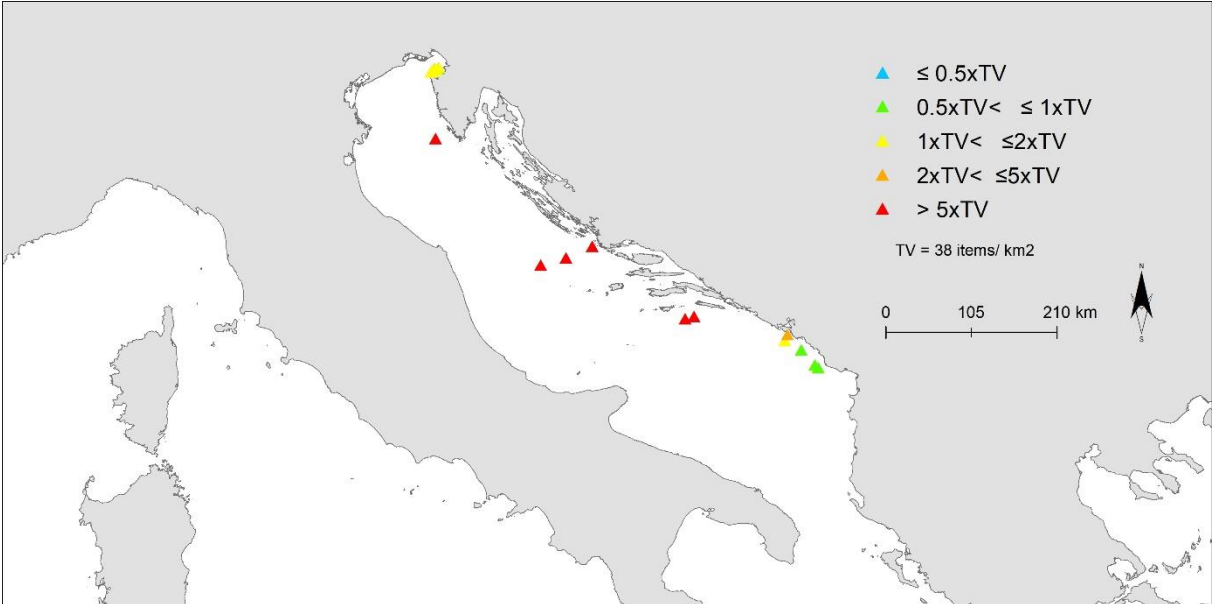


Figure 13: GES assessment classification of the seafloor stations monitored for marine litter in the Adriatic Mediterranean sub-regions.

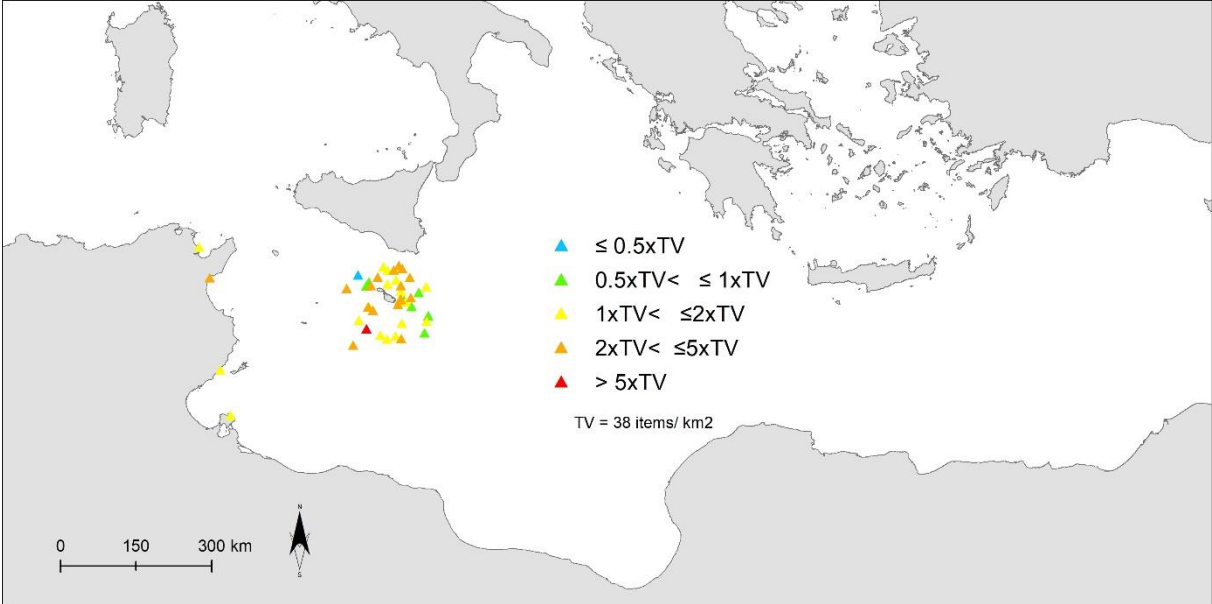


Figure 14: GES assessment classification of the seafloor stations monitored for marine litter in the Central Mediterranean sub-region.

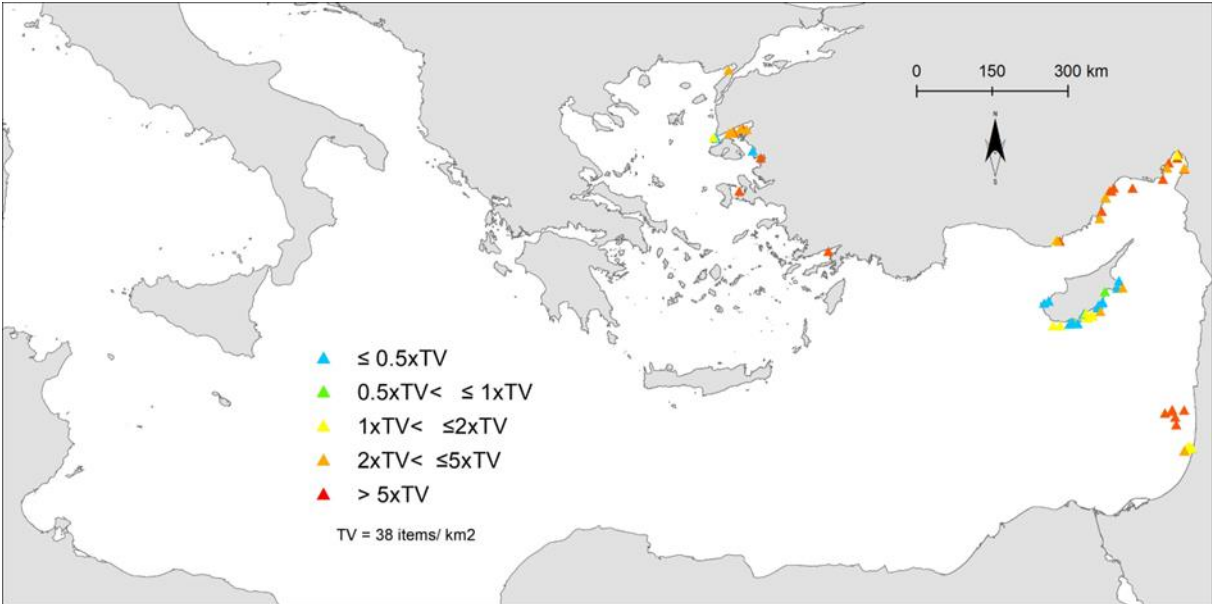


Figure 15: GES assessment classification of the seafloor stations monitored for marine litter in the Eastern Mediterranean sub-region.

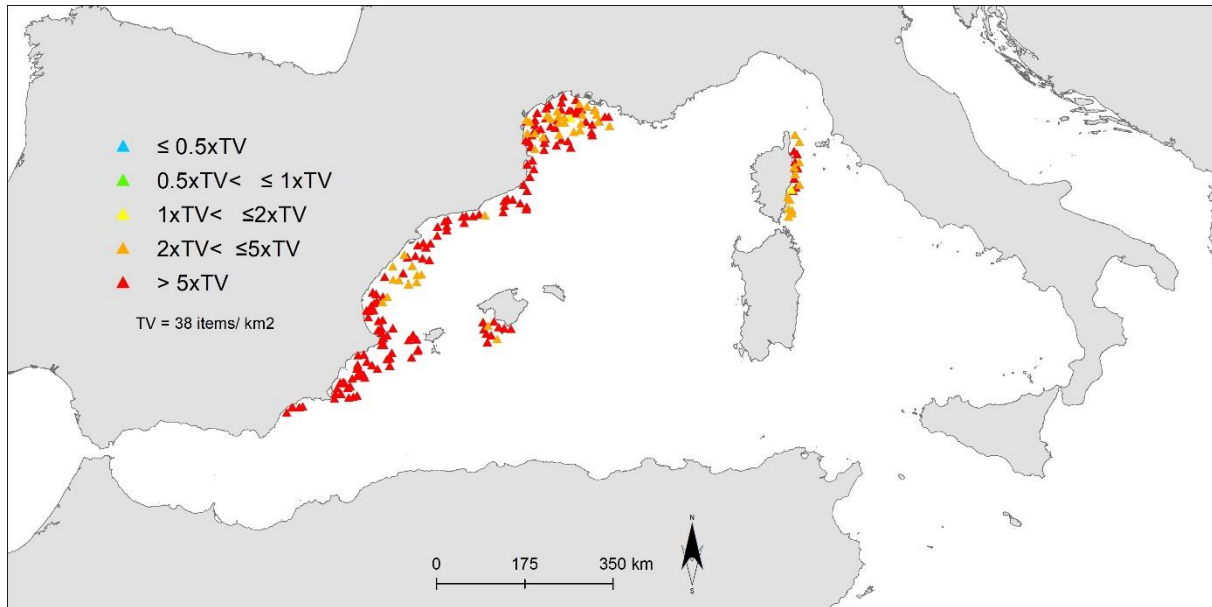


Figure 16: GES assessment classification of the seafloor stations monitored for marine litter in the Western Mediterranean sub-region.

97. Further to the submission of data for seafloor macro-litter, an analysis was undertaken with an explicit focus on fisheries-related items. The purpose of this analysis is to identify hotspot areas in the Mediterranean where high abundance rates can be associated with impact on biota (e.g., through ghost fishing, Abandoned Lost or Otherwise Discarded Fishing Gear (ALDFG)). Seafloor litter can harm marine organisms of all sizes by various mechanisms, including entanglement, smothering (i.e., in soft bottom environments) and ingestion.

98. A small component (10%) of seafloor macrolitter was represented by fishery-related items. The most common items recorded from the trawl surveys are:

- a) “L1i - Synthetic ropes/strapping bands” (39%);
- b) “L1f - Fishing nets (polymers)” (27%);
- c) “L1g - Fishing lines (polymers)” (25%);
- d) “L5c - Natural fishing ropes” (6%);
- e) “L1h - Other synthetic fishing related” (2%); and
- f) “L3f - Fishing related (hooks, spears, etc.)” (1%).

99. Fishery-related marine litter items varied among countries, from a mean value of approximately 26 items/km² in France to approximately 1 item/km² in Israel. Intermediate values have been recorded in Türkiye approx. 19 items/km², Malta approx. 15 items/km², Tunisia approx. 8, and Croatia with approx. 3 items/km².

100. In Morocco, fishery-related litter monitored through SCUBA diving represented just the 4% of all the items found. The most common litter item was “L1j - Fishing lines (polymers)” (34%), followed by “L1f - Fishing nets (polymers)” (19%), “L1h – Other synthetic fishing related” (12%), “L3f – Fishing related (hooks, spears, etc.)” (12%), “L5c – Natural fishing ropes “ (12%) and “L1i – Synthetic ropes/strapping bands” (9%). The distribution of the fisheries-related items in 3 Mediterranean sub-regions is provided under Figures 17, 18 and 19, below:

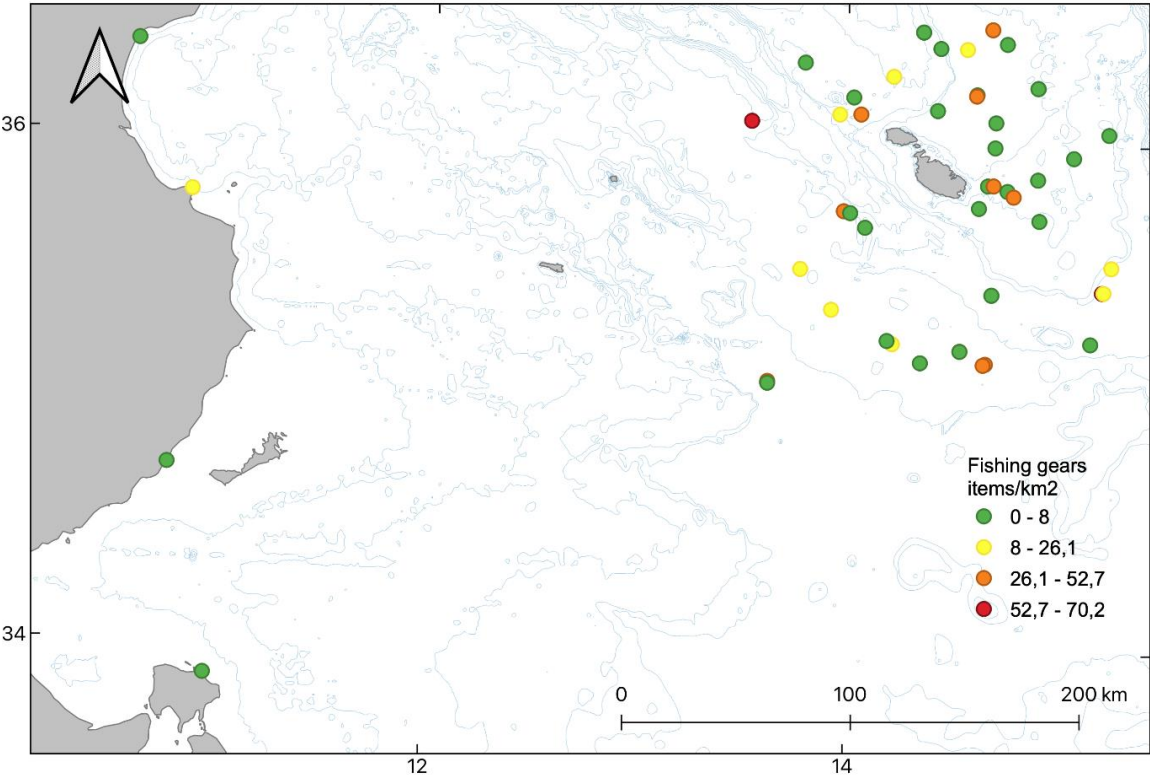


Figure 17: Fishing gear distribution on the seafloor of the Central Mediterranean sub-region.

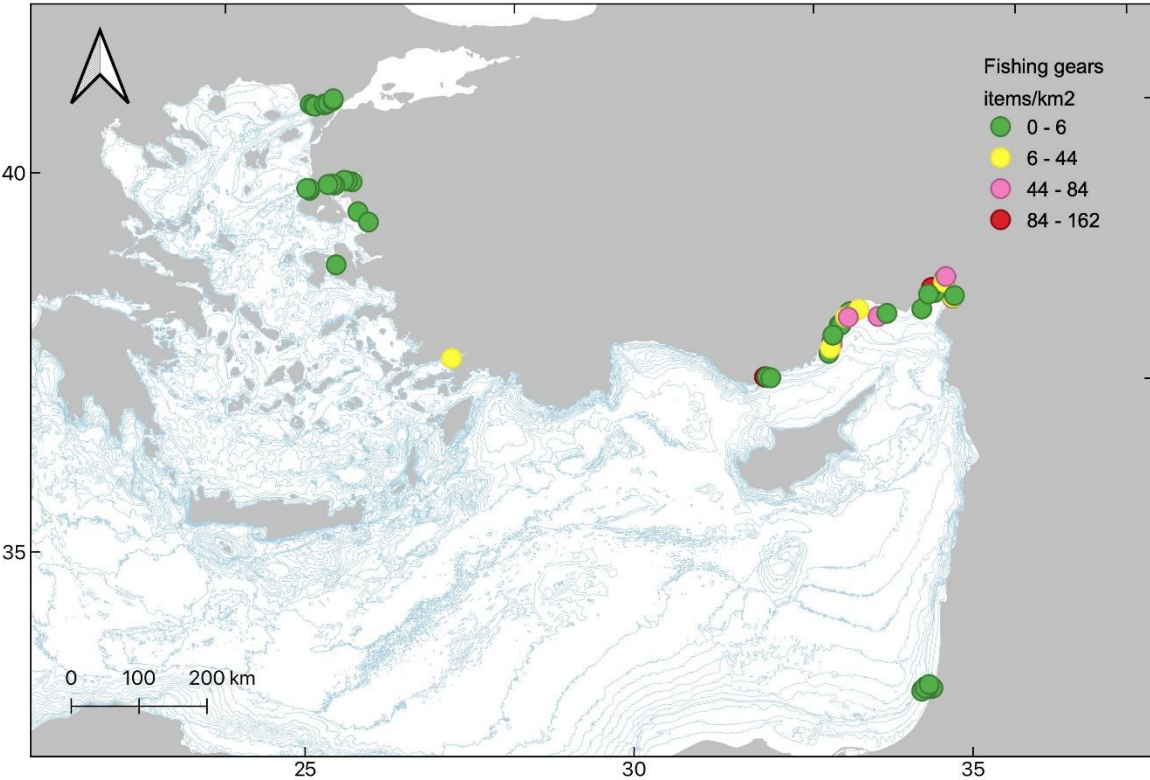


Figure 18: Fishing gear distribution on the seafloor of the Eastern Mediterranean sub-region.

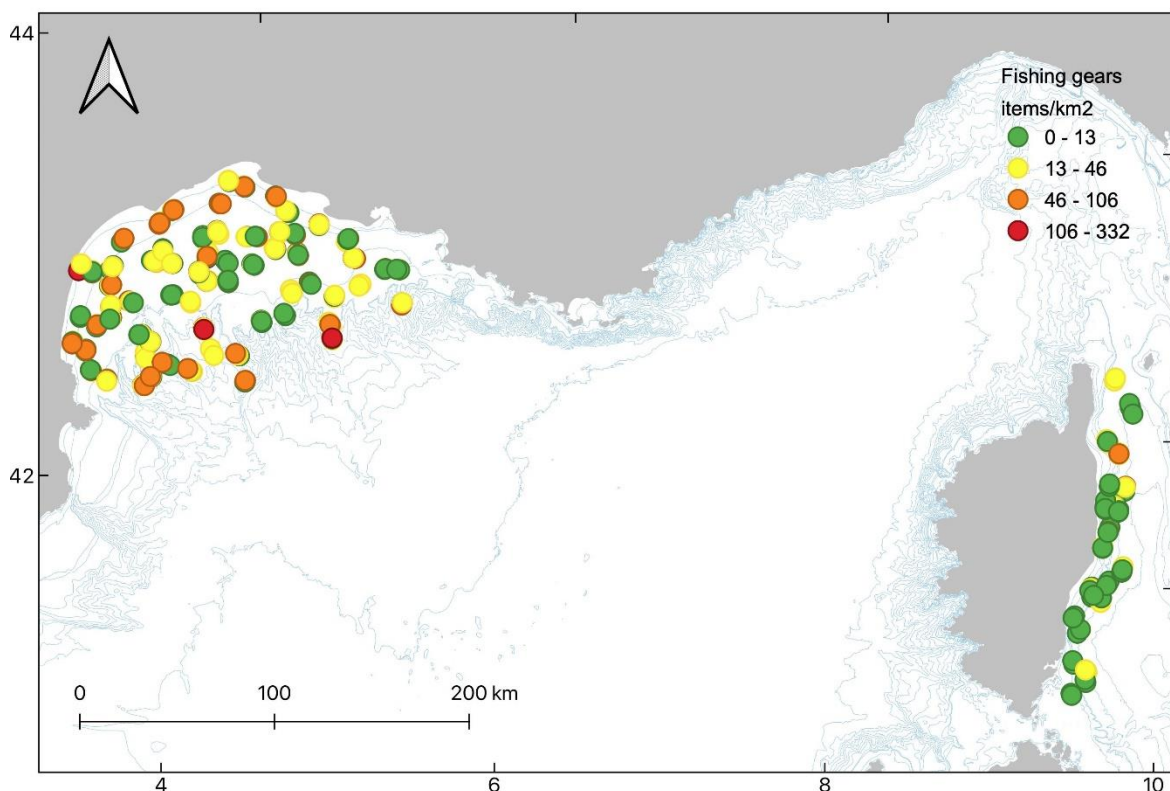


Figure 19: Fishing gear distribution on the seafloor of the Western Mediterranean sub-region.

4.3 GES Assessment for the EO / alternative assessment for EO

4.3.1 Application of the NEAT Assessment Tool for EO10 for the Adriatic Sub-region

4.3.1.1 Defining the assessment areas

101. The present work applies the methodology defined by UNEP/MAP in 2021 on Integration and Aggregation Rules for Monitoring and Assessment. The scope of the work is to provide an assessment on the Quality Status for the Adriatic Sea subregion of the Mediterranean Sea focusing on the level of IMAP Ecological Objective 10 (EO10) on Marine Litter and both Common Indicators CI22 and CI23. In brief, the nested approach is followed (UNEP/MAP 2016 and 2019,) which ensures that a balance is achieved between a too broad scale, that can mask significant areas of impact in certain parts of a region or subregion, and a very fine scale that could lead to very complicated assessment processes. The first element that needs to be considered for the implementation of the nested approach is the delimitation of the areas of assessment within the Adriatic Sea based on the areas of monitoring.

102. For IMAP EO10/CI 22, integration of assessments up to the subdivision level is considered meaningful. Three main subdivisions of the Adriatic Sea, namely, North, Central and South Adriatic have been chosen following the specific geomorphological features as available in relevant scientific sources (e.g., bottom depths and slope areas, existence of deep depression, salinity and temperature gradient, water mass exchanges).

103. Geographical data for the 3 Adriatic subdivisions have been retrieved from (Cushman-Roisin et al., 2001). The coverage of the 3 sub-divisions is shown in Figure 20. The 3 sub-divisions are nested under the Adriatic Sea, while within each of them are nested the areas of assessment set further to the spatial coverage of the areas of monitoring of each of the CPs. Following the rationale of the IMAP national monitoring programmes as well as the methodology described in UNEP/MAP 2021, two zones for integration of areas of monitoring are defined. These two zones are set based on monitoring stations distribution and anticipation of the relevant IMAP monitoring areas as follows: (i) the coastal zone

including monitoring stations within 1nm from the coastal line; and (ii) the offshore zone including monitoring stations beyond 1 nm up to 12nm from the coastal line (i.e., the area $1 \text{ nm} < <12 \text{ nm}$).

104. For the nesting of the areas, these were first classified under the 3 subdivisions of the Adriatic Sea (North: NAS, Central: CAS, South: SAS), then a nesting scheme was followed. The approach followed for the nesting of the areas is 4 levels nesting scheme (1 - being the finest level, 4 - the highest): 1st: nesting of all national IMAP SAUs & subSAUs under key IMAP assessment zones per country (i.e. coastal and offshore); 2nd: IMAP assessment zones (i.e. coastal, offshore) on the subdivision level (NAS coastal, NAS offshore; CAS coastal, CAS offshore; SAS coastal, SAS offshore); 3rd: under the 3 subdivisions (NAS, CAS, SAS); 4th: under the Adriatic Sea Sub Region. Similarly, the integration of the assessment results is conducted as follows: 1st Detailed assessment results per subSAUs and SAUs; 2nd Integrated assessment results per NAS coastal, NAS offshore; CAS coastal, CAS offshore; SAS coastal, SAS offshore; 3rd Integrated assessment results per subdivision NAS, CAS, SAS; 4th Integrated assessment results for the Adriatic Sub Region.

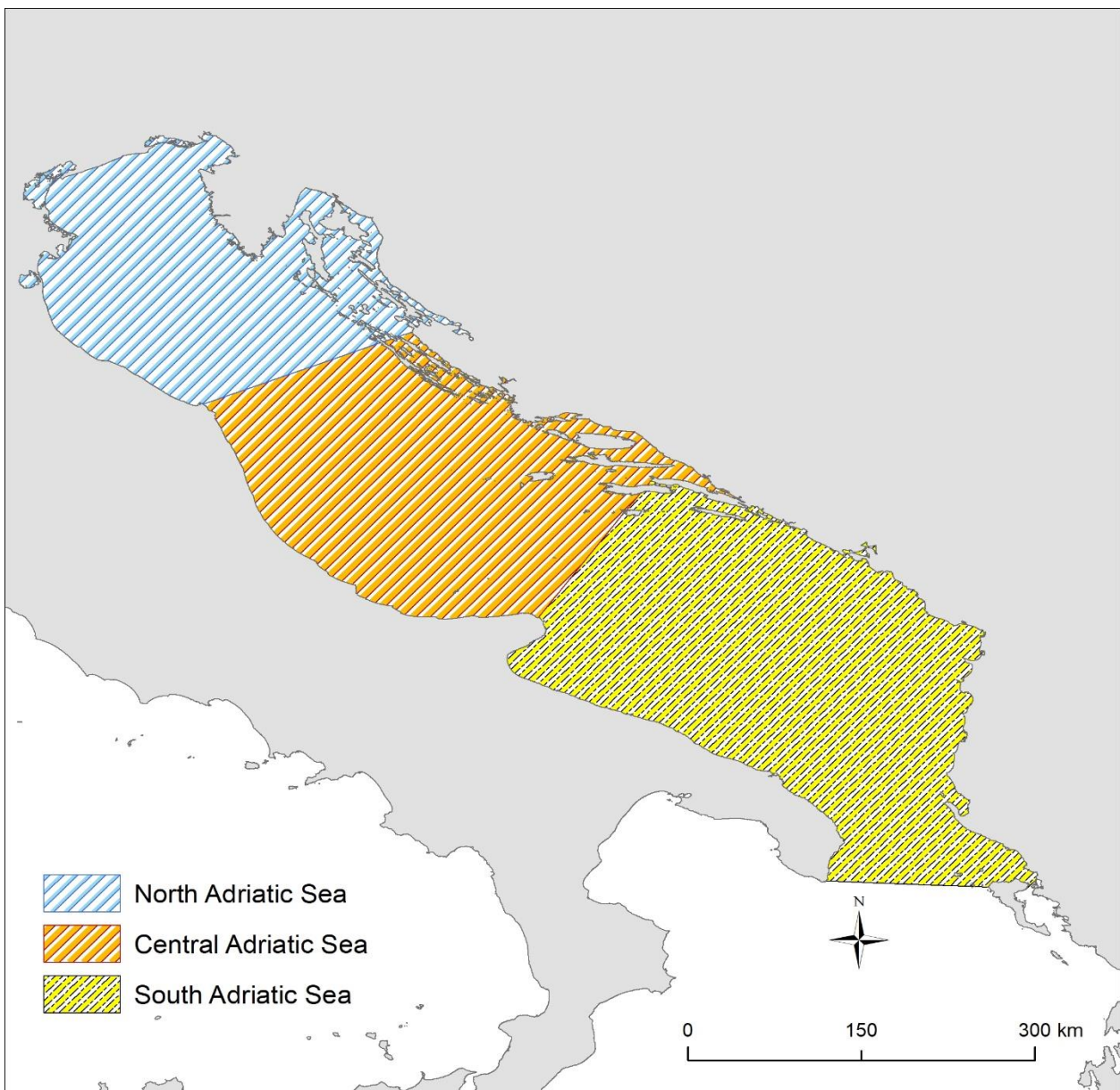


Figure 20: The 3 subdivisions of the Adriatic subregion.

105. The suggested nesting scheme of the IMAP SAUs leads to the aggregation of data on the subdivision level within the coastal and offshore IMAP monitoring/assessment zones and follows the regional/sub-regional approach as required by the IMAP. In line with the integrated assessment approach at the level of Pollution-Marine Litter Cluster, for EO10 CI22/CI23 the assessment is conducted for the same IMAP SAUs and subSAUs (the finest coastal assessment areas on the national level) and the respective nesting scheme, in line with the approach used for IMAP EO9 (Figure 21). The NEAT assessment methodology is applied on the nesting scheme of SAUs and SubSAUs which has the ability to provide aggregated-integrated assessment results.

4.3.1.2 Data availability

106. Data on IMAP EO10/CI22-Beach Litter have been collected from 6 CPs bordering the Adriatic Sea for the years 2016 to 2021 (i.e. Albania, Bosnia & Herzegovina, Croatia, Italy, Montenegro, Slovenia), except from Greece. Beach Litter data used were either reported by the CP to the IMAP IS or shared with the IMAP Secretariat. Data on IMAP EO10/CI23- Seafloor Litter were reported to the IMAP IS only by Slovenia, Croatia and Montenegro. IMAP EO10/CI23- Sea surface floating microplastics (MPs) data sets were reported by 5 CPs (Bosnia & Herzegovina, Croatia, Greece, Italy, Slovenia).

107. Details on the temporal and spatial availability of data per IMAP SAU, are provided in Tables 18 and 19.

108. The spatiotemporal coverage of monitoring varies largely among the CPs and the IMAP SAUs. Of a total of 52 national subSAUs, data for CI22-Beach litter exist for 18 subSAUs and for CI23-Seafloor Litter for only 8 subSAUs. Finally, for CI23- Sea surface Floating MPs data exist for 19 subSAUs. Only two subSAUs, namely MAD-SI-MRU-11, HRO-0423-KOR, are monitored for all 3 EO10 parameters (beach litter, seafloor litter, sea surface floating MPs); the rest are covered by either two or one parameter.

109. On the subdivision level the highest coverage corresponds to SAS, where 12 out of 15 SubSAUs are monitored for at least one EO10 parameter, then follows the CAS with 8 out of 14 subSAUs and finally the NAS is the least covered area with only 9 out of 23 subSAUs monitored.

110. Beach litter data correspond to a total of 45 beaches, Seafloor litter to 18 seafloor monitoring stations and floating microplastics to 71 monitoring stations. The number of monitoring stations and their spatial distribution results to a rather insufficient spatial coverage of the Adriatic Sea sub-Region which is critical for the assessment of EO10 due to the high variability of the relevant parameters observed worldwide.

111. Regarding the temporal coverage, data cover the years 2016, 2017, 2018, 2019, 2020, 2021, 2022. Details on the temporal coverage are given in Table 19. Overall, this spatiotemporal coverage, hinders a meaningful integrated assessment. Having this in mind the results from the application of the NEAT tool should be considered as an example showing how the tool should be applied for GES assessment further to sufficient data reporting by the Contracting Parties.

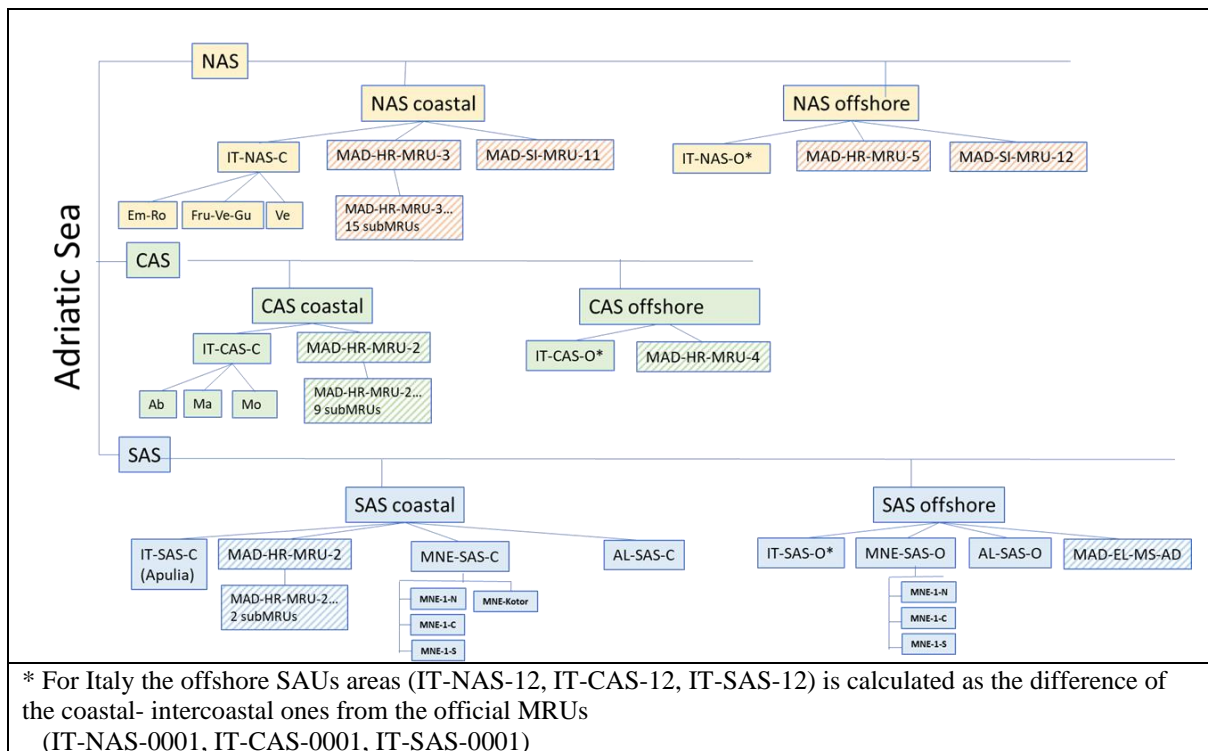


Figure 21: The nesting scheme of the SAUs defined for the Adriatic Sea based on the available information. Shaded boxes correspond to official MRUs declared by the countries that are EU MS and that were decided to be used as IMAP SAUs. The finest SAUs nested under national coastal waters are the subSAUs

Table 18: Spatial coverage of monitoring CI22, CI23 data collected for the Adriatic Sea. The number of monitoring stations/beaches in the SAUs of the Adriatic Sea is shown.

Sub-division	Zone	SAU	sub-SAUs	No beaches	No of Seafloor stations	No of Floating MPs stations		
North Adriatic (NAS)	NAS coastal	MAD-HR-MRU-3	HRO-O423-KVJ	5				
			IT-NAS-C	Emilia Romagna	4		9	
			Friuli Venezia Giulia	5		6		
			Veneto	4		6		
		MAD-SI-MRU-11		4	2	4		
		Central Adriatic (CAS)	CAS coastal	IT-CAS-C	Ab			
					Ma			
					Mo			
				MAD-HR-MRU-2				
				South Adriatic (SAS)	SAS coastal	IT-SAS-C (Apulia)		
MAD-HR-MRU-2								
MNE-SAS-C	MNE-1-N							
	MNE-1-C							
	MNE-1-S							
	MNE-kotor							
AL-SAS-C								
South Adriatic (SAS)	SAS offshore	IT-SAS-O*						
		MNE-SAS-O	MNE-1-N					
			MNE-1-C					
			MNE-1-S					
		AL-SAS-O						
		MAD-EL-MS-AD						

Sub-division	Zone	SAU	sub-SAU	No beaches	No of Seafloor stations	No of Floating MPs stations
	NAS Offshore					
		MAD_SI_MRU_12			10	3
		MAD-HR-MRU-5			1	
		IT-NAS-O				7
Central Adriatic (CAS)						
	CAS coastal					
		MAD-HR-MRU-2				
			HRO-0423-BSK	1		1
			HRO-0423-KOR	1	1	1
		IT-CAS-C				
			Abruzzo	4		6
			Marche	4		6
			Molise	1		5
	CAS offshore					
		MAD-HR-MRU_4		1	4	1
		IT-CAS-O				10
South Adriatic (SAS)						
	SAS coastal					
		IT-SAS-C	Puglia	3		18
		MAD-HR-MRU-2				
			HRO-O423-MOP	2		2
			HRO-0313-NEK			1
		MNE-SAS-C				
			MNE-1-N	1		
			MNE-1-S	1		
			MNE-Kotor	2		
		AL-SAS-C		2		
		BiH-SAS-C		2		1
	SAS offshore					
		IT-SAS-O				4
		MNE-SAS-O				
			MNE-12-N		2	
			MNE-12-C		1	
			MNE-12-S		2	
		MAD-EL-MS-AD				1

Table 19: Temporal coverage of the monitoring beach litter data collected for the Adriatic Sea. The years of data collected per SAU are shown.

Sub-division	Zone	SAU	sub-SAU	Years monitored beaches	Years monitored Seafloor Stations	Years monitored Floating MPs Stations
North Adriatic (NAS)						
	NAS coastal					
		MAD-HR-MRU-3				
			HRO-O423-KVJ	2017 to 2020		
		IT-NAS-C				
			Emilia Romagna	2016 to 2021		2016 to 2020
			Friuli Venezia Giulia	2017 to 2021		2017 to 2020
			Veneto	2017 to 2021		2017 to 2020
		MAD-SI-MRU-11		2017	2017 to 2020	2019-2020
	NAS Offshore					
		MAD-SI-MRU-12			2017 to 2020	2019-2020
		MAD-HR-MRU-5			2017 to 2020	
		IT-NAS-O				2017 to 2020
Central (CAS)	Adriatic					
	CAS coastal					
		MAD-HR-MRU-2				
			HRO-0423-BSK	2017 to 2020		2017 to 2020
			HRO-0423-KOR	2017 to 2020	2017 to 2020	2017 to 2020
		IT-CAS-C				
			Abruzzo	2017 to 2021		2017 to 2020
			Marche	2017 to 2021		2017 to 2020
			Molise	2017 to 2021		2017 to 2020
	CAS offshore					
		MAD-HR-MRU_4		2017 to 2020	2017 to 2020	2017 to 2020
		IT-CAS-O				2017 to 2020
South Adriatic (SAS)						
	SAS coastal					
		IT-SAS-C	Apulia	2016 to 2021		
		MAD-HR-MRU-2				
			HRO-O423-MOP	2017 to 2020		2017 to 2020
			HRO-0313-NEK			2017 to 2020
		MNE-SAS-C				
			MNE-1-N	2018 to 2020, 2022		
			MNE-1_s	2019, 2020, 2022		
			MNE-Kotor	2018 to 2020, 2022		
		AL-SAS-C		2018		
		BiH-SAS-C		2019-2021		2019
	SAS offshore					

Sub-division	Zone	SAU	sub-SAU	Years monitored beaches	Years monitored Seafloor Stations	Years monitored Floating MPs Stations
		IT-SAS-O				2017 to 2020
		MNE-SAS-O				
			MNE-12-N		2019, 2020	
			MNE-12-C		2019, 2020	
			MNE-12-S		2019, 2020	
		MAD-EL-MS-AD				2020

4.3.1.3 Setting the assessment criteria

112. The baseline and threshold values for IMAP CI 22 in the Mediterranean Sea have been endorsed by COP22 (Antalya, Türkiye, 7-10 December 2021) and have been annexed to Decision IG.25/9. The respective values for IMAP CI23 in the Mediterranean were first submitted for review to the CORMON Meeting for Marine Litter Monitoring on 3 March 2023 and an updated version was prepared for the Integrated CORMON Meeting (27-28 June 2023). The threshold value between Good and non-Good Environmental Status used in the NEAT assessment is the TV equal to 130 items/100m for beach litter, the TV equal to 135 items/km² for seafloor litter, and the TV equal to 0.000845 items/m² for floating microplastics.

113. According to the IMAP implementation all stations/beaches having concentrations equal or below the TVs are considered in GES, and those with concentrations higher than the TV value are considered not in GES (nonGES). Apart from the GES-nonGES threshold/boundary values and their interrelation with the threshold/assessment criteria values, the NEAT tool requires also two more boundary values within the nonGES range of concentrations which defines the ‘worse’ conditions. In this way a 5-status class is produced which further discriminates the above GES threshold concentration range into two more classes depending on the distances from the GES threshold value. For this boundary (worse conditions) the maximum concentration value of the data set was used.

114. The 5 NEAT status classes for CI22 and CI23_SFL are: the high status with concentrations in the range $0 < \leq 0.5 \times TV$; the ‘good’ status with concentrations in the range $0.5 \times TV < \leq TV$; the moderate status with concentrations in the range $TV < \leq 2 \times TV$; the poor status with concentrations in the range $2 \times TV < \leq 5 \times TV$. Finally, the ‘bad’ status is defined by concentrations falling above the $5 \times TV$ boundary value. For CI23_ Sea surface MPs the boundary values for the 5 classes are modified as follows: high status with concentrations in the range $0 < \leq 0.5 \times TV$; the ‘good’ status with concentrations in the range $0.5 \times TV < \leq TV$; the moderate status with concentrations in the range $TV < \leq 10 \times TV$; the poor status with concentrations in the range $10 \times TV < \leq 100 \times TV$. Finally, the ‘bad’ status is defined by concentrations falling above the $100 \times TV$ boundary value.

115. Following the IMAP methodology, NEAT class named ‘high’ is considered as ‘good’ *sensu* IMAP i.e., in GES; NEAT classes named ‘moderate’ and ‘poor’ *sensu* NEAT are considered as ‘Bad’ *sensu* IMAP i.e., not in GES. These boundary values and their relation to the IMAP and the NEAT status classes are shown in Tables 20 and 21.

Table 20: Relation of assessment status classes between the IMAP methodology and NEAT tool and respective colour coding. The position of the 3 required thresholds for the NEAT tool are shown.

	GES		non-GES		
IMAP – traffic light approach	Good	Moderate	Bad		
NEAT tool	High	Good	Moderate	Poor	Bad
Boundary limits and NEAT scores	1 < score ≤ 0.8	0.8 < score ≤ 0.6	0.6 < score ≤ 0.4	0.4 < score ≤ 0.2	Score < 0.2
Thresholds for CI22 Beach and CI23 Seafloor Litter	1/2(TV)	TV	2(TV)	5(TV)	
Thresholds for CI23 Sea surface Floating Microplastics	1/2(TV)	TV	10(TV)	100(TV)	

Table 21: Boundary/Threshold values introduced in the NEAT tool.

	Low Boundary limit	Threshold High/Good	Threshold Good/Moderate	Threshold Moderate/poor	Threshold Poor/Bad	Upper Boundary Limit
Beach Litter (items/100m)	0	65	130	260	650	2000
Seafloor Litter (items/km²)	0	67.5	135	270	675	2000
Floating Microplastics (items/m²)	0	0.000422	0.000845	0.00845	0.0845	1.076

116. A data matrix to be used for the NEAT software was prepared and given below in Table 22.

Table 22: Average values and standard error for beach litter (items/100 m) per SAU of the Adriatic subregion. (n: the number of records per SAU, i.e., station number x times visited)

Sub-division	Zone	SAU	Sub-SAU	Beach Litter (items/100m)	Seafloor Litter (items/km ²)	Sea surface Floating Microplastics (items/m ²)
North Adriatic (NAS)						
NAS coastal						
MAD-HR-MRU-3						
			HRO-O423-KVJ	99 ± 31 n=7		
IT-NAS-C						
			Emilia Romagna	233 ± 21 n=40		0.330 ± 0.093 n=4
			Friuli Venezia Giulia	759 ± 167 n=40		0.042 ± 0.006 n=4
			Veneto	363 ± 61 n=38		0.270 ± 0.046 n=6
			MAD-SI-MRU-11	436 ± 120 n=12	59 ± 3 n=2	0.1250 ± 0.023 n=24
NAS Offshore						
			MAD-SI-MRU-12		33 ± 7 n=10	0.123 ± 0.027 n=8
			MAD-HR-MRU-5		491 n=1	
			IT-NAS-O			0.144 ± 0.027 n=7
Central Adriatic (CAS)						
CAS coastal						
MAD-HR-MRU-2						
			HRO-0423-BSK	484 n=1		0.083 n=1
			HRO-0423-KOR	93 n=1	1103 n=1	0.085 n=1
IT-CAS-C						
			Abruzzo	694 ± 92 n=40		0.122 ± 0.026 n=4
			Marche	1556 ± 908 n=37		0.151 ± 0.009 n=4
			Molise	150 ± 26 n=10		0.025 ± 0.015 n=3

Sub-division	Zone	SAU	Sub-SAU	Beach Litter (items/100m)	Seafloor Litter (items/km ²)	Floating Microplastics (items/m ²)
	CAS offshore					
		MAD-HR-MRU_4			654 ± 178 n=4	0.056 n=1
		IT-CAS-O				0.066 ± 0.014 n=10
South (SAS)	Adriatic					
	SAS coastal					
		IT-SAS-C	Puglia	305 ± 31 n=30		0.195 ± 0.026 n = 14
		MAD-HR-MRU-2				
			HRO-O423-MOP	852 ± 599 n=4		0.114 ± 0.047 n=2
			HRO-0313-NEK			0.028 n=1
		MNE-SAS-C				
			MNE-1-N	1129 ± 281 n=5		
			MNE-1-S	802 ± 293 n = 2		
			MNE-Kotor	968 ± 190 n=2		
		AL-SAS-C		757 ± 187 n=4		
		BiH-SAS-C		1240 ± 611 n=2		0.011 n=1
	SAS offshore					
		IT-SAS-O				0.391 ± 0.230 n=4
		MNE-SAS-O				
			MNE-12-N		118 ± 66 n = 2	
			MNE-12-C		22 n = 1	
			MNE-12-S		25 ± 1 n = 2	
		MAD-EL-MS-AD				0.168 n=6

4.3.1.4 Results of the NEAT tool for the Assessment of the IMAP EO10/CI22/CI23 status in the Adriatic subregion

117. The results obtained from the NEAT tool are shown in Table 23 and in Figures 22-25.

118. On the individual parameter level the classification results of subSAUs regarding CI22-Beach Litter show that three subSAUs in Croatia are classified under 'Good' status (HRO-0423-KVJ, HRO-0423-KOR) and three under 'Moderate' (MAD-HRU-MRU-2, IT-Em-Ro-1, IT-Mo-1). All other subSAUs are classified under 'Poor' or 'Bad' status. For the case of CI-23 Seafloor Litter the subSAUs monitored in Slovenia and Montenegro (MAD-SI-MRU-12, MNE-12-C, MNE-12-S) are classified under 'Good' status while all other subSAUs are classified under 'Poor' or 'Bad' status. Finally, for CI23 Sea surface floating MPs all subSAUs monitored are classified as non-GEs and under 'Poor' and 'Bad' status classes.

119. Integration of data per each EO10 parameter on higher levels within the nesting scheme (bold lines in Table 7) shows that the NAS subdivision is classified under 'Good' status regarding Beach Litter, under 'Bad' regarding Seafloor Litter and Floating MPs. The CAS subdivision is classified as 'Poor' regarding Beach Litter and Sea surface Floating MPs and under 'Bad' regarding Seafloor Litter. Finally, the SAS subdivision is classified under 'Poor' status for Beach Litter, 'Good' status for Seafloor Litter and 'Bad' status for Sea surface Floating MPs.

120. When aggregating all EO10 parameters data per SubSAU, the SubSAUs HRO-0423-KVJ and MNE-12-C, MNE-12-S fall into 'Good' status class and the subSAUs IT-Mo-1, MAD-SI-MRU-12 into 'Moderate'. All other subSAUs are classified under 'poor' or 'bad' status classes.

121. Based on the data available the assessment results obtained by the NEAT methodology show that most areas of the Adriatic subregion do not achieve GES regarding EO10.

Table 23: Results of the NEAT tool on the assessment of IMAP EO10 in the Adriatic subregion (CI22_BL:Beach Litter; CI23_SFL:Seafloor Litter; CI23_MP:Floating Microplastics). The various levels of spatial integration within the nested scheme are shown in bold. Blank cells denote absence of data.

SAU	Area	Total SAU weight	NEAT value	Status class	Confidence %	CI22_BL	CI23_SFL	CI23_MPs
Adriatic Sea	139783	0	0.234	poor	94.7	0.38	0.223	0.2
Northern Adriatic Sea	31856	0	0.292	poor	100	0.632	0.173	0.189
NAS-Coastal	9069	0	0.569	moderate	67.8	0.632	0.489	0.194
MAD-HR-MRU-3	6422	0	0.695	good	69	0.695		
HRO-0313-JVE	73	0						
HRO-0313-BAZ	4	0						
HRO-0412-PULP	7	0						
HRO-0412-ZOI	473	0						
HRO-0413-LIK	7	0						
HRO-0413-PAG	30	0						
HRO-0413-RAZ	10	0						
HRO-0422-KVV	494	0						
HRO-0422-SJI	1923	0						
HRO-0423-KVA	686	0						
HRO-0423-KVJ	1089	0.046	0.695	good	69	0.695		
HRO-0423-KVS	577	0						
HRO-0423-RILP	6	0						
HRO-0423-RIZ	475	0						
HRO-0423-VIK	455	0						
IT-NAS-C	2592	0	0.259	poor	100	0.324		0.194
IT-Em-Ro-1	371	0.003	0.296	poor	99.9	0.442		0.15
IT-Fr-Ve-Gi-1	575	0.004	0.248	poor	99.9	0.184		0.312
IT-Ve-1	1646	0.012	0.255	poor	100	0.347		0.163
MAD-SI-MRU-11	55	0	0.336	poor	100	0.327	0.489	0.191
NAS-Offshore	22788	0	0.183	bad	99.3		0.172	0.188
MAD-HR-MRU-5	5571	0.056	0.167	bad	100		0.167	
IT-NAS-O	10540	0.106	0.188	bad	98.9			0.188
MAD-SI-MRU-12	129	0.001	0.425	moderate	75.3		0.653	0.196
Central Adriatic	63696	0	0.239	poor	100	0.273	0.141	0.253
CAS-Coastal	9394	0	0.299	poor	100	0.464	0.099	0.236
MAD-HR-MRU-2	7302	0	0.315	poor	100	0.555	0.099	0.236
HRO-0313-NEK	253	0.005	0.349	poor	100			0.349
HRO-0313-KASP	44	0						
HRO-0313-KZ	34	0						
HRO-0313-MMZ	55	0						
HRO-0413-PZK	196	0						
HRO-0413-STLP	1	0						
HRO-0423-BSK	613	0.013	0.245	poor	100	0.285		0.204
HRO-0423-KOR	1564	0.034	0.338	poor	100	0.714	0.099	0.2
HRO-0423-MOP	2480	0						
IT-CAS-C	2092	0	0.242	poor	95.9	0.248		0.235

SAU	Area	Total SAU weight	NEAT value	Status class	Confidence %	CI22_BL	CI23_SFL	CI23_MPs
IT-Ab-1	282	0.005	0.193	bad	71.8	0.193		0.192
IT-Ma-1	319	0.006	0.126	bad	85.1	0.066		0.187
IT-Mo-1	229	0.004	0.463	moderate	93.7	0.569		0.356
CAS-Offshore	54303	0	0.229	poor	96.4	0.191	0.149	0.254
MAD-HR-MRU-4	18963	0.178	0.205	poor	74.3	0.191	0.149	0.275
IT-CAS-O	22393	0.21	0.249	poor	91.6			0.249
Southern Adriatic Sea	44231	0	0.185	bad	61	0.218	0.646	0.146
SAS-Coastal	7276	0	0.206	poor	58.1	0.218		0.189
MAD-HR-MRU-2	4252	0	0.182	bad	55.3	0.17		0.194
HRO-0313-ZUC	13	0						
HRO-0423-MOP	1756	0.031	0.182	bad	55.3	0.17		0.194
IT-SAS-C (Ap-1)	1810	0.013	0.277	poor	100	0.377		0.178
MNE-SAS-1	483	0	0.181	bad	68.3	0.181		
MNE-1-N	86	0.002	0.129	bad	95.4	0.129		
MNE-1-C	246	0						
MNE-1-S	151	0						
MNE-Kotor	85	0.002	0.234	poor	69	0.234		
AL-SAS-C	646	0.005	0.184	bad	72.7	0.184		
BiH-SAS-C	12.9	0	0.113	bad	84.9	0.113		
SAS-Offshore	36955	0	0.181	bad	69.6		0.646	0.142
IT-SAS-O	22715	0.222	0.138	bad	90.2			0.138
MNE-SAS-O	2076	0	0.646	good	94.8		0.646	
MNE-12-N	513	0.005	0.326	poor	62.3		0.326	
MNE-12-C	713	0.007	0.768	good	100		0.768	
MNE-12-S	849	0.008	0.737	good	100		0.737	
AL-SAS-O	716	0						
MAD-EL-MS-AD	2253	0.022	0.183	bad	100			0.183

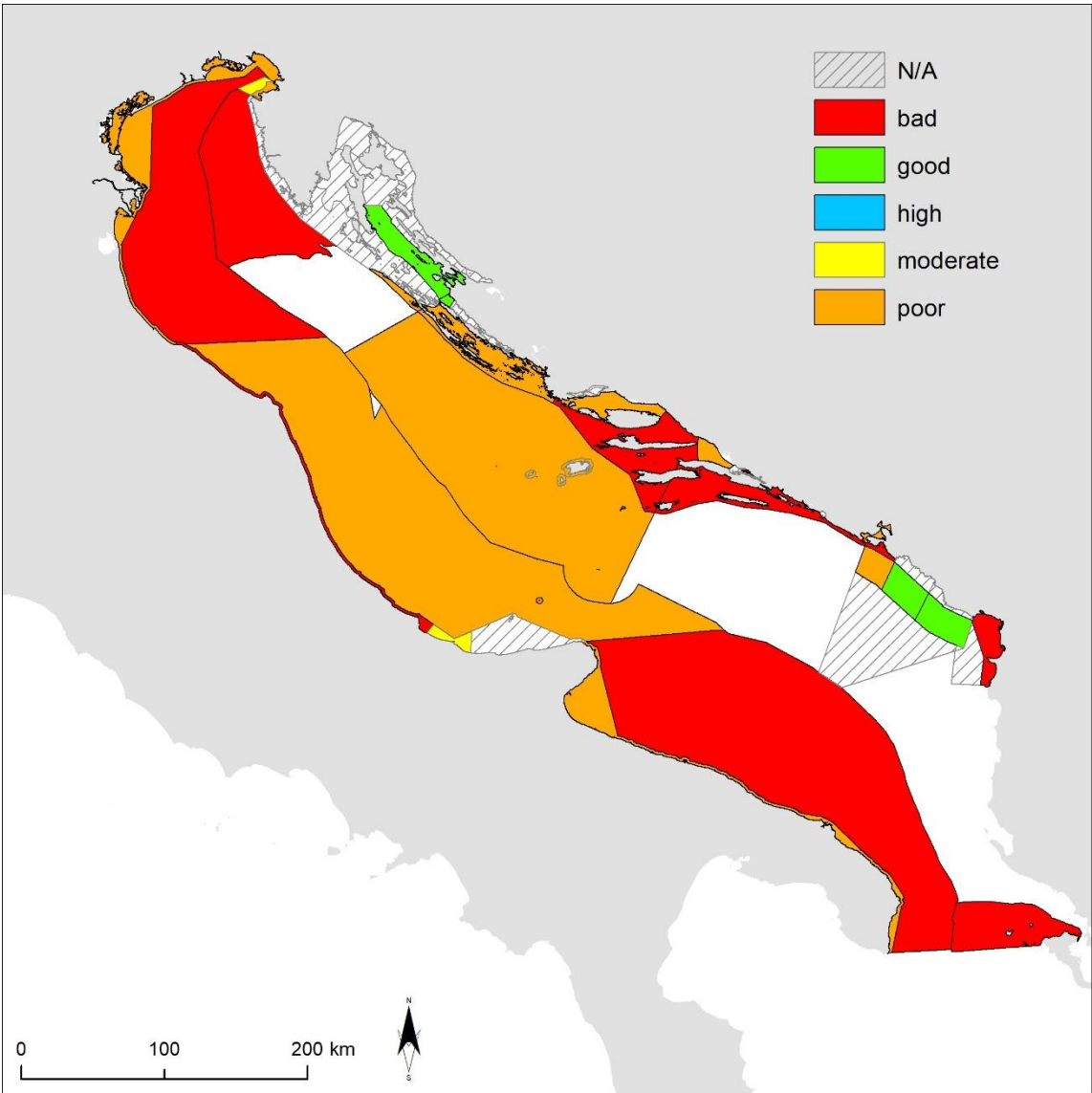


Figure 22: The aggregated-integrated assessment of EO10 in the Adriatic sub-Region following the NEAT assessment methodology.

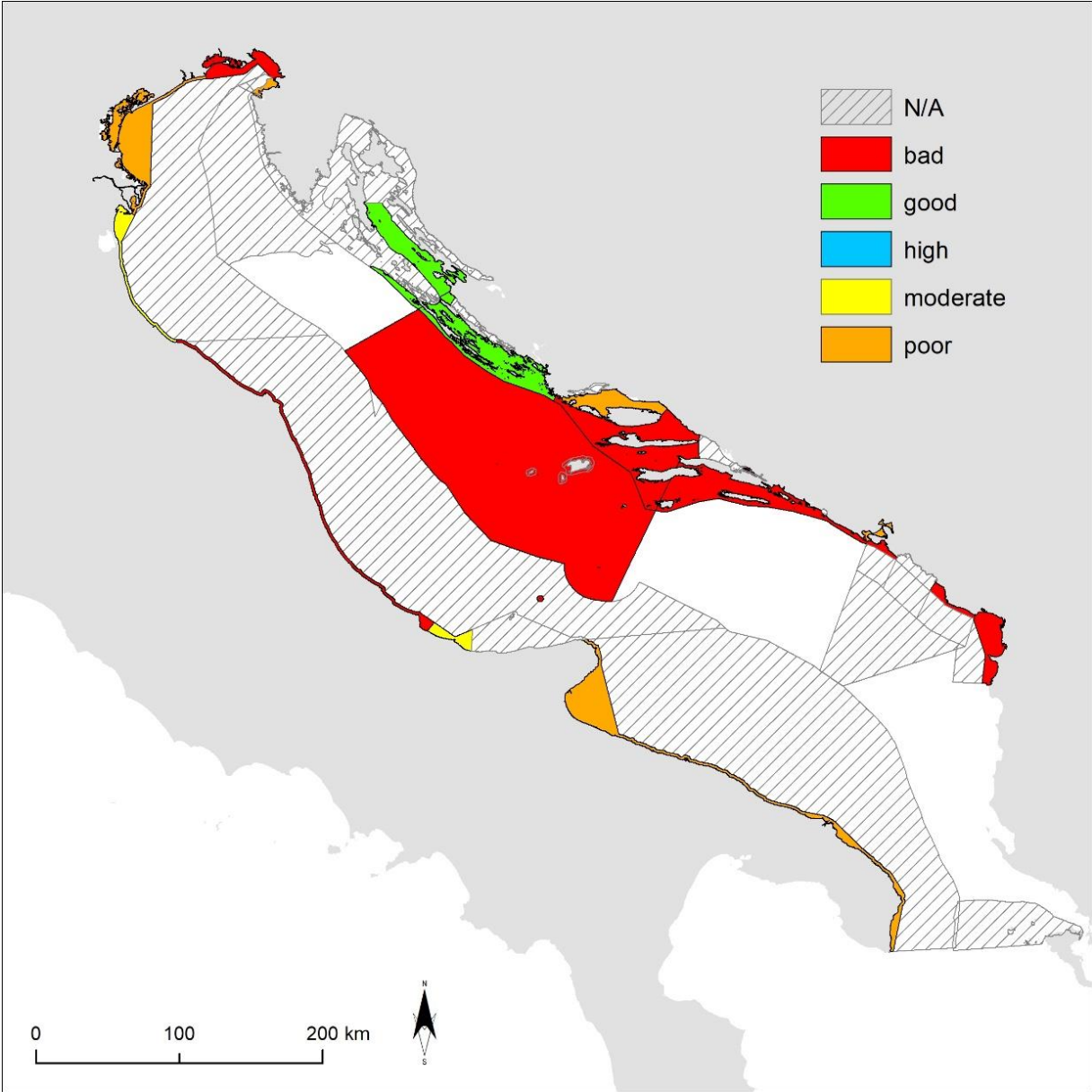


Figure 23: The assessment of CI22-Beach Litter spatial integration in the Adriatic sub-Region following the NEAT assessment methodology.

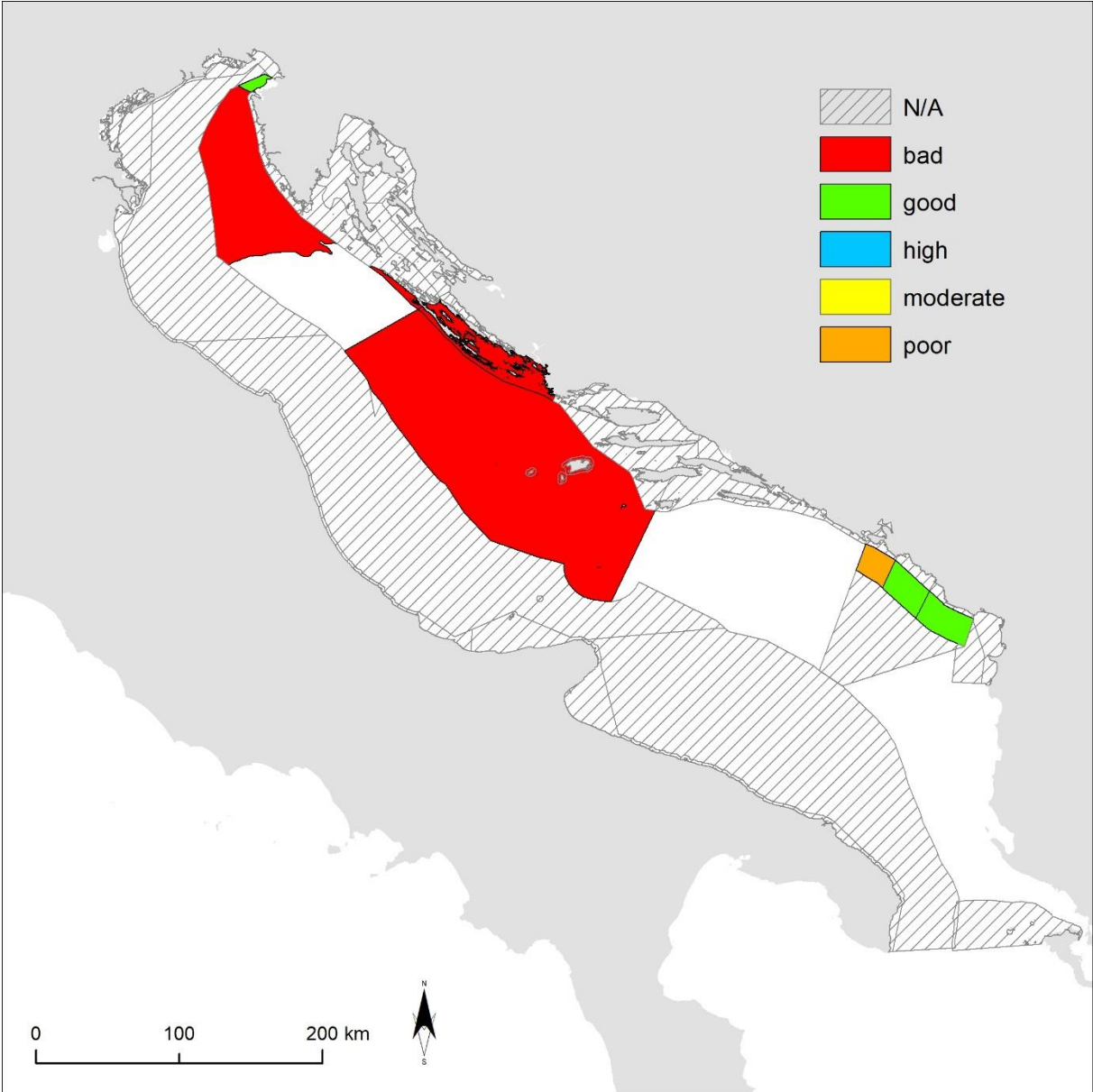


Figure 24: The assessment of CI22-Seafloor Litter spatial integration in the Adriatic sub-Region following the NEAT assessment methodology.

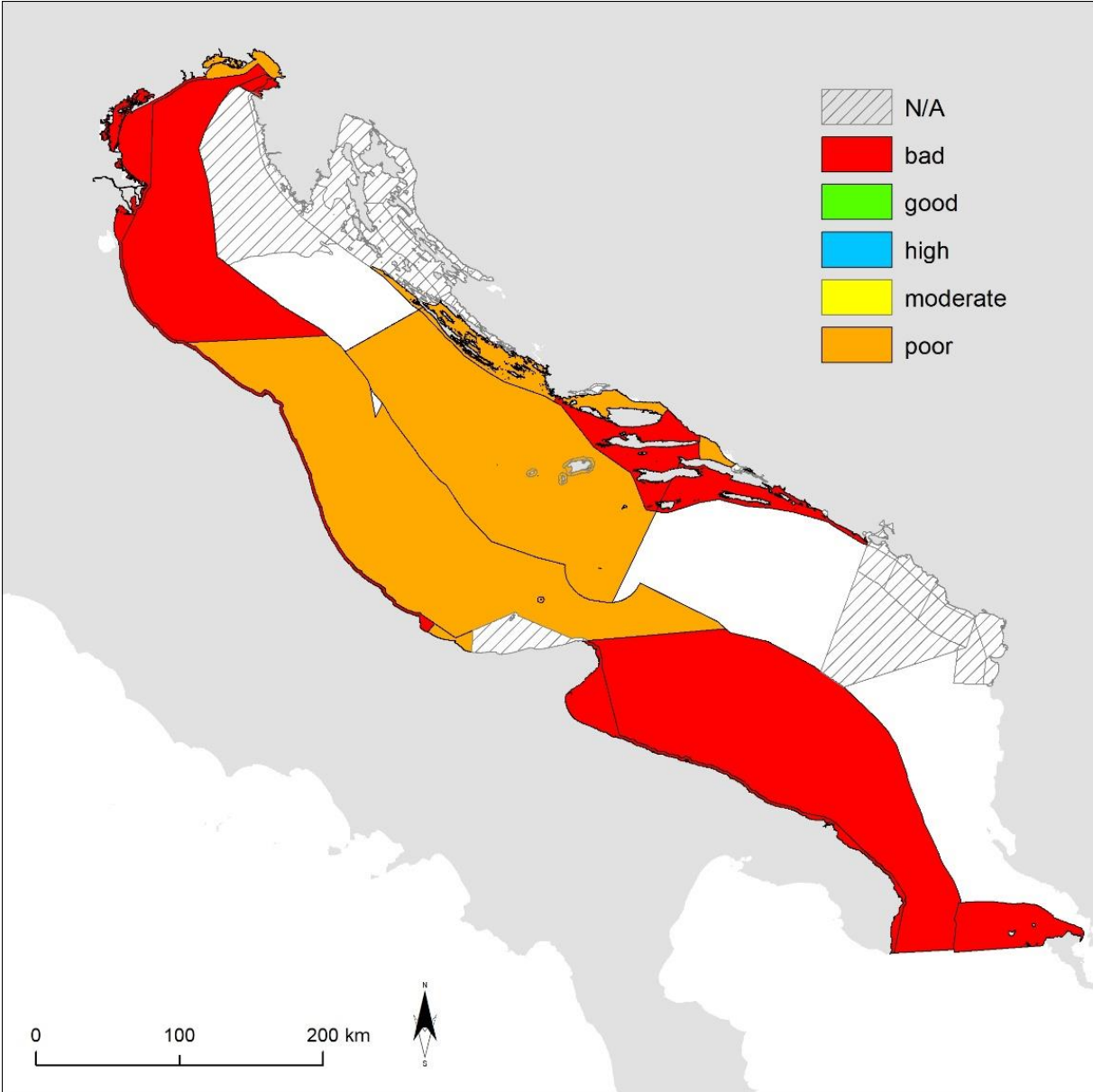


Figure 25: The assessment of CI23-Seasurface Floating MPs spatial integration in the Adriatic sub-Region following the NEAT assessment methodology.

4.3.1.5 Sensitivity analysis of the assessment results.

122. Based on the standard deviation of beach litter per SAU the NEAT tool provides a sensitivity analysis for calculating the uncertainty of the assessment results using a Monte-Carlo simulation model for 1000 iterations. In Table 24 the results of the error analysis are presented.

123. In other words, 1000 assessments are run using different random combinations of the data. Instead of using the average value of the parameters inserted by the user, other random values are used by the tool to run the assessment. The selection of these random values is done based on the standard deviation and it is repeated 1000 times. The resulting assessment value of each of these 1000 assessment runs is recorded and may lead to a different assessment classification. The number of times (out of 1000) of the appearance of these different assessments is given in Table 24. For example, the overall status for the SAU MAD-HRU-MRU-3 is reported as ‘good’. However, from Table 24, it is understood that out of 1000 iterations, 690 lead to Good status, and 164 to Moderate and 146 to High Status. These results imply a rather high uncertainty (confidence 69%), in contrast to MAD-HRU-MRU-5 where all 1000 iterations led to High status (confidence 100%).

Table 24: Confidence assessment of all SAU/assessment class combinations as absolute counts falling into the specified classes (maximum possible count = 1000).

SAU	bad	poor	moderate	good	high	Confidence %
Adriatic Sea	4	947	49	0	0	94.7
Northern Adriatic Sea	0	1000	0	0	0	100
Southern Adriatic Sea	610	335	5	37	13	61
Central Adriatic	0	1000	0	0	0	100
NAS-C	0	0	678	322	0	67.8
NAS-O	993	7	0	0	0	99.3
SAS-C	325	581	93	1	0	58.1
SAS-O	696	248	6	0	50	69.6
CAS-C	0	1000	0	0	0	100
CAS-O	36	964	0	0	0	96.4
MAD-HR-MRU-3	0	0	164	690	146	69
IT-NAS-C	0	1000	0	0	0	100
MAD-SI-MRU-11	0	1000	0	0	0	100
MAD-HR-MRU-5	1000	0	0	0	0	100
IT-NAS-O	989	11	0	0	0	98.9
MAD-SI-MRU-12	0	247	753	0	0	75.3
MAD-HR-MRU-2	553	333	89	23	2	55.3
IT-SAS-1 (Ap-1)	0	1000	0	0	0	100
MNE-SAS-C	683	316	1	0	0	68.3
AL-SAS-C	727	271	2	0	0	72.7
BH-SAS-C	849	104	17	7	23	84.9
IT-SAS-O	902	42	6	0	50	90.2
MNE-SAS-O	0	0	0	948	52	94.8
MAD-EL-MS-AD						
MAD-HR-MRU-2	1000	0	0	0	0	100
IT-CAS-C	0	1000	0	0	0	100
MAD-HR-MRU-4	0	959	41	0	0	95.9
IT-CAS-O	257	743	0	0	0	74.3

SAU	bad	poor	moderate	good	high	Confidence %
HRO-0423-KVJ	84	916	0	0	0	91.6
IT-Em-Ro-1						
IT-Fr-Ve-Gi-1						
IT-Ve-1						
HRO-0423-MOP						
MNE-1-N						
MNE-1-S						
MNE-Kotor						
MNE-12-N						
MNE-12-C						
MNE-12-S						
HRO-0313-NEK	0	0	164	690	146	69
HRO-0423-BSK						
HRO-0423-KOR						
IT-Ab-1						
IT-Ma-1						
IT-Mo-1	0	999	1	0	0	99.9

124. As for any assessment results, the accuracy of the results described above, is dependent also on the amount of data available for each SAU. Many subSAUs totally lack data, so that the integrated results on the SAU level actually reflect the status of one or two subSAUs and cannot be considered indicative of the overall SAU status with confidence.

5. Comparison of the two assessment methodologies applied for the Adriatic sub-region

125. Given the assessed data availability for EO10 CI22 and CI23 for the Mediterranean Sea as described in Chapters 2.1 and 2.2 the following approach is followed for the quality status assessment. For each CI and each measured parameter (Beach litter, Seafloor Litter, Floating Microplastics) temporal data are averaged per monitoring station. The resulting average value is compared against the respective TV and the score ratio (CR) is calculated. Classification of stations is conducted following the status classes described in Table 5. No further aggregation on the EO 10 level or spatial integration is conducted for the Mediterranean region as a whole. For the Adriatic sub-division, for which spatial assessment units have been defined in 2022 for the Eutrophication-Pollution and Marine litter cluster, the application of the NEAT methodology was made possible for the 2 IMAP Common Indicators on marine litter (CI22 and CI23).

126. For the Adriatic sub-region a comparison was made between the two assessment approaches, i.e. the assessment results on the CI level based on the CHASE+ methodology (Chapters 4.2.1; 4.2.2.1; 4.2.2.3) and the results on the EO10 level using the NEAT methodology (Chapter 4.3.1), further to the recommendations for the harmonization of the two assessment.

127. The first assessment approach on the CI level (Chapters 4.2.1; 4.2.2.1; 4.2.2.3) provides assessment per individual stations, while the second one, using NEAT, provides assessments either on the EO10 or CI level spatially integrated (Chapter 4.3.1) along a predefined hierarchical nesting scheme of assessment areas. Therefore, the comparison of the results obtained from the two methods was made possible only on the first level of aggregation i.e. on the subSAUs, for each of the EO10 components separately (CI22-BeachLitter, CI23-Seafloor Litter, CI23-Seasurface MPs). The score ratios (CR) for each of the EO10 components as obtained from the first assessment approach, were grouped for all stations belonging to a specific subSAU and averaged to get one CR per subSAU per EO10 component. Then the subSAU was classified following the rationale already described in Chapters 4.2.1; 4.2.2.1; 4.2.2.3 and shown here below in Table 25 for both methods. All thresholds used were identical in the two methodologies (Table 25). The resulting classification is then compared to the respective NEAT value of the subSAU (Table 23). The two alternative assessment results per subSAU and per EO10 component are shown in Table 26.

Table 25. Assessment classification boundary limits/thresholds for a harmonized application of NEAT and simplified CHASE+ tools in the Adriatic Sea sub-region.

	GES		non-GEs			
IMAP – traffic light approach	Good	Moderate	Bad			
NEAT tool	High	Good	Moderate	Poor	Bad	
	0 < meas. conc. ≤ BAC	BAC < meas. conc. ≤ GES/nGES threshold	GES/nGES < meas. conc. ≤ moderate/poor threshold	moderate/poor threshold < meas. conc. ≤ max. conc.		
Boundary limits and NEAT scores	0 1 < score ≤ 0.8	0.8 < score ≤ 0.6	0.6 < score ≤ 0.4	0.4 < score ≤ 0.2	Score < 0.2	Max. conc.
Thresholds CI22; CI23_SFL		½ TV	TV	2 TV	5 TV	
CI23_MPs		½ TV	TV	10 TV	100 TV	
CHASE+ tool	High	Good	Moderate	Poor	Bad	
Thresholds CI22; CI23_SFL		½ TV	TV	2 TV	5 TV	
CI23_MPs		½ TV	TV	10 TV	100 TV	
CHASE+ Scores	0 < CR ≤ 0.5	0.5 < CR ≤ 1	1 < CR ≤ 2	2 < CR ≤ 5	CR > 5	

Table 26. Comparison of the two assessment methodologies applied in the Adriatic sub-region for the status assessment of EO10 components. Discrepancies in assessment results marked in bold.

CI22_Beach Litter		
SAU	Average subSAU score ratio (CR)	NEAT Score
MAD-SI-MRU-11	3.4	0.31
MAD-HR-MRU-4	3.7	0.191
HRO-0423-BSK	3.7	0.285
HRO-0423-KOR	0.7	0.714
HRO-0423-KVJ	0.7	0.695
HRO-0423-MOP	4.2	0.17
IT-Em-Ro-1	1.8	0.442
IT-Fr-Ve-Gi-1	8.5	0.184
IT-Ve-1	2.9	0.347
IT-Ab-1	5.3	0.193
IT-Ma-1	12.3	0.066
IT-Mo-1	1.2	0.569
IT-SAS-1 (Ap-1)	2.3	0.377
BH_SAS_1	9.5	0.113
MNE-1-N	5.7	0.129
MNE-1-S	6.2	0.129
MNE-Kotor	4.6	0.234
AL-SAS-1	5.8	0.184

CI23_Seafloor Litter		
SAU	Average subSAU score ratio (CR)	NEAT Score
MAD-SI-MRU-11	1.57	0.489
MAD-SI-MRU-12	1.09	0.653
MAD-HR-MRU-4	17.22	0.149
HRO-0423-KOR	8.17	0.099
MAD-HR-MRU-5	3.64	0.167
MNE-12-N	3.09	0.326
MNE-12-C	0.6	0.768
MNE-12-S	0.66	0.737

CI23_Sea surface MPs		
SAU	Average subSAU score ratio (CR)	NEAT Score
MAD-SI-MRU-11	148	0.191
MAD-SI-MRU-12	134	0.196
MAD-HR-MRU-4	66	0.275
HRO-0423-BSK	98	0.204
HRO-0423-KOR	101	0.2
HRO-0423-MOP	135	0.194
HRO-0313-NEK	33	0.349
IT-Em-Ro-1	390	0.15
IT-Fr-Ve-Gi-1	49	0.312
IT-Ve-1	319	0.163
IT-Ab-1	144	0.192
IT-Ma-1	35	0.187
IT-Mo-1	29	0.356
IT-SAS-1 (Ap-1)	231	0.178
IT-NAS-12	170	0.188
IT-CAS-12	78	0.249
IT-SAS-12	463	0.138
BH_SAS_1	13	0.393
MAD-EL-MS-AD	198	0.183

128. The comparison of the two methodologies (Table 26) shows that out of the 45 individual assessments per subSAU per EO10 component only 6 discrepancies were found, most of them between the 'poor' and 'bad' classes. The two methods agree on 87 % of cases, while the GES/nGES classification, with the exception of one SAU, is identical between methods and thus results can be considered comparable.

6. Key findings per CI

129. The key findings for IMAP EO10 Common Indicator 22 are listed hereunder:

- a) The monitoring efforts around the region and between the sub-regions vary significantly and further alignment and strengthening of IMAP EO CI22 is required from the Mediterranean Countries.
- b) Concentrations of beach marine litter are highly variable around the region ranging between 8 and 12,842 items/100m.
- c) Overall, 16% of the monitored beaches achieve GES, 79% do not achieve GES of which 29 % fall into the poor status class and 25% in to the bad one. (i.e., beach litter concentrations are up to two to five times higher than the TV).
- d) The Central Mediterranean appears the least affected by beach litter with 32% out for the 22 beaches monitored falling into the GES category.
- e) The Adriatic, Eastern and Western Mediterranean sub-regions show equal distribution between GES and non-GES classes with only ~14-16 % of the beaches monitored falling into the GES class, with the highest percentages of beaches (34 - 38%) being classified under the poor or bad classes.
- f) For 11 countries, the top-10 item list represents more than 70% of the collected litter items (Bosnia and Herzegovina Lebanon, Slovenia, Croatia, Italy, France, Cyprus, Montenegro, Greece, Israel, and Türkiye), and for 2 Countries represents slightly lower share (approximately 68-69%) (Spain and Morocco).
- g) At the level of the Mediterranean Plastic/polystyrene pieces (2.5 cm – 50 cm) are the most commonly found marine litter, followed by cigarette butts and filters, and plastic caps and lids. These 3 items account for more than 60% of the recorded marine litter.
- h) The predominant source seems to be human activities on beaches, whereas the “beaching” process seems to play an important role, especially through the fragmentation process.

130. The key findings for IMAP EO10 Common Indicator 23 are listed hereunder:

A. Floating Marine Litter:

- a) Monitoring efforts are evident in several parts of the Mediterranean, however monitoring efforts for IMAP EO10 CI23 floating microplastics should be further strengthened also in the Southern part of the Mediterranean.
- b) Concentrations of Floating Microplastics (items/km²) are highly variable fluctuating between 0 and 31 items /m².
- c) Average floating microplastics concentration on the Mediterranean Sea surface is found equal to 0.36 ± 1.9 items/m².
- d) Almost all stations (99%) that have been monitored do not achieve GES, and most of them fall into the poor (44 %) and bad (49 %) classes (i.e., floating microplastics litter concentrations are up to 100 and 1000 times higher than the TV respectively).
- e) The Mediterranean region and its subregions suffer from elevated microplastics concentrations in surface waters, reaching up to 100 times and 1000 times higher than the IMAP TV.
- f) In the Eastern Mediterranean 44% of monitored stations exceed the bad class with concentrations more than 1000 times the TV and are classified as ‘very bad’.
- g) In the Western Mediterranean only 2 % of stations are found above 1000xTV.
- h) From the recorded floating microplastics, Sheets (39%) have been found to be predominant, followed by Filaments (29%), Pellets (21%), Fragments (5%), Foam (5%), and Granules (1%).
- i) The ACCOBAMS Survey Initiative (ASI), was the first international basin-wide survey of the Mediterranean Sea for floating mega-litter (>30cm) following an opportunistic approach while the main interest was to provide estimations about the mega-fauna.

- j) ACCOBAMS (ASI) has developed a well-elaborated monitoring protocol for monitoring mega-litter through aerial surveys.
- k) Some 41,000 floating mega-litter items were recorded in total during the ASI, with an average encounter rate of 0.8 mega-litter per km, ranging between 0 and 111 litter per km.
- l) The total number of floating mega-litter was estimated at 2.9 million items (80% confidence interval was 2.7 to 3.1 million) and average density 1.5 ± 0.1 items per km^2 .
- m) More than two thirds of the mega-litter recorded were identified as plastics (68.5%; e.g., plastic bags, bottles, tarpaulins, palettes, inflatable beach toys, etc.), while 1.7% were fishery debris and 1.9% were anthropogenic wood-trash. The remaining quarter (27.9%) was anthropogenic mega-debris of an undetermined nature.
- n) During the ASI, only 20% of the Mediterranean was free of floating mega-debris.
- o) Many endangered or vulnerable species, some of them endemic to the area, are at risk of entanglement or of ingesting debris.

B. Seafloor Marine litter:

- a) Concentrations of seafloor marine litter are highly variable fluctuating between 0 and 28,228 items / km^2 .
- b) The average seafloor litter concentration collected by seafloor trawling on the Mediterranean is found equal to $570 \pm 2,588$ items/ km^2 .
- c) The majority (88%) of the seafloor stations monitored do not achieve GES, and most of them fall into the poor and bad categories (23 % and 53 % respectively) (i.e., seafloor litter concentrations are up to five times higher than the TV).
- d) The Western Mediterranean highly appears affected by seafloor marine litter since all stations monitored (100%) are classified in the nonGES category.
- e) The Central Mediterranean is highly affected by seafloor litter with 81 % of stations monitored classified under nonGES classes.
- f) In the Adriatic sub-region 65% of the stations monitored falling into the nonGES class with the highest percentage of seafloor stations to be classified under the moderate (35%) and poor (26 %) classes.
- g) The Eastern Mediterranean subregion is also affected by seafloor litter, since 68 % of the monitored stations are classified under nonGES class, with more or less equal share among the 3 nonGES classes.
- h) An uneven spatial distribution of stations within each sub-region is evident in the present study, for example the CEN is covered only by Malta and Tunisia.
- i) Fisheries-related items comprise up to 10% of the total recorded marine litter.
- j) 3 items are the most commonly recorded among fisheries related items : (i) Synthetic ropes/strapping bands (L1i) with 39%; Fishing nets (polymers) (L1f) with 27%; and Fishing lines (polymers) (L1g) with 25%.
- k) Another set of 3 items are recorded in minor percentages: (i) Natural fishing ropes (L5c) with 6%; (ii) Other synthetic fishing related" (L1h) with 2%; and (iii) Fishing related (hooks, spears, etc.) (L3f) with 1%.
- l) Interesting results have been obtained from limited scuba-dive surveys ($972,500 \pm 801,311$ items/ km^2) and IMAP should further provide additional support and guidance to further expand this monitoring component for marine litter (IMAP EO10).

7. Measures and actions required to achieve GES

131. The legally binding Regional Plan on Marine Litter Management in the Mediterranean was introduced in 2013 (Decision IG.21/7, COP18); entered into force in 2014; and updated in COP 22 (Antalya, Turkey, 7-10 December 2022; Decision IG.25/9) to further reflect global and regional agenda relevant to marine litter management.

132. The Updated Regional Plan on Marine Litter Management includes stronger links to global agenda, i.e. the United Nations Environmental Assembly (UNEA) Resolutions on marine plastic litter, microplastics and single-use plastic products pollution; UNEP marine litter partnerships and initiatives like the Global Partnership on Marine Litter (GPML) and the Clean Seas Campaign; the IMO Action Plan to Address Marine Plastic Litter from Ships; the Basel Convention - Plastic Waste Partnership (PWP); as well as the EU Policies on Marine Litter and Plastic.

133. The Updated Regional Plan on Marine Litter Management:

- a. Introduces a number of new, region-wide agreed definitions on marine litter (e.g., ALDFG, BAT-BEP, Circular Economy, EPR, Fishing Gear, Lightweight plastic carrier bags, monitoring, micro-litter/plastics, primary/secondary microplastics, SUPs etc.);
- b. Expands the scope of measures in four key areas: (i) economic instruments, (ii) circular economy of plastics, (iii) land-based and (iv) sea-based sources of marine litter;
- c. Introduces ambitious, amended targets for plastic waste and microplastics; and
- d. Introduces two new appendices with lists on (i) single-use-plastic items, and (ii) chemical additives of concern used in plastic production further to the Stockholm Convention.

134. The Regional Plan also incorporates a number of additional, important principles and measures are addressed, including:

- Phasing out single-use plastic items and promote reuse options;
- Setting targets for plastic recycling and other waste items;
- Introducing economic instruments such as environmental taxes, bans and design requirements, and Extended Producer Responsibility (EPR) schemes (land and sea-based sources);
- Promoting new technologies and measures for the removal of marine litter;
- Applying prevention measures to achieve a circular economy for plastics addressing the whole life cycle of plastics;
- Reducing packaging;
- Promoting voluntary agreements with industry;
- Integrating the informal sector into regulated waste collection and recycling schemes;
- Strengthening measures related to Sustainable Consumption and Production (SCP) programmes;
- Phasing-out chemical additives used in plastic products, in particular those under Stockholm Convention;
- Introducing concrete measures on microplastics reduction;
- Implementing measures to prevent and reduce marine litter in Marine Protected Areas (MPAs);
- Minimizing the input of marine litter associated with fisheries and aquaculture;
- Establishing national marine litter monitoring programmes as part of IMAP EO10, including on riverine inputs and wastewater treatment plants (WWTP);
- Enhancing public awareness and education; and
- Introducing measures to Specially Protected Areas of Mediterranean Importance in the (SPAMIs) to combat marine litter.

135. Monitoring and assessment should be further linked and connected with the implementation of measures. Specific and well-elaborated findings can provide the basis for the implementation of targeted measures.

136. The presence of marine litter in the Mediterranean is variable, however tackling few items may yield promising and encouraging results pertinent to the health status of the marine and coastal environment.

137. Based on the assessment findings for both IMAP CI22 and CI23, most of the stations are under nonGES status and urgent action is required.

138. Cigarette butts and filters are predominant in the Mediterranean beaches and primarily require a behavioral change along with the implementation of strong anti-smoking policies and measures, including a strengthened communication campaign linking the damage in human health with the damage in the marine environment. Cigarette filters do not contain only plastic, but also a cocktail of toxic substances (e.g., arsenic, lead, nicotine and pesticides, etc.) for which their effects in the marine biota and the marine environment still are unknown. The engagement of the cigarette companies in this process is of great importance, including their potential inclusion in a “polluters-pay” principle.

139. The vast presence of plastic bottles is documented by the third main item on the Mediterranean beaches, comprising of plastic caps and lids. The introduction of sound alternatives and incentivizing the use of re-use caps could be among the possible options. Strengthening recycling and Extended Producer Responsibility schemes, targeted and tailored to tackle plastic bottles are also part of the solution, including the minimization of the small-sized bottles (<0.5 liters) which are easier to escape in the marine and coastal environment.

140. Microplastics of various types and shapes are escaping into the marine and coastal environment through wastewater treatment plants (WWTP). At the Mediterranean level, the Contracting Parties to the Barcelona Convention in their 22nd COP (Antalya, Turkey, 7-10 December 2021) adopted Decision IG.25/8 related to the Regional Plans on Urban Wastewater Treatment and Sewage Sludge Management in the framework of Article 15 of the Land-based Sources Protocols. Among several measures to ensure their sustainable and safe use and discharge of wastewaters, the regional plan on wastewater treatment addresses for the first time in its scope microplastics. The updated Regional Plan calls for the introduction of emission limit values for emerging pollutants considering the identification of potential microplastic sources and adoption of related policy and methodology further to state of the art on related research on this topic.

141. The Regional Plan on Sewage Sludge Management gives particular attention to the presence and effective management of microplastics on Pharmaceuticals and Personal Care Products (PPCP) (e.g., lotions, soaps, facial and body scrubs and toothpaste) being present in sewage sludge and proposes methods for reduction at the source as provided hereunder:

- a) Regulatory approvals for new products potentially harmful to the environment to be introduced for most/all of personal care materials or detergents. However, the said measure may be difficult to be applied for medication products.
- b) Education on the correct use of substances containing drugs, and especially the use of the right dose without excess, including ecolabels to raise awareness of ecological impacts of PPCPs.
- c) Encouraging the return of unused or expired pharmaceuticals to specific collection points; and
- d) Subjecting wastewater originating from pharmaceutical industries, hospitals or healthcare centres to regulations that limit the concentration of organic pollutants in their effluents.

142. Wastewater treatment plants (secondary + tertiary levels of treatment with adequate sludge management) to efficiently remove microplastics from sewage, trapping the particles in the sludge and preventing of entrance into aquatic environments. Treatment plants are essentially taking the microplastics out of the wastewater and concentrating them in the sludge (Corradini et al., 2019). Therefore, sludge management is of great importance for microplastic removal. Controls should be exercised however on the subsequent use of sludge.

143. Measures that can contribute toward reducing sewage concentrations of microplastics include:

- a) Bans on single-use plastics and microplastics in personal care and cosmetic products;
- b) Behavior changes and campaigns to reduce the use of such products;
- c) Certain textile designs can reduce microfibre generation during washing;
- d) Development of household-based systems to prevent microplastics from being released into sewer lines or directly into the environment; and
- e) Incineration of sewage sludge to avoid soil and water contamination by microplastics. Care should be exercised however to monitor and regulate pollutants in air emissions with a view to minimise these emissions as much as possible.

144. As rivers in most of the cases is the final repository of litter coming from the various land-based sources the application of measures on land are very relevant for the control and effective management of litter in riverine systems.

145. A Conceptual flow of plastic from production to consumption, waste management and leakage into the environment (i.e., land, rivers and ocean), including possible points of action for policies should be considered. Minimizing leakage on land will subsequently minimize the riverine inputs deriving from wind and rain transportation, as well as from direct dumping and sewerage, and will further reduce the amount of plastics (incl. microplastics) entering the ocean.

146. The updated Regional Plan on Marine Litter Management in the Mediterranean:

- a) Takes into consideration the occurrence and extent of marine litter accumulations, and calls for identification and assessment by the year 2025, on the impacts of these accumulations in upstream regions of rivers and their tributaries, and to apply measures to prevent or reduce their leakage into the Mediterranean, particularly during flood seasons and other extreme weather events;
- b) Envisages the application of enforcement measures to prevent, reduce and sanction illegal dumping and illegal littering in accordance with national and regional legislation, in particular on coastal zones and rivers, in the areas of application of the Regional Plan; and
- c) Couples the aforementioned provisions with aspects related to monitoring of marine litter originating from riverine inputs.

147. Storm water is an important contributor of riverine inputs of marine litter especially for the Mediterranean where seasonal, on several occasions extreme, weather events take place such as flash floods. And with the impacts of climate change, this aspect is becoming more significant as the Mediterranean is experiencing rainfalls, more intense and in shorter periods of time, the impact of which is less infiltration into the ground and more surface run-off.

148. A more systematic approach should be also offered when developing urban storm water management plans. Those plans typically address how urban storm water quantity and quality should be managed to protect ecological, social/cultural, and economic values. Urban storm water management plans are used to assist decision making to ensure that remedial measures (structural and non-structural) in existing developed areas are undertaken in a cost-effective, integrated and coordinated manner, and that decisions in relation to areas of new expansion (including redevelopment) are made with the implications for storm water impacts taken into account in order to achieve the quality goals for water bodies.

149. Urban storm water management (USWM) plans have been developed to a various extent across the Mediterranean. This ranges from major cities having USWM Plans to smaller municipalities where such plans are non-existent, or at best are under preparation. USWM Plans in the Mediterranean mostly include only flooding control segments, i.e., no pollution control, while segments on risk management and information on location of land-based activities are covered only on a basic level. In some cases, some elements of the USWM plans are incorporated into Urban Plans but only to a limited extent, such as collection systems layout, principles and recommended techniques regarding flood and pollution control management, as well as principles on how to achieve environmental water quality goals for water bodies.

150. The Establishment of separate collection systems for surface water run-off should be also promoted. A separate storm water sewer system is a collection of structures, including retention basins, ditches, roadside inlets and underground pipes, designed to gather storm water from built-up areas and discharge it, with or without treatment, into local water bodies, e.g., streams, rivers, coastal waters (National Research Council, 2009). Separate collection prevents the overflow of sewer systems and treatment stations during rainy periods and the mixing of the relatively little polluted surface run-off with chemical and microbial pollutants from municipal wastewater. Separate storm water systems allow for design of sewers and treatment plants that consider the volume of the wastewater only, while surface run-off and rainwater can be reused after a simplified treatment (e.g., for landscaping or agriculture).

151. Measures for combined collection systems are of great importance. Combined collection systems are sewer networks designed to collect rainwater runoff, domestic sewage, and industrial wastewater in the same pipe. Most of the time, combined sewer systems transport all of their wastewater to a wastewater treatment plant (WWTP) where it is treated and then discharged to a water body (National Research Council, 2009). During periods of heavy rainfall, however, the wastewater volume in a combined collection system can exceed the capacity of the sewer system or the treatment facilities, for which reason the combined collection systems are designed to overflow occasionally and discharge excess wastewater directly into nearby streams, flood drainage canals rivers, lakes or coastal waters.

152. A variety of additional measures could be also proposed with the aim of reducing the occurrence and impacts of storm water overflows and associated floods and pollution (Milieu, 2016), including the following:

- a) End-of-pipe solutions such as building water storage capacity to optimising the use of the wastewater treatment plant and sewer system (e.g., using sewer networks for additional storage and optimising pumping operations);
- b) Reduction of clean storm water entering a sewer system (e.g., de-connecting impervious areas from combined sewer systems);
- c) Alternative green infrastructures as potentially cost-effective measures to reduce storm water (e.g., retention basins, infiltration trenches).

153. In addition, it would be valuable to close the knowledge gaps by gathering comparable information across the Mediterranean on the extent of storm water overflows from combined collection systems, which should include inventory of the locations of overflow structures, inventory of functioning of the overflow structures, inventory of sewage storage capacity structures (e.g. starting with agglomerations of more than 100,000 p.e.), with the aim of acquiring better understanding of the occurrence of storm water overflows and their impacts on the quality of receiving water bodies.

154. Promoting Sustainable Urban Drainage Systems (SUDS) is another measure which aims to minimize the impervious cover by promoting infiltration, ponding, and harvesting of storm water runoff. Furthermore, in this decentralized management approach, storm water runoff and pollution are primarily controlled by measures located near the source to strive towards well-integrated measures that perform multiple functions, including flood protection, pollution removal and groundwater recharge, as well as recreation, biodiversity and urban aesthetics.

155. The Fisheries sector, including both fishing and aquaculture activities have a contribution on marine litter generation.

156. In the past years, considerable attention has been brought to the scale of abandoned, lost and discarded fishing gear (ALDFG), the impacts on the marine environment through ghost fishing, and possible measures for reducing its occurrence like the [FAO Voluntary Guidelines on the Marking of Fishing Gear](#). Given that aquaculture now supplies over half the seafood produced worldwide, it is considered of great importance that this issue is also examined at farm level, especially given the continued expansion of global aquaculture development (Huntington, 2019).

157. Measures targeting specifically on aquaculture farming should focus on overall recommendations and to propose measures scoping to reduce marine litter from aquaculture, block the relevant pathways to the marine environment and reduce the contribution to marine plastic pollution by aquaculture. Moreover, a second level of measures should be introduced touching upon the specific requirements and standards to be applied on a mandatory basis for aquaculture practices.

158. Measures that can contribute to reduced generation of marine litter from aquaculture include the following:

- a) Replace to the extent possible plastic infrastructure components with other of physical nature.
- b) Use higher density plastics (e.g., Polyethylene terephthalate (PET) or Ultra-high molecular weight polyethylene (UHMWPE)) which are more resistant to fragmentation, UV-irradiation.
- c) Reduce single-use plastic with the introduction of relevant alternatives and invest in developing recovery, cleaning and re-distribution schemes.
- d) Minimize the use of plastic types with low levels of recyclability.
- e) Reduce to the extent possible the use of equipment consisting of different types of plastic (i.e., different lifespan and different approach for collection and recycling).
- f) Ensure to the extent possible that all packaging is reusable or recyclable.
- g) Reduce to the extent possible packaging and over-packaging to minimize packaging waste.
- h) Develop awareness raising trainings for aquaculture staff similar to those offered from the shipping sector (e.g., HELMEPA).
- i) Reduce to the extent possible the use of single-use plastics and establish relevant policies;
- j) Minimize the use of plastic types with low levels of recyclability;
- k) Reduce to the extent possible the use of equipment consisting of different types of plastic (i.e., different lifespan and different approach for collection and recycling).

159. Moreover, aquaculture should ideally apply a circular approach planning considering the whole life cycle of the used equipment. High procurement standards should be introduced, especially when dealing with purchasing of equipment, packaging, polystyrene boxes and other types of consumables and equipment.

160. With regards to plastic pollution, the updated Regional Plan on Marine Litter Management calls for:

- a) Innovative business practices to prevent plastic waste generation in line with the Extended Producer Responsibility approach through the establishment of Deposit/Refund System for expandable polystyrene boxes in the commercial and recreational fishing and aquaculture sectors; and
- b) Prevention measures aiming to achieve, to the extent possible, a circular economy for plastics (Regulate the use of primary microplastics, Implement Sustainable Procurement Policies, Establish voluntary agreements, Establish procedures and manufacturing methodologies, Identify single-use plastic products, Set targets to phase out production and use, increase the reuse and recycling, Phase-out chemical additives used in plastic products, Promote the use of recycled plastics, substitute plastics, Implement standards for product labelling, Establish dedicated collection and recycling schemes, minimize the amount of marine litter associated with fishing/aquaculture, Scale-up and replicate sustainable models).

161. During the 21st Meeting of the Contracting Parties to the Barcelona Convention, Decision IG.24/14 was adopted. It provides a clear mandate for the development/update of technical guidelines addressing estimation techniques for pollutant releases from agriculture, catchments runoff and aquaculture in the Mediterranean. The proposed techniques and guidelines constitute effective tools that would enable the generation of compatible data to evaluate the effectiveness of adopted measures in the National Action Plans (NAPs) and in the Regional Plan for Aquaculture Management in the Mediterranean.

162. Shipping is particularly evident in the Mediterranean, thus contribution proportionally to waste and marine litter generation. Although most of the marine litter in the Mediterranean region originates from land-based sources, studies confirmed that ship-originated litter are found at sites under major shipping routes and lost fishing gear are also recognized as an important source of marine litter in the region (UNEP/MAP 2015).

163. While the international maritime organization IMO adopted in 1973 the International Convention for the Prevention of Pollution from Ships (MARPOL) which is the main international convention covering the prevention of pollution of the marine environment by ships from operational and accidental causes. The MARPOL convention under its Annex IV Prevention of pollution by sewage from ships present requirement to control the pollution of sewage into the sea.

164. MARPOL Annex V seeks to eliminate and reduce the amount of garbage being discharged into the sea from ships, which means all ships operating in the marine environment, from merchant ships to fixed or floating platforms to non-commercial ships like pleasure crafts and yachts must follow the same regulation.

165. The IMO's Marine Environment Protection Committee (MEPC) recently adopted its strategy to address marine plastic litter from ships with substantial actions to reduce marine plastic litter from, fishing vessels; shipping, and improve the effectiveness of port reception and facilities and treatment in reducing marine plastic litter. The strategy also aims to achieve further outcomes, including enhanced public awareness, education and seafarer training; improved understanding of the contribution of ships to marine plastic litter; improve the understanding of the regulatory framework associated with marine plastic litter from ships; strengthened international cooperation; targeted technical cooperation and capacity-building.

166. Under the Mediterranean Strategy for the Prevention of, Preparedness, and Response to Marine Pollution from Ships (2022-2031) in its common strategy also addresses the prevention and reduction of litter, in particular plastics entering the marine environment from ships through the fully implementation of the IMO Action Plan and the UNEP/MAP updated Regional Plan on Marine Litter Management in the Mediterranean.

167. Through the updated Regional Plan on Marine Litter Management in the Mediterranean, the Contracting Parties of the Barcelona Convention have set measures and a timetable to be implemented in relation to sea-based sources of marine litter, especially related to the establishment of best practices to create incentives for fishing vessels to retrieve derelict fishing gear, collect other items of marine litter, and deliver it to port reception facilities. It also presents incentives to the delivering of waste in port reception facilities such as the non-special fee system.

168. Under the Prevention and Emergency Protocol of the Barcelona Convention in its article 14 relevant to the provision of adequate Port Reception Facilities, the Contracting Parties to the Barcelona Convention are invited to explore ways to charge reasonable costs for the use of Port facilities.

169. When facing plastic pollution at large, the following measures or aspects can be also considered:

- a) Introducing a number of prevention elements/measures at regional, sub-regional and national levels, having a focus to minimize the production, use and consumption of plastics (especially of single-use plastics), as well as to minimize their leakage into the marine and coastal environment (so, before the introduction of effect/impact);
- b) Revising of the current legal framework of the Mediterranean Countries at the National level (e.g., updated/new National Action Plans and/or Programmes of Measures) and development of data base on the production and consumption of plastic products at the national level;
- c) Development of compulsory, legally binding EPR systems for priority products (e.g., food and beverage packaging);
- d) Progressive minimum recycled content in priority products;
- e) Reduction targets in production and consumption of virgin plastic feedstock;
- f) Promote behavioral change for achieving sustainable consumption patterns and increase rates of separation, collection, and recycling;
- g) Develop mandatory requirements with the industry with a focus on specific, priority single-use plastic items (e.g., information on the composition of plastics on the market and even standards to ease the recycling of certain single-use plastic products);
- h) Strengthen the acceptance criteria of the plastics for admission to the organized landfill, facilitating the recycling, reducing plastic disposal at organized landfills, and soliciting and promoting the separation, and recycling at sub-national level (i.e., municipalities, cities, or agglomerations);
- i) Minimize the introduction of incentivized interventions, and rather focus on structural changes at governance/national administration, industry, and society levels.

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