UNITED NATIONS

EP

UNEP/MED WG.492/13

UNITED NATIONS
ENVIRONMENT PROGRAMME
MEDITERRANEAN ACTION PLAN

26 March 2021
Original: English

Meeting of the Ecosystem Approach Correspondence Group on Pollution Monitoring

Videoconference, 26-28 April 2021

Agenda item 6: Cross-Cutting Issues - The Integration and Aggregation Rules and Assessment Criteria for IMAP Ecological Objectives 5, 9 and 10

Integration and Aggregation Rules for Monitoring and Assessment of (IMAP Pollution and Marine Litter Cluster)

Note by the Secretariat

In line with the Programme of Work 2020-2021 adopted by COP21 (Naples, Italy, December 2019), the MED POL Programme has prepared a Proposal of Integration and Aggregation Rules for Monitoring and Assessment of National Data for IMAP Pollution and Marine Litter Cluster. The preparation and possible agreement on integration and aggregation rules for monitoring and assessment represents an important milestone of the 2023 MED QSR Roadmap implementation (Decision IG.24/4 of COP21).

With the view to delivering this task, an in-depth analysis was undertaken of the current national monitoring and assessment practices of the Contracting Parties, along with other related best available knowledge and practices. The present document elaborates: 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 – based monitoring programmes, considering also 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), considering also interrelation with the Coast & Hydrography (EO6, EO7) and Biodiversity (EO1) Clusters, therefore detailing the rules for integration of monitoring efforts within relevant monitoring units; 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 along with application of the assessment criteria and DPSIR approach within the nested scheme.

The present Proposal is submitted for consideration of the Meeting of the Ecosystem Approach Correspondence Group on Pollution Monitoring for its feedback and guidance on the next steps for its application, as appropriate. The Meeting is also expected to endorse its submission for consideration by the Meeting of MEDPOL Focal Points that will be held in May 2021.

Table of Contents

Annexes

List of Abbreviations / Acronyms

BAC	Background Assessment Concentration
BC	Background Concentration
CI	Common Indicator
CHASE	Chemical Status Assessment Tool
COP	Conference of the Parties
CORMON	Correspondence Group on Monitoring
CPs	Contracting Parties
EO	Ecological Objective
EU	European Union
GFCM	General Fishery Commission for the Mediterranean
GES	Good Environmental Status
HAB	Harmful Algae Blooms
HEAT	HELCOM Eutrophication Assessment Tool
HELCOM	Baltic Marine Environment Protection Commission - Helsinki Commission
HOLAS	Holistic Assessment of Ecosystem Health Status
ICZM	Integrated Coastal Zone Management in the Mediterranean
IMAP	Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria
MAP	Mediterranean Action Plan
MED POL	Programme for the Assessment and Control of Marine Pollution in the Mediterranean Sea
MED QSR	Mediterranean Quality Status Report
MSFD	Marine Strategy Framework Directive
MRU	Marine Reporting Unit
MSs	Member States
NEAT	Numeric GES assessment tool
OSPAR	Convention for the Protection of the Marine Environment for the North-East Atlantic
SPAs	Specially Protected Areas

1. Introduction

1. The Ecosystem Approach (EcAp) (Decision IG 17/6, COP 15; Decision IG 20/4, COP 17; Decision 21/3, COP 18) and IMAP programme (Decision IG.22/7; COP 19) define Good Environmental Status (GES) towards a healthy Mediterranean Sea and coasts, including a sustainable use of the marine resources. In line with the recommendations of the 2017 MED QSR (Decision 23/6, COP 20), the main elements of the ecosystem should be assessed in an integrated manner and closely linked to the effects of pressures from human activities.

2. In the present document: 'Rules for Integration of Monitoring Activities' refer to recommendations for realizing a monitoring scheme that takes into account the interrelationships of CIs and EOs. 'Rules of Integration of Assessments' refer to the principles that underlie meaningful assessments on appropriate scales of assessment. 'Rules for aggregation-integration of GES assessments' refer to the methods (i.e. numerical calculations) for combining data in order to produce findings on the status of a specific area of assessment.

3. The use of 'aggregation' and 'integration' in the concept of GES assessment methods has been introduced by Borja et al (2014)[1]. The term aggregation is used for the combination of comparable elements across temporal and spatial scales, indicators and criteria, within a descriptor. The term integration is used for the combination of different elements (e.g., across descriptors) to produce a single value of GES as a whole. Under this concept, which is also followed by the MSFD documents, integration is conceived only across descriptors and in the ecosystem space as a whole.

4. For the purposes of IMAP implementation, there is a need of defining the temporal and spatial scales of the assessments. In relation to the scales of assessment for EO5 and EO9, the Meeting of CorMon on Pollution Monitoring, held on 2-3 April 2019, in Podgorica, Montenegro, has pointed out that the scales of monitoring should be considered along with the scales of assessment as a condition to define the "adequate" nested approach of the monitoring units into assessment scales[2]. The nested approach 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.

5. Within a nested approach, the two types of scales (i.e. scales of monitoring and scales of assessment) are interrelated, however a clear description of them should be made for a better comprehension of this interrelationship. The scales or units of monitoring refer to the physical spatiotemporal space where the observations are made (or samples taken) i.e. the points in time and space which are monitored. Monitoring scales are usually defined upon significance of the environmental parameters that are monitored, the expected variability and the types of pressures posed on a particular area/habitat. The parameters monitored within a specific monitoring unit may reflect the environmental conditions/impacts/extent of impacts of the monitoring unit itself or the environmental conditions/ impacts/ extent of impacts of a larger unit. For example, at a coastal monitoring unit, enterococci in bathing waters reflect the environmental conditions of the monitored unit, while observations of stranded entangled animals on a beach do not reflect the environmental conditions of the coastal monitored unit, but rather of a greater area. In that sense the information retrieved from monitoring data (i.e. assessment findings) may correspond or may be interpreted to different spatial scales from those the monitoring takes place. So, the scales of monitoring may differ from the scales of assessment and this depends on the ecological significance of the parameters/elements/Common Indicators (CI) monitored.

6. Within implementation of IMAP, the Contracting Parties to Barcelona Convention (CPs) are obliged to report the data produced in a specific format, as defined in IMAP Data Dictionaries (DDs) and Data Standards (DSs)[3], that allows for the assessment of state or impact for a spatial unit and subsequently for GES for the Mediterranean Sea as a whole. For each group of parameters, the areas are defined where monitoring takes place; these are the monitoring units. From the monitoring units the areas of assessment can be then defined by applying relevant criteria, e.g. representativeness/importance of the areas of monitoring for establishing

[1] Borja A., Prins T.C., Simboura N., Andersen J.H., Berg T., Marques J.-C., Neto J.M., Papadopoulou N., Reker J., Teixeira H. and Uusitalo L. (2014) Tales from a thousand and one ways to integrate marine ecosystem components when assessing the environmental status. *Front. Mar. Sci*., 1:7 2. doi: 10.3389/fmars.2014.00072.
[2] UNEP/MAP (2019). UNEP/MED WG.463/8. Approaches on Scales of Monitoring for Common Indicators related to pollution.
[3] UNEP/MAP (2019a). UNEP/MAP 467/9. Data Standards and Data Dictionaries for Common Indicators related to Pollution and Marine Litter

areas of assessment; presence of impacts of pressures in monitoring areas; sufficiency of quality assured data for establishing the areas of assessment covering as many as possible IMAP Common Indicators to the extent possible, and ensuring that adequate consideration is given to the risk based principle (both in pristine areas and areas under pressure). Taking into consideration these criteria may not necessarily lead to the assessment areas compatible with the national/local administrative geographical divisions.

7. The harmonization of the scales approach between the CPs is the starting point for the integration process i.e. to scale up the marine assessment to sub-regional and regional scales as required under IMAP. In order to support harmonization, there is a need to define Integration Rules for Monitoring Activities, which refer to a set of guidelines[4] that should be followed when implementing monitoring programmes, in order to produce coherent data sets that will facilitate the subsequent process of nested GES assessments. The harmonized application of the nested approach requires also defining Integration Rules for Assessments. Given the differences among the EOs, these rules can be better defined on the IMAP Cluster level taking into consideration the interrelationships of CIs within the same and across other clusters of the IMAP. Interrelationships between the IMAP Ecological Objectives respectively the IMAP Common Indicators and status of the ecosystem elements and impacts of pressures are important to ensure the integrated assessment of GES.

8. The final step for an ecosystem-based integrated approach is to determine and assess GES based on the data derived from the monitoring programmes. Due to the complexity of the marine ecosystems one single value will never appropriately reflect the physical, chemical, biological and societal aspects that need to be combined, yet it is useful for the development of the management plans and policies. For this purpose, various aggregation approaches and methodologies for GES assessment have been developed. These refer to the methods (i.e. numeric calculations) applied in order to combine measured parameters/elements of specific IMAP CIs within EOs and then across EOs to eventually result in an assessment of GES for a specific area of assessment. The methods need to be easy to communicate to managers and policy makers without oversimplifying the information. Care should be taken that information is not lost/obscured/masked during the aggregation/integration process and all the steps can be clearly tracked. This is particularly important for targeting policy measures. In addition, it is advisable that the assessment method can provide the degree of uncertainty for a particular assessment. Uncertainty of assessments is related to the disproportional information regarding monitoring data obtained per CIs/EOs and/or spatial coverage.

2. Comparative analysis of national IMAPs regarding implementation of EO5, EO9 and EO10

9. A fundamental step of IMAP implementation was setting up a new generation of national monitoring programmes aligned with IMAP during a period 2018-2019. The national monitoring networks for IMAP Pollution and Marine Litter Cluster were established by applying IMAP requirements and considering the knowledge and practices obtained over 40 years of MED POL monitoring implementation by the CPs.

10. The findings provided in present document resulted from the analysis of national IMAP – based monitoring programmes of Algeria, Bosnia and Herzegovina, Egypt, Israel, Lebanon, Libya, Montenegro, Morocco and Tunisia prepared with assistance of UNEP/MAP including under EU funded ECAP MED II Project and GEF Adriatic Project during period 2018-2019, as well as monitoring programmes prepared by the Contracting Parties that are EU Member States within 1st cycle of MSFD implementation. The most important findings are elaborated here-below in the context of applying integration and aggregation rules, whilst relevant details are provided in UNEP/MED WG.492/Inf.9 submitted for information of present Meeting. This information document also includes a detailed analysis report on the compatibility with the IMAP requirements of updated monitoring programmes related to contaminants, marine litter and eutrophication prepared in line with the Marine Strategy Framework Directive (MSFD).

a) National IMAP-based monitoring programmes of the Contracting Parties

11. The MED POL IV pollution monitoring programmes concerning eutrophication and contaminants, that correspond to IMAP EO5 and EO9, have been generally focused on narrow coastal areas, whilst monitoring

[4] To that effect Monitoring Guidelines/Protocols for IMAP CIs 13, 14, 17 and 20 have been discussed and agreed by the Integrated Meetings of CorMons organized 1-3 December 2020; whilst the Monitoring Guidelines/Protocols for IMAP CI 18, as well as for Analytical Quality Assurance and Reporting of Monitoring Data for IMAP Pollution related Common Indicators are submitted for consideration to present Meeting.

efforts under IMAP are extended to offshore areas including the three matrixes[5]. Collection of biota (e.g. bivalves, fish), sediment and water samples in offshore areas are challenging operations that require research/adequate vessels, heavy sampling equipment, detailed planning and additional financial resources. Reference, main coastal and hotspot stations as established within MED POL IV monitoring programmes in narrow coastal waters remain within new national IMAP-based monitoring programmes. Whilst number of sampling locations is reduced in narrow coastal strip, therefore also contributing to the cost effectiveness of monitoring efforts, the new monitoring areas and transects are established in offshore areas, in order to enlarge geographical scope of monitoring programmes, in accordance with IMAP requirements. The mutual alignment of the national IMAP-based monitoring programmes considers new spatial scales, as defined in relevant IMAP Guidance Fact Sheets[6], as well as a need to correlate pressures, status and impacts (ca. DPSIR framework). Spatial and temporal scales of monitoring related to IMAP Pollution and Marine Litter Cluster are also integrated with other relevant EOs, to the extent possible (see details provided in UNEP/MED WG.492/Inf.9), with the aim to support integrated and holistic assessment of the Good Environmental Status (GES) of marine environment.

12. With regards to the temporal scales for monitoring eutrophication and chemical pollutants, it must be noted that frequency of monitoring activities as defined relevant IMAP Guidance Fact Sheets (UNEP/MAP 2019 c), resulted in the balance of both program requirements and actual capabilities, after almost four decades of MED POL Programme implementation in the Mediterranean Sea by the CPs. In line with IMAP requirements, temporal scales for eutrophication respond to minimum seasonal episodes (i.e. spring and winter in the Mediterranean Sea), and yearly for chemical pollution.

13. The analysis of information on the CPs` national monitoring networks for IMAP Pollution and Marine Litter Cluster allows for detecting the commonalities and differences among them. All the new national networks of monitoring stations/areas are aligned with IMAP requirements. They are built to great extent on the relevant common criteria, as presented in UNEP/MED WG. 492/Inf.9, therefore significant differences among CPs were not observed.

14. Almost all countries have previous experience regarding EO5 and EO9 requirements through past national monitoring programmes prepared and implemented within MEDPOL IV. The requirements in monitoring the CIs of EO10 are new to all countries, with no previous or limited expertise or data exist. The spatial coverage of monitored stations is well designed allowing for full integration of EO5, EO9 and EO10. A detailed analysis of commonalities and differences among countries is provided in UNEP/MED WG. 492/Inf.9.

15. With regard to the current national IMAPs implementation, the CPs define data monitoring and reporting on the level of pollution, without always establishing links with the sources and causes, as well as direct and indirect effects. For example, for CIs17 and CI18 not all sub-indicators are measured or planned for measurement in systematic manner or in all relevant matrixes (biota and sediment) for CI17. In many cases it is not clear if levels of contaminants in commonly consumed seafood (CI20) are systematically measured (or planned for measurement) and if number of contaminants, which have exceeded maximum regulatory levels are occasionally detected and reported. The percentage of intestinal enterococci concentration (CI21) are generally measured in compliance with the standards, but increased discrepancies are observed regarding the temporal scales of monitoring. Trends in the amount of litter washed ashore and/or deposited on coastlines (CI22) and in the water column including microplastics and on the seafloor (CI23) are recent parameters and considerations for several Mediterranean countries are in the initialization stage.

16. Regarding time scales, most monitoring programmes considered appropriately the time frame and the risk-based approach, and high-pressure areas and sensitive areas are identified for monitoring as prioritized areas. However, it should be pointed out that the integration of risks is not fully ensured within all national monitoring programmes.

5 According to IMAP requirements, seawater is not included in the mandatory matrices to be analyzed in the framework of IMAP. At this stage of IMAP implementation, it is recommended that seawater monitoring is carried out on a country decision basis, including contaminants that countries consider more appropriate and technically feasible to be monitored, whilst seawater pollution is an issue of concern that might be introduced at later stage of the IMAP implementation.

6 UNEP/MAP (2019 c). UNEP/MAP WG.467/5. IMAP Guidance Factsheets: Update for Common Indicators 13, 14, 17, 18, 20 and 21; New proposal for Candidate Indicators 26 and 27.

17. Overall, it can be considered that eutrophication parameters, as well as the parameters relating to the concentration of heavy metals/organic compounds in surface sediments are currently monitored by the CPs at relatively acceptable level, whereas marine litter can be considered as a recently introduced set of monitoring parameters for IMAP. There is a very good compliance between the EO5-EO9 monitoring stations/areas in most cases and frequently but not as often as for EO5 and EO9, the EO10 monitoring sites are close to an area that is subject to pollution monitoring. The current national IMAP-based monitoring programmes do not specify how the integration/aggregation needed for assessing GES should be carried out.

b) Monitoring programmes of the Contracting Parties that are EU Member States

18. The EU MSs put great effort into adapting their established pollution monitoring programmes[7] related to Descriptors D5, D9 and D10 of relevance for IMAP EO5, EO9 and EO10 respectively, to the existing non-MSFD policy requirements within ongoing planning of the new monitoring programmes, including the emerging needs related to implementation of MSFD and IMAP. The present analysis relies mainly on the monitoring programmes of EU MSs that were established during the 1st cycle of MSFD implementation[8].

19. A comparison of the national MSFD monitoring programmes with IMAP requirements contributes to further synchronization of the policies, good practices and the innovative monitoring standards related to MSFD and IMAP implementation. Ultimately, this needs to result in development of cost-effective and accurate monitoring programmes with similar environmental objectives and geographical scales. To that effect the following key findings are presented here-below whilst a detail elaboration is provided in UNEP/MED WG.492/Inf.9:

i) MSFD monitoring programmes are structured according to the MSFD Descriptors, reflecting the different aspects of GES that need to be monitored, and therefore which data need to be generated for GES assessment. Each programme contains one or more subprogrammes structured around implementation of the monitoring efforts in relevant regions/sub-regions/sub-areas/sub-divisions, reflecting different data types and data collection methodologies.
ii) Overall national monitoring programmes for D5, D9 and D10 show a general consistency, since all of them have been elaborated considering the same principles stated in the MSFD and subsequent guidance documents. It can also be concluded that there is a good match between the descriptors, criteria and indicators and the Common Indicators of IMAP that should prevent duplication of monitoring efforts. However, it could be more useful if all the EU MSs` MSFD monitoring programmes explicitly refer to the Common Indicators of IMAP by providing their interrelation with the MSFD Descriptors in each sub-programmes.
iii) However, the monitoring efforts related to D5, D9 and D10 are heterogeneous regarding the percentage of the subprograms addressing each descriptor. To overcome this heterogeneity, a common list of elements to be monitored and the correspondent indicators should be agreed at the regional level, to ensure the feasibility of a regional GES assessment. To that effect IMAP of UNEP/MAP should be considered as the key framework for harmonization of national monitoring programmes.
iv) Regarding the areas of assessment defined within MSFD national/regional plans, it should be noted that the Commission Decision (EU) 2017/848 sets out the criteria and methodological standards to be used for assessing the extent to which Good Environmental Status (GES) is being achieved for the MSFD. The regions and subregions are specified in MSFD Article 4 of which a map was agreed by the MSFD Common Implementation Strategy (CIS) based on the definition of a marine region in MSFD Article 3(2), which states that they are 'determined taking into account hydrological, oceanographic and biogeographic features'. MSFD Article 4 also recognizes a need for defining the subdivisions to consider the specificities of a particular area to support implementation of the Directive. Following the 2012 reporting, discussions on assessment scales and areas within the MSFD CIS, particularly in the framework of the Working Group on Good Environmental Status (WG GES),

[7] Regarding EU MSFD implementation diagram providing information on defined monitoring programmes and sub-programmes for EU MSs is included in UNEP/MAP MED WG.492/Inf.9

[8] These monitoring programmes were available through EIONET hosted by the European Environment Agency. Given some EU MSs missed the 2014 reporting deadline and therefore present document also relies on information available in relevant EU or national projects (e.g. ACTIONMED, MEDCIS, MEDREGRION, etc.). Also, there was a delay with submission of updated monitoring programmes by some countries (due in October 2020) for the 2nd cycle of MSFD implementation (2018-2024) and therefore it was not possible to take them into consideration within present analysis.

have focused on a need for more coherent approach. This led to inclusion of the assessment scales in the 2017 GES Decision and progress towards more consistent approaches, including the coordinated systems used for HELCOM's HOLAS II and OSPAR's Intermediate Assessment 2017. Furthermore it should be mentioned that the NEAT tool is a further development of the HOLAS tool, as a structured, hierarchical tool for making marine status assessments (Berg et al., 2017; Borja et al., 2016), as explained in section 5.

v) In line with above all Mediterranean EU MSs have defined their Marine Reporting Units (MRUs), since reporting on Articles 8, 9 and 10 always needs to be linked to a specific Marine Reporting Unit, thereby linking the reported information to a specified part of each MS marine waters. The MRUs can be of varying sizes as indicated in the new GES Decision by the scales of assessment to be used. More details on presently defined MRUs, as well as spatial assessment units recognized within implementation of different projects is provided in UNEP/MED 492/Inf. 9.[9]

3. Defining the scales of assessment

20. In the region of Mediterranean Sea, four main areas (sub-regions) have been established for practical reasons and for the purpose of the UN Environment/MAP 2011 Initial Integrated Assessment[10] and the Med QSR 2017 assessment, namely: the Western Mediterranean Sea (including the Alborán Sea characterized by the exchange of the Mediterranean waters with the Atlantic Ocean), the Adriatic Sea (which is a double semi-enclosed area by itself), the Central Mediterranean (acting as the nexus for the eco-regions and located in the center of the basin with a low anthropogenic influence), and the Aegean and Levantine Seas in the Eastern Mediterranean part.

21. The sub-divisions (i.e. subareas/seas) for IMAP Pollution and ML Cluster have been initially identified according to availability of database sources for the purpose of development of the assessment criteria for pollution as provided in Table 1 of the Annex I [11]. Sub-divisions might initially further correspond to the CPs` coastal zones and offshore areas[12]. Other sub-divisions may be defined. This Mediterranean sub-regions and subareas aggregation initially follows the risk-based approach in a nested scheme as follows: (i) coastal waters; (ii) national subdivisions (within national borders); (iii) regional subdivisions; (iv) subregions; (v) Mediterranean Region.

22. The areas of assessment need to be built from the monitoring units by applying nested approach and can be fit-for-purpose according the general or specific objectives to be covered in relation to the environmental threat. Therefore, the analysis of the areas of monitoring is the first step to propose optimal integration of the areas of monitoring into areas of assessment. The monitoring areas, as defined in national IMAP Pollution - based monitoring progarmmes, provide a basis for proposing rules for integration of the areas of monitoring into areas of assessment, along with a consideration of the areas of assessment defined by the CPs within implementation of MSFD.

23. The harmonization of the scales approach between the Contracting Parties is the starting point to scale up the marine assessment to sub-regional and regional scales as required under IMAP. Despite the general agreement on the nested scales approach, the CPs are still required to agree on the common criteria and delimitation for the local/national areas for defining the areas of assessment. This may well vary between and within EOs, but pragmatic approaches are needed to allow assessment and management at all relevant levels.

24. The initial proposal of the scales of assessment for IMAP CIs, as agreed by the Meeting of CorMon on Pollution Monitoring organized in 2019 and the 7th Meeting of EcAp Coordination Group[13] is provided in Table 2, Annex I. In order to further elaborate the proposal for assignment to the most appropriate scales of assessment of elements to be assessed, the national parts of areas of assessment at sub-division level need to

[9] Since there have been considered topological problems (i.e. mainly overlaps and gaps) in the GIS data submitted by Member States in 2012, the resulting updated MRUs entities after checked for topological consistency whenever such discrepancies are resolved, should be upload into the CDR (Central Data Repository in EIONET).
[10] UNEP/MAP (2011). UNEP(DEPI)/MED WG.363/Inf.21. UNEP/MAP 2011 Initial Integrated Assessment
[11] UNEP/MAP (2016 a). UNEP(DEPI)/MED WG.427/Inf.3. Background to the Assessment Criteria for Hazardous Substances and Biological Markers in the Mediterranean Sea Basin and its Regional Scales these revised assessment criteria
[12]UNEP/MAP(2019). UNEP/MED WG.467/7. Cross-Cutting Issues and Common Challenges: The Methodological Approach for Mapping the Interrelations between Sectors, Activities, Pressures, Impacts and State of Marine Environment for EO5 and EO9.
[13] 7th Meeting of the Ecosystem Approach Coordination Group, Athens, Greece, 9 September 2019

be refined for the Parties that have recently prepared their national IMAP-based monitoring programmes, considering factors described above (eco-geographical features, existing pressures, monitoring programmes and administrative boundaries).

25. The question that arises is how to define the most appropriate spatial areas for assessments that will lead to ecologically meaningful assessments of the environmental status, by applying the nested approach. In practical terms, for defining finer scales of assessment for the national part of the sub-divisions, it is recommended, to prepare the geographical information in the form of GIS based layers including those providing the following elements: (i) existing pressures: offshore platforms, navigation routes, ports, WWTPs, coastal industries, desalination plants, aquaculture units; (ii) sensitive areas: Ramsar sites, Natura sites, MPAs, etc.; (iii) spatial distribution of monitoring stations respectively areas of monitoring, including information on stations` position and type (Coastal Master, Coastal Hotspot, Open Master, Coastal Reference and Open Reference stations), as provided in national IMAP Pollution-based monitoring programmes; (iv) national administrative units i.e. the national administrative units/divisions of marine waters. The information layers provided on the country level can then be coupled and superimposed to one another level in order to produce one common map.

26. In this way, the geographical limits of the assessment areas can be defined on the national level and directly nested to the appropriate sub-division and sub-region level. It is therefore recommended to initiate discussions on the types of information (i.e. GIS layers) to be agreed among the CPs.

27. The following criteria could be considered for coupling the geographical information to define the appropriate areas of assessment: i) application of the risk assessment approach in order to ensure optimal spatial distribution of monitoring stations for EO5, EO9 and EO10 in coastal and offshore waters; ii) the representativeness of the areas of monitoring respectively determining whether they represent areas of high or low risk; this is related both to the spatial and temporal scales; iii) the co-existence of monitoring stations with pressures and/or sensitive areas, given that the defined areas of assessment should allow for capturing impact and state in relation to the pressures; iv) sufficiency of quality assured data covering as many as possible IMAP Common Indicators to the extent possible that could be reported from monitoring stations established in given area of assessment in order to ensure reliable assessments; v) taking into account the administrative boundaries of the CPs, whilst being aware that these criteria may not necessarily lead to the assessment areas compatible with the national/local administrative geographical divisions.

28. After having defined the areas of assessment on the national level and according to the criteria described previously, the initial proposal of national parts of sub-divisions (coastal and off shore), as provided in Table 1, Annex I[14], needs to be further elaborated. Then, their integration (up-scaling) into subareas and seas or to sub-region level can be made possible depending on the needs of the assessments by applying the rules for integration of assessments within the nested scheme as elaborated in section 4.2 here-below.

29. Rules for integration of monitoring and assessment areas within IMAP Pollution and Marine Litter Cluster (EO5, EO9, EO10), considering also its interrelation with the Coast and Hydrography (EO6, EO7) and Biodiversity (EO1) Clusters

30. The rules or guidelines for integration of monitoring activities can be applied on each EO separately, or on each IMAP cluster or across clusters. In all cases the rules for establishing an integrated monitoring scheme aim to provide integrated assessments in a cost-effective way that is built on the interrelations of the EOs and CIs. Rules for establishing the integrated monitoring programmes are closely linked to those for integrated assessments. The interrelations of EOs and in particular the links between Pressure – Impact - State CIs of IMAP have been outlined in UNEP/MED WG.463/5 and UNEP/MED WG.467/7, as provided in Annex II of present document.

31. By taking account of this initial work, as well as the relevant best practices coming from the EU MSFD implementation and IMAP monitoring practices, including an initial proposal of the interrelations of CIs as provided in National IMAP-based monitoring programmes of Montenegro, the proposal of interrelations of IMAP CIs of EO5, EO9 and EO10, as well as their interrelations with EO1, EO7 and EO8 is provided here-below.

[14] As provided in UNEP/MED WG.463/8 and in Annex I of UNEP/MED WG.467/7

32. The rules for establishing interrelations of relevance for monitoring interconnections of CIs of EO5 and CIs of EO1, EO3, EO7, EO8, EO9 and EO10 are provided here-below in Table 1; the rules for establishing interrelations of relevance for monitoring interconnections of IMAP CIs of EO9 and CIs of EO1, EO3, EO5, EO7, EO8 and EO10 are provided in Table 2; and the rules for establishing interrelations of relevance for monitoring interconnections of IMAP CIs of EO10 and CIs of EO1, EO3, EO5, EO7, EO8 and EO9 are provided in Table 3. The practical application of proposed interrelations is further elaborated in UNEP/MED WG.492/Inf.9 submitted for information to present Meeting.

33. Furthermore such defined interrelations have been applied on national IMAP Pollution-based monitoring programmes /MSFD monitoring programmes in order to (i) map across the EOs the relations of the state - impact - pressure CIs and identify CIs indicative of same pressures i.e. pressures originating from common drivers/economic sectors and (ii) conclude at what level these interrelations have been applied in present IMAP monitoring practices. The results of the application of these rules within present National IMAP-based monitoring programmes /MSFD monitoring programmes is provided in UNEP/MAP MED WG 492/Inf.9 for each country, along with related comparative analysis among the countries.

Table 1. EO5 EUTROPHICATION: Interrelations of IMAP Common Indicators 13 and 14 of EO5 and IMAP Common Indicators of EO1, EO3, EO7, EO8 and EO9.

Ecological objective	Common Indicator	Interrelations with CIs 13 and 14 of EO5	Monitoring interconnections
EO1 Marine Habitats	CI1: Habitat distributional range (to also consider habitat extent as a relevant attribute) STATE	Excessive concentrations of nutrients and chlorophyll a may cause chemical and transparency change with consequent effects on habitat communities. The excessive nutrients concentrations may cause increased abundance of phytoplankton biomass (chlorophyll-a - CI14) and macroalgae, as well as proliferation of opportunistic and HAB species with consequent effects on habitat communities, for example phytoplankton blooms may reduce light availability for marine plants. PRESSURE, IMPACT	If possible, overlapping of EO5 stations is desired with the key locations of benthic habitats with plant species, preferably also within the MPA (as a reference station).
EO1 Marine Species	C2: Condition of the habitat's typical species and communities STATE		
EO3	CI7: Spawning stock Biomass STATE	Nutrients and chlorophyll a can possibly impact the spawning stock biomass through the changes in chemical conditions and transparency	
EO7	CI15: Location and extent of the habitats impacted directly by hydrographical alterations. IMPACT	An interrelation with monitoring of eutrophication can be expected since among others turbidity, which might be related to increased eutrophication, can play a crucial role in maintaining marine habitats PRESSURE	Basic hydrographic data should be collected and reported on all EO5 stations, such as temperature and salinity, to define the major coastal water types for eutrophication assessment.
EO8	CI16: Length of coastline subject to physical disturbance due to the influence of man-made structures. PRESSURE	Since eutrophication is related to urbanized areas due to nutrient increase (CI 13) through the anthropogenic (particularly non-treated or not appropriately treated) wastes Another interrelation is with EO8 - CI16 (as physical disturbance due to man-made structures can affect hydrographical characteristics as are turbidity, currents, release of nutrients) PRESSURE	The type of construction/infrastructure on the coastline is determined as part of EO8 monitoring. To some extent, it could contribute towards identifying type of pressure coming from human sources relevant for monitoring at EO5 stations. In addition, information coming from EO5 monitoring could complement EO8 monitoring.
EO9	CI17-CI20		Integration of sampling stations for EO5 and EO9 ensures cost-effectiveness.

Table 2. EO9 CONTAMINANTS: Interrelations of IMAP Common Indicators of EO9 and IMAP Common Indicators of EO1, EO5, EO7, EO8 and EO10.

Ecological objective	Common Indicator	Interrelations with CIs of EO9	Monitoring interconnections
EO1 Marine Habitats	CI2: Condition of the habitat's typical species and communities STATE	CI18: Biological effects It can be expected that ecotoxicological pollution has impacts on species. The unwanted effects include harm to organisms at lower levels of the food chain and a magnification of concentrations through food webs, resulting in higher concentrations and potential impacts at the top of the food chain. CI19: Biological effects from accidents/oil spills can have significant impacts on species CI20: Actual levels of contaminants in seafood IMPACT	The results of the EO9 monitoring could be taken into considerations to complement EO1 monitoring (in terms of identification of pressures); therefore, it should be recommended for selection of monitoring areas for EO9 to consider a distribution of marine habitats and species
EO1 Marine Species	CI3: Species distributional range CI5: Population demographic characteristics STATE		
EO3	CI7: Spawning stock biomass	CI20: Actual levels of contaminants in seafood IMPACT	Sampling for CI20 can be conducted along with CI7,
EO5	CI13, CI14 PRESSURE	CI17, CI21 PRESSURE	It is recommended to ensure Common sampling locations for EO5 and EO9 mainly due to cost- effectiveness of monitoring efforts.
EO7	CI15: Location and extent of the habitats impacted directly by hydrographical alterations. IMPACT	CI17, CI21 are directly linked to anthropogenic pressures such as coastal urban development, port facilities, dredging, dumping, mining, etc. PRESSURE	Basic hydrographic data should also be collected and reported on all EO9 stations, such as temperature and salinity. The areas/monitoring units for CIs 17, 21 are closely associated with those of CI15 following a need to apply the risk-based approach for defining the monitoring network.
EO8	CI16: Length of coastline subject to physical disturbance due to the influence of man-made structures. PRESSURE		The monitoring areas/stations for CIs 17, 21, are closely associated with those of CI16 following a need to apply the risk-based approach for defining the monitoring network.
EO10	CI22: Trends in the amount of litter washed ashore PRESSURE	CI21: Marine litter can carry pathogens PRESSURE	Overlapping of monitoring areas/units should be considered, as to allow recording of marine litter CI 22 parameters whilst monitoring of CI21 takes place, as appropriate and feasible
	CI23: Trends in the amount of litter in the water column including microplastics and on the seafloor CI24: Trends in amount of litter ingested PRESSURE, IMPACT	CI17, CI20: Marine litter, in the form of microplastics, can carry and release chemical contaminants into the marine environment or transfer them directly to marine organisms after ingestion. PRESSURE, IMPACT	Overlapping of monitoring areas/units should be considered, as to allow recording of marine litter CIs 23 and 24 parameters whilst monitoring of CIs 17 and 20 takes place, as appropriate and feasible

Table 3. EO10 MARINE LITTER: Interrelations of IMAP Common Indicators of EO10 CIs and IMAP Common Indicators of EO1, EO5, EO7, EO8 and EO9.

Ecological objective	Common Indicator	Interrelations with CIs of EO10 CIs	Monitoring interconnections
EO1 Marine Habitat	CI1: Habitat distributional range (to also consider habitat extent as a relevant attribute) CI2: Condition of the habitat's typical species and communities STATE	CI23: Litter on the sea bottom damages benthic species and can affect distribution of habitats. Information on type and amount of the marine litter is relevant for the assessment of pressures to the benthic habitats.	Data from EO1 monitoring could complement monitoring of sea floor marine litter. Also, results of the EO10 monitoring could complement EO1 monitoring. Overlap of monitoring areas/ units is required.

Ecological objective	Common Indicator	Interrelations with CIs of EO10 CIs	Monitoring interconnections
		PRESSURE	
EO1 Marine Species	CI3: Species distributional range. CI4: Population abundance of selected species CI5: Population demographic characteristics STATE	CI24: Marine litter could cause significant impacts to marine mammals, reptiles and marine birds, through ingestion and/ or entangling. The unwanted effects include harm to organisms at lower levels of the food chain and a magnification of concentrations through food webs, resulting in higher concentrations and potential impacts at the top of the food chain. IMPACT	
EO3	CI7: Spawning stock Biomass		In order to ensure cost-effectiveness, expeditions undertaken for EO3 monitoring could, at the same time, be used for EO10 (offshore seafloor and surface monitoring).
EO5	Whilst monitoring of CIs 13 and 14 takes place, recording of marine litter CIs parameters should be undertaken, as appropriate and feasible		
EO7	No interrelation - interconnection		
EO8	CI16: Length of coastline subject to physical disturbance due to the influence of man-made structures. PRESSURE	CI22: Trends of marine litter washed ashore. Directly linked to anthropogenic pressures such as coastal urban development, port facilities, dredging, dumping, mining, etc.. PRESSURE	The areas/monitoring units for CI22, are closely associated with those of CI16 following a need to apply the risk-based approach for defining the monitoring network
EO9	Whilst monitoring of CIs of EO9 takes place, recording of marine litter CIs parameters should be undertaken, as appropriate and feasible		

4.1 Rules for integration of monitoring efforts within relevant monitoring units

34. An analysis of available National IMAP Pollution-based monitoring programmes illustrates the homogenous coverage of the sampling areas/stations in the South and Eastern Mediterranean. It reveals high distribution of stations for the coastal waters. Despite a good coherence and comparability of the spatial coverage of the scales of monitoring, there are some proportionally small areas where information was not yet available from some CPs (i.e. Albania, Turkey and Syria). A summary of the analysis of present monitoring practices established by the CPs for EO5, EO9 and EO10 has been described previously in chapter 2, as well as in UNEP/MED WG.492/Inf.9 submitted to present Meeting.

35. With regards to the Contracting Parties which are EU member States(MEDCIS Deliverable D3.5 – Carbonell *et al*. 2018[15]), the majority of monitoring activities within MSFD are planned to be carried out within the coastal areas of marine demarcations, since 38% of monitoring subprograms will be carried out exclusively in transitional waters and within the first mile from coastline (WFD monitoring), and 19% of subprograms will cover also waters up to 12 miles offshore. This, besides 3% of monitoring special areas and 4% in terrestrial part of MSs, makes that monitoring subprograms covering offshore areas represent only 36% of total. A detailed analysis can be found in UNEP/MED WG.492/Inf.9 submitted to present Meeting.

36. Considering above presented spatial coverage of the monitoring areas, as explained above and having established the links and interrelationships of CIs within IMAP Pollution and Marine Litter Clusters, as well as across IMAP Pollution, Biodiversity and Coast & Hydrography Clusters (Tables 1, 2 and 3), the proposal for integration of monitoring areas/units for the respective CIs is defined in Table 4 below. The associations are made also in relation to the spatial scale and environmental matrix as defined within the IMAP Guidance Factsheets for eutrophication (EO5), contaminants (EO9) and marine litter (EO10). For the state indicators of EO1, the habitat type and specific species relevant to the data collected within the Pollution Cluster is noted.

[15] Carbonell, A., Rios, B., Torres, A. P., Deudero, S., Alemany, F., Bellas, J., Dall' Angelo, C., Campostrini, P., Klancnik, K., Gorjanc, S., Koren, S., Mavric, B., France, J., Pastres, R., Marcomini, A., Basset, A., Zeri, C., Dassenaki, M., Paramana, T., Streftaris, N., Giannoudi, L., and Pagou, K. (2018). 'Report on proposals for optimizing existing MSFD related monitoring plans in the Mediterranean, focusing on NIS and Marine litter. MEDCIS Project, Deliverable 3.5', December 2019, 87 p.

Further details related to the parameters measured and temporal scales for EO5 and EO9 can be found in UNEP/MED WG. 463/8, as well as in UNEP/MED WG.467/5[16].

Table 4. Monitoring units and environmental matrices interrelated for the CIs of EO5, EO9 and EO10, as well as for the EO1, EO7 and EO8

	Monitoring unit					
	Coastal waters			Offshore waters		
Pressure related CIs						
	water	sediment	biota	water	sediment	biota
EO5	13, 14[+]	13[**], 14	14[+]	13, 14[+]	13[**], 14	14[+]
EO9	19[*+], 21	17	20[+]	19[*+]	17	20[+]
EO10	23	22, 23	24[+]	23	23	24[+]
EO8	16 Length of coastline			-		
Impact related CIs						
	Biota			Biota		
EO5	14[+]			14[+]		
EO9	18, 19[*+], 20[+]			18, 19[*+], 20[+]		
EO10	24[+]			24[+]		
EO7	15			15[†]		
State related CIs						
EO1	1 Seabed habitats	2, 3, 5 Marine reptiles		1 Seabed habitats	2, 3, 5 Marine reptiles	

[*]Depending on the monitoring unit, the accident may happen in either coastal or offshore waters, so the monitoring unit for this CI cannot be fixed a priori

[**]Monitoring of nutrients is important for water sediment interface, including in offshore areas, especially where important estuaries exist

[+]Both pressure and impact CIs

[†] Related to offshore structures

4.2 Rules for integration of assessments within the nested approach

37. As stated in the introductory remarks of the present document, the areas of monitoring may not necessarily be identical to the areas of assessment depending on the specificities of the parameters monitored and their ecological relevance. Compatibility between pressure-impact and state assessments should also be ensured based on the interrelations of CIs and EOs. Further to methodology explained above for establishing the areas of assessment based on areas of monitoring, in order to produce an assessment at the regional or sub-regional level as IMAP requires, it is of outmost importance that the nesting of assessment areas has been agreed for IMAP. However, for the meaningful GES assessments within the nested scheme, the spatial assessment units need to be optimally considered when applying the assessment methods described below in chapter 5.

38. A distinction should be made between the CIs and EOs which are related to point sources and are monitored according to the risk-based approach (e.g. eutrophication), and those which provide information on both local and transboundary features of pollution (e.g. marine litter, or mobile species). During the process of integration of assessments into higher levels, the results for CIs and EOs related to point sources should be treated so as to hold a relative weight of significance within the assessment area. For example, eutrophication (EO5) is related to land-based inputs and the information/data collected in coastal monitoring units are indicative of the status for coastal waters only, while data collected in the offshore monitoring units are indicative of the offshore status. Assessments made on the subdivision level, or higher level (i.e. sub-regional/regional levels), should take into consideration that the results on coastal and on offshore trophic status cannot be integrated in the same way, i.e. do not have the same weight of significance, for the whole assessment area.

39. Another important criterium is the implementation stage of the IMAP monitoring activities among countries and the availability of monitoring data. For IMAP CIs 13, 14, 17, 18, a weighting factor and

[16] UNEP/MAP (2019 c). UNEP/MAP WG.467/5. IMAP Guidance Factsheets: Update for Common Indicators 13, 14, 17, 18, 20 and 21; New proposal for Candidate Indicators 26 and 27

integration of assessments up to the subdivision level is recommended. For CIs 19, 20, 23 (sea surface microplastics), and CI24, an integration up to either the subdivision or the subregion level is considered meaningful and a weight factor is not needed. For CI21 which is relevant to local conditions in coastal waters, the integration of this information beyond the national coastal waters part of the subdivisions is open for discussion. For CI22 beach litter and CI23 seabed litter assessments can be made by applying or not applying a weight factor depending on the policy needs and targets, while assessments are meaningful for both cases up to the subregion level. A very high level of integration on the subregion or even region level can be done, but it may mask the information on the lower levels and impact negatively the decision-making process.

40. The above findings are shaped in a tabular matrix of the nesting aggregation scheme for areas of assessment (Table 5). This proposal further refines the initial proposal for IMAP EOs 5, 9 and 10 as presented in Table 2 of Annex I and explained above in Chapter 3. It is also compatible to the MSFD implementation guidance. The colours in Table 5 correspond to the assessment levels. For the CIs which require a weighted approach within the assessment areas a further discrimination is made. The degree of recommendation for meaningful assessments per CI is shown by the "X" sign.

Table 5. Upgraded aggregation scheme for areas of assessment for EO5, EO9, EO10 within the nested approach.

			Mediterranean Region			
				Subregion (i)		
					Subdivision (i)	
					National part	
EOs		**CIs**			**National offshore waters**	**National coastal waters**
EO5		CI 13 Nutrients	X	X	XXX	XXX
		CI 14 Chlorophyll-a	X	X	XXX	XXX
EO9		CI 17 Key harmful contaminants	X	X	XXX	XXX
		CI 18 Pollution effects	X	X	XXX	XXX
		CI 19 Acute pollution events and their effects	X	XXX	XXX related to where the event happened	
		CI 20 Contaminants in seafood	XX	XXX according to FAO areas	XXX according to FAO areas	
		CI 21 Intestinal enterococci				XXX
EO10		CI 22 Beach litter	X	X	XXX	XXX
		CI 23 Litter at sea	XX	XXX seabed litter	XXX seabed litter	XXX seabed litter
			XX	XXX sea surface microplastics	XXX sea surface microplastics	
		CI24 Ingestion and entanglement	XX	XXX	XXX	

The colors correspond to the levels of assessment scales (Light blue: Region; Light green: Sub-region; Light purple: Sub-division; Dark purple: Sub-division weighted results).

Xs denote the degree of recommendation of spatial scale for the assessment of specific CIs within the IMAP programme (XXX: strong; XX: medium; X: weak).

41. For implementation of this updated nested aggregation scheme, there is a need to define the scales of assessment at national part of sub-division level. Further progress in that respect depends on submission of relevant spatial distribution maps of the monitoring and assessment areas as defined within implementation of national IMAP-based monitoring programmes, respectively MSFD monitoring strategies, following the methodology for coupling of relevant geographical information in the form of GIS-based layers and by applying suggested aggregation criteria, as explained above in chapter 3. To that end, the CPs need to make available the information presented here-below in Table 6.

Table 6. Tentative list of information needed for defining the national part of the sub-divisions within upgraded nested assessment scheme

A) The following information on the national level is indispensable for building areas of assessment from monitoring areas.

Type of information	**GIS layer** (indicate type of file)*	**Excel table** (Lat, Lon)**	**Other** (please specify, including relevant narrative methodological explanations)
monitoring stations/area at sea clearly defining the type of station (coastal, hot spot, offshore, reference)		**Y/N (yes or no)**	
area of assessment(s)***			
monitoring beaches			
bathing waters locations			
sensitive areas including MPAs and Natura sites			
Ports			
aquaculture units			
desalination plants			
operating offshore installations			
planned offshore installations			

* A shapefile with the locations of the stations in WGS84 projection system.
**Answers with YES or NO if position coordinates are available, in excel format, for each type of information (e.g. for stations, ports, desalination plants etc.) whereas longitude and latitude are provided in decimal degrees format (i.e. 23.45674 - 34.98765) with five digits. For each record a column needs to indicate the type of the station either in full name or in coding (Coastal Master, Coastal Hotspot, Open Master, Coastal Reference and Open Reference stations or CM; CH; OM; CR and OR)
*** For CPs which are EU Member States

B) Information related to distribution of stations in the respective sub-division(s) of the Mediterranean Region, according to the following example:

Country Name	**Sub-division (1)**	**Sub-division (2)**	**Sub-division (3)**
	Aegean Sea	Levantine Sea	Ionian Sea
Greece	40	4	25

4. Rules for aggregation – integration towards GES assessment

42. In cross-cutting document elaborated for IMAP Pollution and Marine Litter Cluster (UNEP/MAP 2019b)[17], several methodological approaches have been outlined to interrelate the CIs of EOs by applying DPSIR approach, as one of key elements of integrated GES assessments. They take into consideration the predominant pressures and their impacts on the marine and coastal environment to assess the state of the marine environment (i.e. DPSIR-based assessments) and as a consequence, policy responses (e.g. measures and priority actions) that can be built to address the drivers (e.g. economic sectors and activities) causing the degradation of the marine ecosystem and its ecosystem services. In present document these methodological approaches are taken into account and further complemented, especially those which have a semi-quantitative character, in an attempt to propose an integrated GES assessment scheme based on actual monitoring data for EO5, EO9 and EO10, and application of the criteria of assessment within aggregation of assessment findings at optimally nested scales of assessment.

[17] UNEP/MAP (2019b). UNEP/MED WG.463/7; UNEP/MED WG.467/7. Cross-Cutting Issues and Common Challenges: The Methodological Approach for Mapping the Interrelations between Sectors, Activities, Pressures, Impacts and State of Marine Environment for EO5 and EO9.

43. Namely, the following two types of methodological approaches were elaborated: i) those which provide interactions between pressures and impacts for EO5, EO9 and EO10 i. e. GRID/Table Approach and Scoreboards Method (Tables 1, 2, 3 in document UNEP/MAP WG.467/7), based on known pressures at source (economic driver) and are based on expert judgment, and ii) those which refer to GES assessment methods based on monitoring data i.e. NEAT Approach and UN regional Seas Programme Approaches (Chapters 2.3, 2.4 in document WG.467/7). There is a need to optimally interrelate/compare the two types of methodological approaches within the defined areas of assessment. In that respect the paragraphs 5.1 and 5.2 describe the most appropriate methods for GES assessment based on monitoring data by applying the assessment criteria, whilst paragraph 5.3 provides a proposal for comparison with Drivers and Pressures at source.

5.1 Assessment Criteria

44. The GES assessment follows specific methods (i.e. numeric calculations) which aggregate and integrate the monitoring data at the appropriate assessment scales, as explained above. The application of assessment methods however, requires 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. 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. Hg measured in 10 stations of coastal waters 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 MRU.

45. The explanation and definition of threshold values in the context of the IMAP process has been analyzed in UNEP/MAP (2019b)[18] related to cross-cutting issues. The threshold value for a parameter/element of IMAP CI is set so that it allows for an assessment of the quality level achieved for a particular CI or EO in relation to the degree of change from reference conditions. The thresholds for EOs 5, 9 and 10 are set on the CI level. For EOs 5 and 9, the thresholds are related to harmful/toxicological impact, and/or disruption of human activities (EO9/ CIs 20 and 21). For EO10 thresholds are related to both toxicological and physical damage. In the absence of information related to toxicological effects or damage, thresholds can be set based on baseline values.

46. Upgrading or setting the baselines and threshold values for the Mediterranean Sea in the context of IMAP is an ongoing process. Detail information on their present status is provided in UNEP/MED WG.492/11 and UNEP/MED WG.492/12, as well as UNEP/MED WG.492/Inf.9 that are submitted to present Meeting.

47. After setting/upgrading the threshold values, a decision rule is needed on how to assess GES on optimal spatial scale of assessment. As stated in UNEP/MAP (2019 b) 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.

5.2 Methodologies for Aggregation-Integration of CIs within and across EOs

48. This section describes methods that can be applied to aggregate CIs within EO5, EO9 and EO10 towards an assessment of GES for an assessment area. Different methodologies can be applied for aggregating CIs, which vary, amongst others, in the way the outliers influence the aggregated value. In all cases individual elements/parameters within a CI should be compared against ‘thresholds’ before aggregation methods are applied, as stated previously. 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.

[18] UNEP/MAP (2019b). UNEP/MED WG.463/7; UNEP/MED WG.467/7. Cross-Cutting Issues and Common Challenges: The Methodological Approach for Mapping the Interrelations between Sectors, Activities, Pressures, Impacts and State of Marine Environment for EO5 and EO9.

49. Aggregation methods should ensure that information within an EO is not lost so that progress towards GES as well as the effectiveness of measures can be followed (Caroni *et al*. 2013, Borja *et al*., 2014). 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.

50. 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. Needs and options are specific for the Ecological Objectives and Common Indicators. In UNEP/MAP (2019b), the most important features that need to be retained in the assessment outputs are outlined[19].

a) UNEP/MAP methodologies for assessment of the eutrophication and contaminants` status of the Mediterranean Sea as provided in 2017 MED QSR

51. The methodology for eutrophication assessment as provided in 2017 MED QSR, as well as for 2019 updated assessments of the eutrophication status of the Mediterranean Sea[20] is based on coastal water types (reference conditions) and boundaries for chlorophyll *a* in the Mediterranean Sea (i.e. CI14), as agreed in Decision 22/7 (COP 18). The methodology applied for assessment of the contaminants of the Mediterranean Sea in 2017 MED QSR, as well as for 2019 updated assessments, is aligned with the below approach of OSPAR. The methodology was based on the calculation of the percentages of stations (i.e. units) with levels are below or above the BACs and above environmental criteria (ca. ECs and ERLs); accordingly that were mapped for additional interpretations. Detail explanation on UNEP/MAP methodologies are provided in UNEP/MAP WG.492/Inf.9.

52. Present efforts are aimed at further advancement of these assessment methodologies in order to ensure i) interrelations between CIs of EO 5 respectively EO9, as well as with CIs of other EOs, including well established interrelations of impacts of pressures and state of marine environment; ii) application of integration and aggregation rules for an integrated GES assessment scheme based on actual monitoring data for EO5, EO9 and EO10; iii) application of the criteria of assessment within aggregation of assessment findings at optimally nested scales of assessment that are built from scales of monitoring by applying relevant methodological approach, as elaborated above; iv) quantitative expression of assessment findings against GES achievement in considered area of assessment.

b) The ICES/OSPAR approach for integrated assessment of contaminants

53. Like the approach followed in 2017 MED QSR, a multi-step aggregation scheme is used by ICES/OSPAR (Vethaak *et al*., 2015). It is based on a further aggregation and integration between CIs on the EO level and on spatial assessment scales. More details and an example are given in UNEP/MAP WG. 492/Inf.9 for the visualization of the 5-step aggregation scheme. This approach could be tested for EO10 as well.

c) The CHASE tool for Contaminants and HEAT tool for Eutrophication

54. The Chemical Status Assessment Tool (CHASE) and the HELCOM Eutrophication Assessment Tool (HEAT) have been specifically developed for the integrated assessment of the chemical and eutrophication status by the HELCOM as two of the components of the HOLAS ("Holistic Assessment of Ecosystem Health Status") tool. It has been applied by the Baltic States for the requirements of both the WFD and the MSFD. More details about the CHASE tool are given in UNEP/MAP WG. 492/Inf.9.

[19] Number or percentage of assessed elements failing/meeting threshold values/good status; Distinction between elements accessible to management and those that are not (e.g. banned legacy contaminants vs. contaminants in use);Distinction between matrices where this helps addressing management;Expression of distance to the threshold value/good status in order to provide an insight into the magnitude of the problem and an indication of progress between IMAP cycles. Options depend on the indicators and may include bar chart presentations of the assessment values against threshold, possibly normalized on a scale 0–1 or differentiated classification on both sides of the good/not good boundary.

[20] UNEP/MAP (2019d). (UNEP/MED WG.463/Inf.6). Updated Thematic Assessments of the Eutrophication and Contaminants Status in the Mediterranean Marine Environment, as a Contribution to the 2019 State of Environment and Development Report (SoED)

d) The NEAT tool

55. The NEAT tool is a further development of the HOLAS tool. NEAT is a structured, hierarchical tool for making marine status assessments (Berg *et al*., 2017; Borja *et al*., 2016), and freely available at www.devotes-project.eu/neat. NEAT was firstly developed to assess biodiversity status of marine waters under the MSFD and since then has been used to assess different ecosystem components and geographical areas. NEAT uses a combination of high-level integration of habitats and spatial units and an averaging approach, allowing for specification on structural and spatial levels, applicable to any geographical scale. The analysis provides an overall assessment for each case study area and a separate assessment for each of the ecosystem components included in the assessment. The final value has an associated uncertainty value, which is the probability of being determinative in a certain class status (GES/non-GES, See UNEP/MED 492/Inf.9) (Uusitalo *et al*., 2016).

56. Essentially, the final assessment value is calculated as a weighted average, where the final weights are combined with the observed indicator values. No special rules are applied, but the tool design allows assigning different aggregation rules at the various steps in the calculation of the overall assessment value. In order to assess the uncertainty in the final assessment value and thus the uncertainty of the indicator state classification, the standard error of every observed indicator value is used (Borja *et al*., 2016). In addition, the more data and indicators used the more robust are the outcomes.

57. During the EU funded MEDCIS project (www.medcis.eu) a main objective was to apply integrative methods to assess the environmental status, under the MSFD concept. Hence, the objective of this MEDCIS Deliverable D2.2 (Borja *et al.,* 2018) was to use NEAT at the Mediterranean level, to assess the environmental status in an integrative way, under the MSFD, demonstrating its usefulness under different circumstances (more or less indicators per area studied, more or less ecosystem components, etc.). It was shown that: (i) it is possible to integrate data from different sources, spatial and temporal scales and from different ecosystem components into a unique value; (ii) this integration has permitted to undertake a real Ecosystem Based Management (EBM) assessment; (iii) despite the integration there is not a loss in tracking the problems that should be addressed at the indicator, ecosystem component, descriptor or smaller spatial levels; (iv) this track of the problems is clearly related with the pressures identified and the pressure index used to validate the assessment undertaken using NEAT; (v) the assessment demonstrates also the temporal changes due to the management measures taken, showing the recovery of the system in respect to the time needed for each ecosystem component and area; and (vi) all of these findings and conclusions could be very useful for managers, policy makers and scientists when deciding the method to use in assessing and communicating the environmental status under the MSFD. A more detailed description of the NEAT tool can be found in UNEP/MAP WG. 492/Inf.9.

58. In line with above, the application of NEAT approach should be considered in the context of GES assessment based on IMAP EOs 5, 9 and 10.

4.3 Methodology for integration of assessment results within the DPSIR approach

59. In this chapter two approaches are described that aim to compare/connect the GES assessment results obtained by applying the methodology(ies) described previously, for a specific assessment area, with the known pressures/drivers already defined for this area by expert judgment.

a) The GRID/Table approach

60. Previous UNEP/MAP documents[21] on cross-cutting issues elaborated the methodological approach for mapping the interrelations between sectors, activities, pressures, impacts and state of marine environment for EO5 and EO9, including the GRID/Table approach that takes into account the geographical scales for the assessment to the sub-division level. It provides the links between the IMAP CIs to specific pressures, in a tabular form for representation, using a color scale for the intensity of pressure related to each of the CIs. The color scale is based on the known pressures at source, i.e. focusing on the primary activities generating the pressure. This information comes from cross-mapping of all the anthropogenic activities with significant

[21]UNEP/MAP (2019b). UNEP/MED WG.463/7; UNEP/MED WG.467/7. Cross-Cutting Issues and Common Challenges: The Methodological Approach for Mapping the Interrelations between Sectors, Activities, Pressures, Impacts and State of Marine Environment for EO5 and EO9.

contribution to pressures and assessment of the intensity of their impact on marine environment based on expert judgment.

61. The above approach, however, is not related to the assessment results of GES at sea, i.e. the level of pressure in the marine environment to which the different elements of the ecosystem are subjected. Therefore, the below Table 6 provides an update of the GRID/Table approach that was elaborated in previous UNEP/MAP documents and considered a starting point towards the Med QSR 2023. Namely, the results from the GES assessments for a specific spatial unit are included in the GRID/Table. The column 'Assessment Result' in the GRID/Table denotes the assessment status for each assessment area as provided by applying the methodologies explained in 5.2. The assessment result may be given according a quality status colour scale or scale of scores. By complementing the GRID/Table with assessment a direct comparison of the environmental status to the known pressures for a specific area can be made following the DSIR approach.

62. The comparison between the GES assessment results and the known pressures by expert judgment is expected to provide a better understanding of the actual impacts of pressures on the environmental status. If disagreement appears between status result and degree of pressure, then efforts should be concentrated in order to elucidate the causes. For example, a good GES result for Hg, Cd, Pb in areas where high degree of pressure is assigned by expert judgment, may be indicative either that the relevant sectors do not relate to these contaminants or that successful measures are undertaken. In this way corrective actions can be initiated towards a more effective monitoring scheme, while the effectiveness of measures can be checked.

Table 6. The GRID/Table combined with the GES assessment results.

Scaled GRID pressures/impact approach	**SUB-REGIONS**	**SUB-DIVISIONS**	**Country/ National Part**	**Assessment Result**	**Coastal urbanizati**	**Industry**	**Offshore structures**	**…..**
Common Indicator x	**Western Mediterranean Sea**	North Western (NWMS)	Coastal (1 nm)	**non-GES**				
			Territorial (12 nm)	**GES**				
		Alboran Sea (ALBS)	Coastal (1 nm)	**…**				
			Territorial (12 nm)	**..**				
		Tyrrhenian Sea (TYRS)	Coastal (1 nm)					
			Territorial (12 nm)					
	Adriatic Sea	North Adriatic (NADR)	Coastal (1 nm)					
			Territorial (12 nm)					
		Middle Adriatic (MADR)	Coastal (1 nm)					
			Territorial (12 nm)					
		South Adriatic (SADR)	Coastal (1 nm)					
			Territorial (12 nm)					
	Central and Ionian Sea	Centra l (CEN)	Coastal (1 nm)					
			Territorial (12 nm)					
		Ionian Sea (IONS)	Coastal (1 nm)					
			Territorial (12 nm)					
	Aegean and Levantine Seas	Aegean Sea (AEGS)	Coastal (1 nm)					
			Territorial (12 nm)					
		Levantine (LEVS)	Coastal (1 nm)					
			Territorial (12 nm)					

b) The Framework for Vulnerability Assessment

63. There are other several methodological approaches that may be used for mapping the distribution of pressures and assessment of their impacts over different ecosystem components (species groups, pelagic or benthic habitats), including application of defined quality threshold values (i.e. categorizations and values assignment). An example of such approach was piloted in Boka Kotorska Bay (Montenegro) through the CAMP initiative, under the guidance of UN Environment/MAP - PAP/RAC. It included interrelations between the IMAP Common Indicators, coastal vulnerability assessment and management measures, including Marine Spatial Planning (MSP). Further adjustment of the vulnerability assessment and mapping of distribution of

pressures and impacts over different ecosystem components, could be considered as to ensure use of this methodology in the context of GES assessment, as further explained in UNEP/MAP WG.492/Inf.9.

Annex I
The scales of assessment

Table 1. The Mediterranean sub-regions and subareas aggregation according the database sources and availability proposed within the report (UNEP(DEPI)/MED WG.427/Inf.3) and documents (UNEP/MED WG.463/8 and UNEP/MED WG.467/7).

Sub-regions	Sub-division (e.g. subareas/seas)
Western Mediterranean Sea (WMS)	Alboran Sea (ALBS) North Western Mediterranean Sea (NWMS) Tyrrhenian Sea (TYRS) Western Mediterranean Islands and Archipelago (WMIA)
Adriatic Sea (ADR)	North Adriatic (NADR) Middle Adriatic (MADR) South Adriatic (SADR)
Central Mediterranean (CEN)	Central Mediterranean (CEN) Ionian Sea (IONS)
Aegean and Levantine Seas (AEL)	Aegean Sea (AEGS) Levantine (LEVS)

Table 2. Proposed assessment scales for IMAP Common Indicators (after 2017 MED QSR and 2017 MEDCIS workshop) as provided in UNEP/MED WG.463/5; UNEP/MED WG.467/7

EOs	**Common Indicators**	**Region**	**Sub-region**	**Sub-division**	**National part of sub-division**	**Coastal waters**
EO1	CI 1 Distributional range	Diving whales deep sea fish	Birds, small cetaceans, turtles, demersal and pelagic fish	Coastal fish and benthic species		
	CI 2 Condition species	Biogeographically-relevant scales				
	CI 3 Species distribution	Biogeographically-relevant scales				
	CI 4 Population abundance	Diving whales	Small cetaceans, turtles, demersal & pelagic fish	Coastal fish and benthic species		
	CI 5 Population demography	Diving whales	Small cetaceans, turtles, demersal & pelagic fish Coastal fish and benthic species			
EO2	CI 6 Trends in NIS	XX	XX	XX		
EO3	CI 7 Spawning stock Biomass	Ecologically-relevant scales, based on GFCM areas				
	CI 8 Total landings					
	CI 9 Fishing Mortality	Ecologically-relevant scales, based on GFCM areas				
	CI 10 Fishing effort	Ecologically-relevant scales, based on GFCM areas				
	CI 11 CPUE/LPUE					
	CI 12 By-catch	Ecologically-relevant scales, based on GFCM areas				
EO5	CI 13Nutrients	X	X	X	XX	XXX
	CI 14 Chlorophyll-a					
EO7	CI 15 Habitats impacted			X	XX	XXX

EO8	CI 16 Erosion	X	X	XX	XXX	XXX
EO9	CI 17 Key harmful contaminants	X	X	XX	XXX	XXX
	CI 18 Pollution effects	X	X	XX	XXX	XXX
	CI 19 Acute pollution events	X	X	XX	XXX	XXX
	CI 20 Contaminants in seafood	FAO- GFCM areas	FAO- GFCM areas	Catch or Production Area		
	CI 21 Intestinal enterococci			X	X	XXX
	CI 22 Beached litter	Harmonized protocol				
EO10	CI 23 Litter at sea	Surface litter and microplastics				

Annex II
A framework for integrated GES assessment

A framework for integrated GES assessment, as provided in UNEP/MED WG.463/5; UNEP/MED WG.467/7, showing IMAP Common Indicators in relation to the predominant pressures. EOs/Cells in Orange concern pressures (P); IMAP Common Indicators in yellow concern impacts (I) and ecosystem elements in grey cells concern state. Some EOs are repeated, as they are applicable to several ecosystem elements (species groups, pelagic and benthic habitats). EOs for which Common Indicators are not defined (EO 6, 7 and 11) are not considered in the table. Cells marked with '?' indicate situations where an impact from the pressure is possible without any possible assessment.

ASSESSMENT OF GOOD ENVIRONMENTAL STATUS (GES)					Assessment of pressures				
					EO 2	EO 3	EO 5	EO 9	E0 10
					Nis	Extraction of wild species	Eutrophication	Contamination	Marine Litter
					Common Indicators of pressure				
					CI 6	CI 8, CI 10, CI 11	CI 3	CI 17, CI 19	CI 22, CI 23
Assessment of state	EO 1, EO 3	Species (birds, turtles, fish etc.)	State indCIators	CI 1 to 5, CI7, CI9	CI 3-5, C I7	CI 9, CI 12	?	CI 18, CI 20-21	CI 24
	EO 1, EO 3	Pelagic Habitats		CI 1 to 5, CI7, CI9	CI 3-5, C I7	CI 7, CI 9, CI 12	CI 14	CI 18, CI 20-21	CI 24
	EO 1, EO 3	benthic habitats		CI 1 to 5, CI7, CI9	CI 3-5, C I7	CI 7, CI 9, CI 12	CI 14	CI 18, CI 20-21	CI 24
	EO 1, 2, 3, 4	ecosystems		CI 1 to 5, CI7, CI9	CI 3-5, C I7	CI 7, CI 9, CI 12	CI 14	?	?

Annex III

References

UNEP/MAP (2020). UNEP/MED WG 482/28. Comparative analysis of MSFD and IMAP implementation

UNEP/MAP (2019). UNEP/MED WG.463/8. Approaches on Scales of Monitoring for Common Indicators related to pollution.

UNEP/MAP (2019a). UNEP/MAP 467/9. Data Standards and Data Dictionaries for Common Indicators related to Pollution and Marine Litter.

UNEP/MAP(2019b). UNEP/MED WG.463/7; UNEP/MED WG.467/7. Cross-Cutting Issues and Common Challenges: The Methodological Approach for Mapping the Interrelations between Sectors, Activities, Pressures, Impacts and State of Marine Environment for EO5 and EO9.

UNEP/MAP (2019 c). UNEP/MAP WG.467/5. IMAP Guidance Factsheets: Update for Common Indicators 13, 14, 17, 18, 20 and 21; New proposal for Candidate Indicators 26 and 27.

UNEP/MAP (2019 d). (UNEP/MED WG.463/Inf.6). Updated Thematic Assessments of the Eutrophication and Contaminants Status in the Mediterranean Marine Environment, as a Contribution to the 2019 State of Environment and Development Report (SoED)

UNEP/MAP (2018). National IMAP-based monitoring programmes of Algeria, Bosnia and Herzegovina, Egypt, Israel, Lebanon, Libya, Montenegro, Morocco and Tunisia.

UNEP/MAP (2016). Decision 22/7 on Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria" (COP18).

UNEP/MAP (2016a). UNEP(DEPI)/MED WG.427/Inf.3. Background to the Assessment Criteria for Hazardous Substances and Biological Markers in the Mediterranean Sea Basin and its Regional Scales these revised assessment criteria

UNEP/MAP (2015). UNEP(DEPI)/MED WG.420/Inf.10. Final Report of the Informal Online Working Group on Biodiversity and NIS; UNEP(DEPI)/MED WG.417/Inf.15. Report of the online groups on eutrophication, contaminants and marine litter

UNEP/MAP (2011). (UNEP(DEPI)/MED WG.363/Inf.21. UN Environment/MAP 2011 Initial Integrated Assessment.

Andersen, J. H., Murray, C., Larsen, M. M., Green, N., Høgåsen, T., Dahlgren, E., et al. (2016). Development and testing of a prototype tool for integrated assessment of chemical status in marine environments. *Environ. Monit. Assess.*, 188: 115. doi: 10.1007/s10661-016-5121-x.

Berg, T., Murray, C., Carstensen, J., and Andersen, J. H. (2017). NEAT – Nested Environmental Status Assessment Tool - Manual Version 1.3. DEVOTES project.

Borja A., Elliott M., Andersen J.H., Berg T., Carstensen J., Halpern B.S., Heiskanen A.-S., Korpinen S., Lowndes J.S.S., Martin G. and Rodriguez-Ezpeleta N. (2016) Overview of Integrative Assessment of Marine Systems: The Ecosystem Approach in Practice. *Front. Mar. Sci*., 3: 20. doi: 10.3389/fmars.2016.00020.

Borja A., Prins T.C., Simboura N., Andersen J.H., Berg T., Marques J.-C., Neto J.M., Papadopoulou N., Reker J., Teixeira H. and Uusitalo L. (2014) Tales from a thousand and one ways to integrate marine ecosystem components when assessing the environmental status. *Front. Mar. Sci*., 1:7 2. doi: 10.3389/fmars.2014.00072

Borja, A., J.M. Garmendia, I. Menchaca, Y. Sagarmínaga, A. Uriarte, A. Pavlidou, N. Simboura, Ch. Zeri, S. Gorjanc, Š. Koren, K. Klančnik, J. Francé, B. Mavrič, M. Orlando-Bonaca, F. Galgani (2018). An assessment of the environmental status of the Mediterranean. MEDCIS Project, DELIVERABLE D2.2, December 2018, 34 p.

Carbonell, A., Rios, B., Torres, A. P., Deudero, S., Alemany, F., Bellas, J., Dall' Angelo, C., Campostrini, P., Klancnik, K., Gorjanc, S., Koren, S., Mavric, B., France, J., Pastres, R., Marcomini, A., Basset, A., Zeri, C., Dassenaki, M., Paramana, T., Streftaris, N., Giannoudi, L., and Pagou, K. (2018). 'Report on proposals for optimizing existing MSFD related monitoring plans in the Mediterranean, focusing on NIS and Marine litter.

MEDCIS Project, Deliverable 3.5', December 2019, 87 p.

Caroni, R., W. Bund, R.T. Clarke and R.K. Johnson (2013). Combination of multiple biological quality elements into waterbody assessment of surface waters. *Hydrobiologia*, 704: 437-451.

Martínez-Gomez, C., Fernandez, B., Robinson, C.D., Campillo, J., Leon, V.M., Benedicto, J., Hylland, K., Vethaak, A.D. (2015). Assessing the good environmental status (GES) of the Cartagena coastal zone (W Mediterranean) using an integrated framework of chemical and biological effect data: a practical case study. *Marine Environ. Res*. http://dx.doi.org/10.1016/j.marenvres.2016.04.008

Nemati, H., Shokri, M.R., Ramezanpour, Z., Ebrahimi Pour, G.H., Muxika, I., Borja, Á. (2017). Using multiple indicators to assess the environmental status in impacted and non-impacted bathing waters in the Iranian Caspian Sea. *Ecol. Ind.*, 82: 175–182.

Nemati, H., Shokri, M.R., Ramezanpour, Z., Ebrahimi Pour, G.H., Muxika, I., Borja, Á. (). Sensitivity of indicators matters when using aggregation methods to assess marine environmental status. *Mar. Pollut. Bull*., 128: 234–239.

Pavlidou, A., Simboura, N., Rousselaki, E., Tsapakis, M., Pagou, K., Drakopoulou, P., Assimakopoulou, G., Kontoyiannis, H., Panayotidis, P. (2015). Methods of eutrophication assessment in the context of the water framework directive: Examples from the Eastern Mediterranean coastal areas. *Cont. Shelf Res*., 108, 156–168.

Pavlidou A., Simboura N., Pagou K., Assimakopoulou G., Gerakaris V., Hatzianestis I., Panayotidis P., Pantazi M., Papadopoulou N., Reizopoulou S., Smith C., Triantaphyllou M., Uyarra M.C., Varkitzi I., Vassilopoulou V., Zeri Ch., Borja A. (2019). Using a holistic ecosystem-integrated approach to assess the environmental status of Saronikos Gulf, Eastern Mediterranean. *Ecological Indicators*, 96: 336–350.

Simboura, A., Pavlidou, J., Bald, M., Tsapakis, K., Pagou, Ch., Zeri, A., Androni and P. Panayotidis. (2016). Response of ecological indices to nutrient and chemical contaminant stress factors in eastern Mediterranean coastal waters. *Ecol. Ind*., 70: 89–105.

SWD 62 final (2020) COMMISSION STAFF WORKING DOCUMENT Background document for the Marine Strategy Framework Directive on the determination of good environmental status and its links to assessments and the setting of environmental targets Accompanying the Report from the Commission to the European Parliament and the Council on the implementation of the Marine Strategy Framework Directive (Directive 2008/56/EC).

Teixeira, H., Berg, T., Uusitalo, L., Fürhaupter, K., Heiskanen, A.-S., Mazik, K., Lynam, C., Neville, S., Rodriguez, J.G., Papadopoulou, N., Moncheva, S., Churilova, T., Krivenko, O., Krause-Jensen, D., Zaiko, A., Verissimo, H., Pantazi, M., Carvalho, S., Patrício, J., Uyarra, M.C., Borja, A. (2016). A catalogue of marine biodiversity indicators. *Front. Mar. Sci.*, 3. https://doi.org/10.3389/fmars.2016.00207.

Uusitalo, L., Blanchet, H., Andersen, J., Beauchard, O., Berg, T., Bianchelli, S., *et al*. (2016). Indicator-based assessment of marine biological diversity –lessons from 10 case studies across the European Seas. *Front. Mar. Sci*., 3: 159.doi: 10.3389/fmars.2016.00159

Vethaak, A.D., Davies, I.M., Thain, J.E., Gubbins, M.J., Martínez-Gomez, C., Robinson, C., Moffat, C.F., Burgeot, T., Maes, T., Wosniok, W., Giltrap, M., Lang, T., Hylland, K. (2015). Integrated indicator framework and methodology for monitoring and assessment of hazardous substances and their effects in the marine environment. *Marine Environmental Research*, 124: 11-20.