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Meeting of the Ecosystem Approach Correspondence Group on Monitoring (CORMON) on Coast and Hydrography

Rome, Italy; 21-22 May 2019

Agenda item 6: Cross-cutting issues and common challenges

The Methodological Approach for Mapping the Interrelations between Sectors, Activities, Pressures, Impacts and State of Marine Environment (with the focus on EO5 and EO9).

Note by the Secretariat

At their 19th Ordinary Meeting (COP 19, Athens, Greece, 9-12 February 2016), the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention) adopted a novel and ambitious Integrated Monitoring and Assessment Programme and related Assessment Criteria (IMAP).

The IMAP foresees in its initial phase (2016-2019) of implementation, the following:

- Existing national monitoring and assessment programmes of Contracting Parties to be updated and integrated, in line with the IMAP structure, principles and common indicators;
- Good environmental status (GES) definitions to be updated and the assessment criteria to be further refined;
- Scale of reporting units to be defined, taking into account both ecological considerations and management purposes, following a nested approach;
- An updated and integrated data and information system for UN Environment/Mediterranean Action Plan (MAP)-Barcelona Convention with clearly set roles for data handling and assessment for the various components and with a user-friendly reporting platform for Contracting Parties to be developed.

At the 20th Ordinary Meeting (COP20, Tirana, Albania, 17-20 December 2017), the Contracting Parties endorsed in Decision IG.23/6 the key findings of the 2017 MED QSR (the QSR Decision); underlined the gaps of the 2017 MED QSR; and requested the Secretariat to make all possible efforts to overcome them. The Contracting Parties recommended as general directions towards a successful 2023 Mediterranean Quality Status Report (2023 MED QSR): (i) harmonization and standardization of monitoring and assessment methods; (ii) improvement and ensuring availability of long time series of quality assured data to monitor the trends in the status of the marine environment; (iii) improvement of availability of synchronized datasets for marine environment state assessment, including use of data stored in other databases where some of the Mediterranean countries regularly contribute; and (iv) improvement of data accessibility with the view to improving knowledge on the Mediterranean marine environment, ensuring that Info-MAP System is operational and continuously upgraded to accommodate data submissions for all the IMAP Common Indicators.

The Regional Meeting on IMAP Implementation: Best Practices, Gaps and Common Challenges (IMAP Best Practices Meeting, Rome, Italy, 10-12 July 2018) welcomed the work undertaken by the Secretariat and MAP Components to support the implementation of IMAP at regional, sub-regional and national levels, including several cross-cutting issues, as provided in UNEP/MED WG. 450/3. The Meeting further requested the Secretariat to present the following issues for review and more in-depth discussion in the upcoming CORMONs:

- Better interlinkages between activities/pressure/impacts and clarification of definition of impacts noting that such a definition should primarily focus on biodiversity.
- Update, based on feedback and inputs received during the Meeting, of Tables 1, 2 and 3 of document UNEP/MED WG.450/3 for further review by the CORMONs; and
- Clarifications of definitions of integration and aggregation rules opting for giving the priority at this stage of IMAP implementation to the work on geographical aggregation and assessment scaling rather than integration.

In this context, MED POL further elaborated the document UNEP/MED WG.450/3 for consideration of the Meeting of CORMON on Pollution that was held in Podgorica, Montenegro, 3-5 April 2019 with a particular focus on:

a) Section 2 related to the methodological approaches;
b) A semi-quantitative "Scoreboards" method has been introduced with a simplified example to support mapping the interrelation of drivers-pressures-impacts-state-responses in line with DPSIR approach;
c) The UN Regional Seas Programme approaches to integration and aggregation have been included as one of possible approaches;
d) Sections 3 and 4 related to assessment scales and options for the definition of thresholds have been revised and simplified (Tables 5, 6 and 7 have been revised for EO5 and EO9).

Thereafter, further elaboration of the document UNEP/MED WG.463/5, considered at the Meeting of CORMON on Pollution Monitoring, was provided in present document[1] in line with the conclusions of this meeting which:

a. Appreciated the work undertaken by the Secretariat to advance the cross-cutting issues which were presented at the Regional Best Practices Meeting (Rome, Italy, 10-12 July 2018);
b. Acknowledged the methodologies proposed for GES-integrated assessment based on DPSIR approach and approved them in principle;
c. Recommended their testing by the Contracting Parties with the view to present related main findings to the next meeting of CorMon on Pollution Monitoring;
d. Recommended to complement these methodologies with the modelling of monitoring data in order to ensure a more reliable quantification of the magnitude of impacts (i.e. scientifically-based scoring);
e. Requested the Secretariat to present these methodologies to the forthcoming Meeting of the MED POL Focal Points in May 2019.
f. Recommended to continue the application of both trends and new/updated thresholds as appropriate tools for GES assessment, whilst both options should complement each other.

[1] All changes made and revisions introduced **are marked in bold and strikethrough** for easy of reference

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Annexes

1. OVERVIEW OF CROSS-CUTTING ISSUES AND COMMON CHALLENGES OF IMAP IMPLEMENTATION

1. IMAP describes the strategy, themes, and products that the Contracting Parties are aiming to deliver, through collaborative efforts in the framework of the UN Environment/MAP - Barcelona Convention, during the second cycle of the implementation of the Ecosystem Approach Process in 2016-2021. IMAP Decision IG.22/7 provides, during the initial phase of IMAP implementation (2016 -2019), for the review and revision, as appropriate, of the national monitoring and assessment programmes in order to integrate IMAP provisions; the update of GES definitions; as well as the further refinement of assessment criteria.

2. Based on common region-wide agreed Common Indicators (CIs) per Ecological Objectives (EOs), the underlying aim of IMAP is to monitor and assess the status of the marine and coastal environment towards the achievement of Good Environmental Status (GES) of the Mediterranean Sea and Coast. The determination of GES and the assessment on its achievement includes the main elements of the ecosystem and is closely linked to the effects of pressures from human activities (e.g. pressure-based ecological objectives). The evaluation of all IMAP EOs and its consideration as functional units of the marine ecosystem as a whole should allow the definition and assessment of achievement of GES.

3. Further work is required on a number of issues including (i) the harmonization of monitoring and assessment methods; (ii) the definition of links between assessment scales, pressures and cumulative impacts on ecosystem components; (iii) the improvement of long time series of quality assured data to monitor the trends; and (iv) the improvement of data management and data accessibility through the MAP Info-System for all the IMAP Common Indicators (CIs). However, there is a need to address these issues in more detail for the period (2019-2021), and to this respect, criteria for assessments, reference and limit levels (baselines, thresholds, etc.), aggregation rules for the CIs and EOs, assessment scales (spatial/temporal), as well as continuous review of work progresses are considered critical to ensure an effective implementation of IMAP.

1.1. From 2017 Mediterranean QSR towards 2023 Mediterranean QSR: A more integrated approach for GES assessment

4. As indicated above, based on the 2017 MED QSR, the IMAP Guidance (UNEP(DEPI)/MED IG.22/Inf.7) and other UN Environment/MAP documents, as well as findings from ongoing projects and other relevant work, the following issues should be considered as a priority to improve GES assessment:

- Assessment of pressures/impacts/state interactions identifying, where possible, cause-effect relationships;
- Definition of clear and common aggregation (geographical) and integration rules, including in time and space;
- Definition of adequate assessment scales using a nested approach;
- Application of both trends and new/updated IMAP thresholds as appropriate tools for GES assessment.

5. There is a need to ensure better integration and interaction of pressures, impacts and state elements in assessing GES and the interrelation to the extent possible among different relevant Ecological Objectives of the coastal and marine environment in the Mediterranean Sea.

6. Here, the terms pressure is defined as the forces that generate changes in the state of the ecosystem as a result of drivers and thereby the provision of its services (e.g. nutrient load, changes in the salinity regime, fishing effort, oil spills, introduction of invasive species). Impacts are defined as the consequences for the marine environment caused by the pressures affecting state.

7. Transboundary issues should be also considered, since GES achievement in one Contracting Party may be dependent on actions taken by other Contracting Parties within the region or sub-region, due to different interactions, especially regarding anthropogenic pressures that may have transboundary effects. In this respect, based on existing assessment best practices, a two-step process for assessments may be recommended:

- First, an assessment of the predominant pressures and their impacts on the marine environment, including a mapping of the uses and activities in the marine environment, when appropriate.
- Second, an assessment of the environmental status of marine ecosystems (including species and habitats), informed by the pressure and impact assessments under the first step (e.g. Scorecards).

2. METHODOLOGICAL APPROACHES FOR INTEGRATED MARINE ASSESSMENTS

8. There are some approaches to support the integrated assessment under IMAP of the predominant pressures and their impacts on the marine and coastal environment to assess the state of the marine environment (i.e. DPSIR-based assessments); and as a consequence, build policy responses (e.g. measures and priority actions) to address the drivers (e.g. economic sectors and activities) causing the degradation of the marine ecosystem and its ecosystem services.

9. **The following subsections explain some of the most known and used GES-integrated assessment based on DPSIR approach that have been acknowledged and approved in principle by the Meeting of CorMon on Pollution Monitoring.**

2.1. GRID/Table approach

10. Pressures 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.

11. With its EOs and CIs, IMAP is the multidimensional measurement and assessment system of the Barcelona Convention within the application of the DPSIR approach. Therefore, the elaboration of a table with these two dimensions of the IMAP (i.e. by using the IMAP measurement information through Common Indicators cross-checked along their potential sources and origin) would produce an assessment which should allow elucidating priority actions for natural/anthropogenic drivers and related policy responses.

12. Table 1 provides a tabular representation of interactions between pressures and impacts for EO5 and EO9, as measured by IMAP Common Indicators (left column). A full example of the GRID/Table Approach for the overall interrelationships between the IMAP Common Indicators grouped per related Ecological Objectives (EO) and Pressures to the marine ecosystem can be found in Annex I.

13. Thus, the proposed approach is to cross-map all the anthropogenic activities with significant contribution to pressures with the Common Indicators used for its monitoring and assessment. Following the first step, expert judgment can/may better define/refine 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).

Table 2 is an example of pressure/impacts interactions at sub-regional level for key pressures, which is also considering sub-divisions.

14. Table 2 is an example of a GRID/Table template taking into account the relevant geographical scale (i.e. sub-regions and sub-divisions) and is expected to be the starting point to be completed to advance in a future integrated Med QSR 2023, at least for the four sub-regions established in the Mediterranean for assessment purposes in the framework of implementing the Ecosystem Approach Roadmap.

15. Some metrics and sub-divisions are still to be refined to improve the analysis, prior to setting up any management strategy (Table 2). This approach can support the definition of areas/sectors of activities where appropriate pressures reduction and management measures will be needed. It can also support prioritization in terms of specific baselines, thresholds, and finally targets, and support the monitoring of associated measures' efficiency.

16. Finally, the total balance of the reference scales for both environmental state (e.g. healthy ecosystems) and pressures (e.g. anthropogenic impact intensity), could define the selection of geographical scales, starting from both the greatest sensitivity/ecological relevance and highest level of pressures.

Table 1: 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 related measurement IMAP Common Indicators for EO5 and EO9. Following the analysis presented in this table that is based on the expert judgment, **MED POL Focal Points ~~CorMon experts~~** can better define/refine specific interactions, for activities contributing to pressures at Common Indicator level.

Pressures vs. measured IMAP Common Indicators (EO5 and EO9)	**Non-Construction Zone**	**Natural Hazards**	**Natural disasters**	**Climate Change**	**Agric. and forestry runoffs**	**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**	**Aquaculture**	**Solid waste disposal**	**Storage of gases**	**Research and education**	**Defence operations**	**Damping of munitions**
C13. Nutrients																														
C14. Chlorophyll *a*																														
CI17: Key harmful contaminants																														
CI18: Pollution effects																														
CI19: Acute pollution events																														
C20: Contaminants in seafood																														
CI21: Intestinal enterococci																														

Table 2: GRID/Table for IMAP integrated assessments under the nested assessment approach. The four sub-regions have been already defined for practical reasons and for the purpose of the UN Environment/MAP 2011 Initial Integrated Assessment (UNEP(DEPI)/MED WG.363/Inf.21) and the Med QSR 2017, namely the Western Mediterranean, Ionian and Central Mediterranean, Adriatic Sea and Aegean-Levantine Seas. The sub-divisions (i.e. sub-regional seas/basins) have been defined according to availability of database sources for the purpose of development of the assessment criteria for pollution (UNEP(DEPI)/MED WG.427/Inf.3). Sub-divisions might correspond initially to the Contracting Parties` coastal zones and offshore areas. Other sub-divisions may be defined. Downscaling at sub-divisional level is also used under the EU Marine Strategy Framework Directive. Following initiated analysis presented in this table that is based on the expert judgment, **MED POL Focal Points** ~~**CorMon experts**~~ can better define/refine specific interactions, for activities contributing to pressures at Common Indicator level in Mediterranean sub-regions and sub-division.

Scaled GRID pressures/impact approach	**SUB-REGIONS**	**SUB-DIVISIONS**	**Coastal urbanization**	**Industry**	**Offshore structures**	**…**
Common Indicator 14 (Chl-a) (Ecological Objective 5)	**Western Mediterranean Sea**	North Western (NWMS)				
		Alboran Sea (ALBS)				
		Tyrrhenian Sea (TYRS)				
	Adriatic Sea	North Adriatic (NADR)				
		Middle Adriatic (MADR)				
		South Adriatic (SADR)				
	Central and Ionian Seas	Central (CEN)				
		Ionian Sea (IONS)				
	Aegean and Levantine Seas	Aegean Sea (AEGS)				
		Levantine (LEVS)				
Scaled GRID pressures/impact approach	**SUB-REGIONS**	**SUB-DIVISIONS**	**Coastal urbanization**	**Industry**	**Offshore structures**	**…**
Common Indicator 17 (Contaminants) (Ecological Objective 9)	**Western Mediterranean Sea**	North Western (NWMS)				
		Alboran Sea (ALBS)				
		Tyrrhenian Sea (TYRS)				
	Adriatic Sea	North Adriatic (NADR)				
		Middle Adriatic (MADR)				
		South Adriatic (SADR)				
	Central and Ionian Seas	Central (CEN)				
		Ionian Sea (IONS)				
	Aegean and Levantine Seas	Aegean Sea (AEGS)				
		Levantine (LEVS)				

2.2. SCOREBOARDS METHOD: Quantifying pressures/impacts relationships; risk-based approach

17. Mapping of pressures/impacts relationships can be done using a risk-based approach. Risk-based approach is particularly effective for Ecological Objectives that are spatially patchy and where pressures are applied at specific locations. It is recommended to map the pressures that are most likely to have significant impacts, considering the vulnerability of various elements of the ecosystem.

18. Similarly, to the GRID/Table Approach, a variety of scales are necessary to reflect state-based assessments (i.e. ecologically-relevant scales for the various ecosystem elements: species, habitats, ecosystems), and pressure-based assessments aimed to guide management of human activities to reduce their impacts. The GRID/Table approach and the quantitative risk-based methodological scoreboard approach that rely on the calculation of numeric scores (i.e. criteria which should be based on EOs assessments along the spatial distribution of pressures-impacts and risks to the marine environment) for the IMAP integrated assessments could be seen as tools to support implementation of the DPSIR approach.

19. Scoreboard method is similar to the GRID/Table approach; however, it uses numeric scores (i.e. assignment of a numeric value by categories) rather than colours alone, to allow calculating derived quantitative information. As well, the chosen scales would shape the final results obtained by scorecard methods and these are even more powerful when used with a risk-based approach focus.

20. There are several scoreboard methodological approaches that may be used for the mapping of distribution of pressures and assessment of their impacts over different ecosystem components (e.g. species groups, pelagic or benthic habitats), with defined quality threshold values (i.e. categorizations and values assignment). An example, under the guidance of PAP/RAC-UN Environment/MAP including interrelations between the IMAP Common Indicators, coastal vulnerability assessment and management, as well as Marine Spatial Planning (MSP) was undertaken recently in Boka Kotorska Bay (Montenegro), through the CAMP initiatives. This methodological approach might guide next steps to develop the matrixes for quantifying the spatial distribution of pressures and their impacts over different marine ecosystem components.

21. **Following the recommendation of the Meeting of CorMon on Pollution Monitoring, GRID/Table Approach, risk-based and the semi-quantitative approaches should be complemented with the modelling of the monitoring data in order to ensure a more reliable quantification of the magnitude of impacts. The vulnerability assessment and mapping of distribution of pressures and impacts over different ecosystem components (species groups, pelagic or benthic habitats) may be considered to support scientifically-based scoring**.

22. In the absence of quantitative assessment criteria, semi-quantitative approaches should be a basis for mapping and quantifying the interrelation of drivers-pressures-impacts-state-responses relying on the best available expert judgment. Given the fact that IMAP implementation is at stage when monitoring and assessment scales are to be updated/agreed and tested, as well as aggregation and integration rules fully defined, at present, the semi-quantitative scoreboards method is useful for mapping the interrelation of drivers-pressures-impacts-state-responses of complex processes, such as those present in the marine environment (e.g. considering in the vertical axis the economic activities and the natural elements that have great relevance according to the ICZM Protocol and other Barcelona Convention`s Protocols, whilst in the horizontal axis the EcAp/IMAP EOs and CIs). Scoreboards method should provide insights on impacts, which are directly relevant to the state-based assessment of the ecosystem with sufficient detail (e.g. impact on non-commercial species by incidental by-catch which would need to be separated into at least the specified species groups of birds, mammals, reptiles and fish; and preferably at species level, to feed into species-level assessments). The state-based integrated assessments, combining the state-based Common Indicators as a set of ecosystem elements in a holistic manner, should cover the overall pressure-based Common

Indicators affecting it (e.g. the state assessment of the benthic ecosystem should evaluate together the impact from the pressures such as physical loss, physical disturbance, non-indigenous species, nutrient enrichment, removal of species and others). Therefore, this level of detail based on the IMAP EOs and CIs should be the primary methodological basis to develop scoreboard, as well as assign scores, while relying on the best available expert judgment.

23. The added value of the combined synthesis of the semi-quantitative approaches and expert judgment is a clear vision on the requirements and responsibilities from both the managerial and measurement systems. Table 3 details the activities (originated by main drivers) which are commonly known and aligned with the current IMAP multidimensional measurement system (with their Ecological Objectives and Common Indicators) to address current scenarios of Pressures-State-Impacts. The Table provided in UNEP/MED WG.463/Inf.9 presents an extension of this interrelation, relating specifically IMAP, as the measurements system of the Barcelona Convention with relevant responses provided through relevant regional policies.

Table 3: Template to frame the activities according to the DPSIR approach and links them to the Barcelona Convention measurements system (IMAP). Below template includes agriculture as an example, while complete template that includes all other relevant interrelations is provided in UNEP/MED WG.463/Inf.9. **The list of the activities elaborated in this template does not pretend to be exhaustive and may be further extended and adjusted in line with specific circumstances related to concrete example for which determination of the interrelation between pressure/state/impact is needed.**

	SEAWARD - LAGOONS - ISLANDS - OFFSHORE					
Economic (Driver)		**Pressure**	**State**	**Impact**	**IMAP EOs CIs**	**Regional policy (Response)**
	Activity type				**Pressure, Impact and State-based indicators**	**UN Barcelona Convention**
8) Maritime activities	Awaiting areas (oil tankers, cargo transport, hazardous substances vessels)	Introduction of pollutants (oil hydrocarbons and related organic compounds)	Water column habitats decline	Healthy coastal water and habitats decline	BIODIVERSITY (EO1): CI1-CI2; SEA FLOOR INTEGRITY (EO6)	Offshore Protocol
		Risk of accidents and spills	Water quality degradation	Coastal and marine environment impacted	CINTAMINATION (EO9): CI19	Offshore Protocol
	Bunkering	Introduction of pollutants (oil hydrocarbons and related organic compounds)	Water column habitats decline	Healthy coastal water and habitats decline	CINTAMINATION (EO9): CI19; BIODIVERSITY (EO1):CI1-CI2	Offshore Protocol
		Risk of accidents and spills	Water quality degradation		CINTAMINATION (EO9): CI19	Offshore Protocol
	Offshore platforms (oil and gas exploitation)	Introduction of pollutants (oil hydrocarbons and related organic compounds)	Water column habitats decline	Healthy coastal water and habitats decline	CINTAMINATION (EO9): CI17, CI18, CI20; BIODIVERSITY (EO1):CI1-CI2	Offshore Protocol

	SEAWARD - LAGOONS - ISLANDS - OFFSHORE					
Economic (Driver)		**Pressure**	**State**	**Impact**	**IMAP EOs CIs**	**Regional policy (Response)**
	Activity type				**Pressure, Impact and State-based indicators**	**UN Barcelona Convention**
		Risk of accidents and spills	Water quality degradation		CINTAMINATION (EO9): CI19	
	Shipping traffic (commercial, ferries, military, cruise liners)	Introduction of pollutants and noise, litter	Water column habitats decline	Healthy coastal water and habitats decline	BIODIVERSITY (EO1): CI1-CI2; CONTAMIANTION (EO9): CI17, CI20; MARINE LITTER (EO10): CI22-cC24; ENERGY (EO11): CI26-CI27	Offshore Protocol
		Risk of accidents or acute spills	Water quality degradation	Healthy coastal water and habitats decline	CINTAMINATION (EO9): CI19	
		Introduction of NIS (ballastwater)	Biodiversity and functions alteration	Healthy coastal water and habitats decline	NON-INDIGENOUS SPECIES (EO2): CI6	
	Dredging (natural environments)	Extraction of soil substrates	Disturbance of sea-floor integrity impaired	Benthic species and habitats deterioration	SEA FLOOR INTEGRITY (EO6); BIODIVERSITY (EO1): CI1-CI2	Offshore Protocol
	Offshore energy (renewable)	Occupation of coastal marine space	Surface and pelagic ecosystems altered	Healthy coastal water and habitats decline	BIODIVERSITY (EO1): CI1-CI2	Offshore Protocol
	Solid waste disposal	Asfixiation of benthic habitats	Habitats and species loss	Healthy coastal benthic habitats decline	SEA FLOOR INTEGRITY (EO6); BIODIVERSITY (EO1): CI1-CI2	Dumping Protocol
	Storage of gases	Subsubstrate storage (seismic risks)	Disturbance of sea-floor integrity impaired	Healthy coastal benthic habitats decline	SEA FLOOR INTEGRITY (EO6); BIODIVERSITY (EO1): CI1-CI2	Offshore Protocol
	Defence operations	Noise, contamination and waste material	Coastal and marine environment threatened	Healthy coastal water and habitats decline	SEA FLOOR INTEGRITY (EO6); BIODIVERSITY (EO1): CI1-CI2	Offshore Protocol

	SEAWARD - LAGOONS - ISLANDS - OFFSHORE					
Economic (Driver)		**Pressure**	**State**	**Impact**	**IMAP EOs CIs**	**Regional policy (Response)**
	Activity type				**Pressure, Impact and State-based indicators**	**UN Barcelona Convention**
	Disposal of munition	Dumping of munitions (including bacteriological)	Disturbance of sea-floor integrity impaired	Healthy coastal benthic habitats decline	SEA FLOOR INTEGRITY (EO6); BIODIVERSITY (EO1): CI1-CI2	Offshore Protocol

24. Moreover, for each chain of elements part of the analysis (Drivers > Activity type > Pressure > State > Impacts (Ecosystem Services, Welfare) > Responses), the table template provides the link to the related Ecological Objective (EOs) and Common Indicators (CIs) of the Barcelona Convention measurement system (i.e. UNEP/IMAP).

25. The above described approach is then complemented by an Excel tool (see Figure 1) which can be used for an expert-based evaluation with different approaches (both item and impact scores). The structure of the Excel file reflects the content of the template provided in Table 3. On the one hand, the Excel tool could allow simply estimating (in %) how many items (i.e. Drivers/Pressures from land-based sources) have the potential to threat the marine ecosystem. Experts involved in such evaluation can provide an assessment for each activity 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 items (activity types).

26. The same Excel tool (Figure 1) enables to estimate the magnitude of impacts (in %) by adapting its conceptual objective. Thus, for each Driver/Pressure, 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 multiplied by 3).

27. The level of detail based on the IMAP Common Indicators and Ecological Objectives should be the primary methodological basis to assign scores.

SCORECARDS: SEMI QUANTITATIVE APPROACH
(choose 0, 1, 2 or 3 to estimate impact)

None (0) | Low (1) | Moderate (2) | High (3)

Overall of Pressure-Impact (Ecosystem Services) (%):

	SEAWARD - LAGOONS - ISLANDS - OFFSHORE				IMPACT SCORE	
Economic (Driver)		**Pressure**	**State**	**Impact (Ecosystem)**	**% of total impacts**	**Regional policy (Response)**
	Activity type					**UN Barcelona Convention**

Maritime activities	Awaiting areas (oil tankers, cargo transport, hazardous substances vessels)	Introduction of pollutants (oil hydrocarbons and related organic compounds)	Water column habitats decline	Healthy coastal water and habitats decline	3	Offshore Protocol
		Risk of accidents and spills	Water quality degradation	Coastal and marine environment impacted	3	Offshore Protocol
	Bunkering	Introduction of pollutants (oil hydrocarbons and related organic compounds)	Water column habitats decline	Healthy coastal water and habitats decline	3	Offshore Protocol
		Risk of accidents and spills	Water quality degradation		3	Offshore Protocol
	Offshore platforms (oil and gas exploitation)	Introduction of pollutants (oil hydrocarbons and related organic compounds)	Water column habitats decline	Healthy coastal water and habitats decline	2	Offshore Protocol
		Risk of accidents and spills	Water quality degradation		1	IMO
	Shipping traffic (commercial, ferries, military, cruise liners)	Introduction of pollutants and noise, litter	Water column habitats decline	Healthy coastal water and habitats decline	0	Offshore Protocol
		Risk of accidents or acute spills	Water quality degradation	Healthy coastal water and habitats decline	0	IMO
		Introduction of NIS (ballast water)	Biodiversity and functions alteration	Healthy coastal water and habitats decline	3	IMO
	Dredging (natural environments)	Extraction of soil substrates	Disturbance of sea-floor integrity impaired	Benthic species and habitats deterioration	3	Offshore Protocol
	Offshore energy (renewable)	Occupation of coastal marine space	Surface and pelagic ecosystems altered	Healthy coastal water and habitats decline	3	Offshore Protocol
	Storage of gases	Sub substrate storage (seismic risks)	Disturbance of sea-floor integrity impaired	Healthy coastal benthic habitats decline	3	Offshore Protocol
	Disposal of munition	Dumping of munitions (including bacteriological)	Disturbance of sea-floor integrity impaired	Healthy coastal benthic habitats decline	3	Offshore Protocol
				TOTAL SEAWARD IMPACT (Ecosystem services)	**30**	

Figure 1. Example of Scoreboard, including semi quantitative assessment and risk-based approach considerations (note: fictional scoring). This tool allows to estimate the magnitude of impacts % of total (of estimated possible) pressures-impacts on the environment and ecosystem services. It also links the Drivers (with

detailed forces/activities) with Responses (Action Plans, Protocols, etc. within the Barcelona Convention). The same approach could be used to estimate the item scores (see text).

2.3. The NEAT approach

28. The Nested Environmental Status Assessment Tool (NEAT) (Borja et al., 2016) is a pioneering tool developed specifically to assess the marine environment. It uses a combination of high-level integration of habitats and spatial units; therefore, allowing for specification on structural and spatial levels, applicable to any geographical scale. NEAT is a structured, averaging approach and hierarchical tool (i.e. based on a nested assessment approach) for making marine state assessments (freely available at www.devotes-project.eu/neat). Based on a nested assessment approach, the NEAT has been discussed and applied at various scales in the framework of different projects (Action Med, PERSEUS, DEVOTES).

29. In the study of Pavlidou et al. (2019), the results of assessment were evaluated in relation to the anthropogenic pressures affecting the study area, as well as the management measures taken and compared to the results from previous studies. The NEAT was able to show clear spatial gradients differentiating the impacted and slightly impacted areas and the response of the ecosystem towards some management measures. The application of NEAT tool classified the whole tested area with the pelagic habitat components (fish, water column and phytoplankton ecosystem components), contributing strongly to the global environmental status. Sediment, benthic fauna and vegetation, mammals and aliens NIS were the most impacted ecological components.

30. The NEAT tool is now being further considered at the Mediterranean scale, within the project MEDCIS, and could be considered as a best practice in the context of the second phase of IMAP implementation.

2.4. UN Regional Seas Programme approach

31. There is a need to link the state of the marine ecosystem with other mankind dimensions, namely, ecosystem services (i.e. food provision, tourism activities, coastal livelihoods, natural resources, etc.) and economic activities beyond the marine ecosystem boundaries; but affecting it. There is also a need to better manage and communicate their status and trends to decision-makers. A step forward for the integration and aggregation of the IMAP components with other related mankind interests in the marine environment might relay in the use of composite indicators and indices, namely, ecosystem-based indicators (combining both higher levels of aggregation of state-based and pressure-based indicators). These are powerful communication tools at the science-policy interface.

32. The United Nations Environment Programme (UNEP) Regional Seas Programme (RSP), Global Environment Facility-Large Marine Ecosystem Projects (GEF-LMEs), as well as the SGD 14 (Agenda 2030) are encouraging and promoting the use of these science-based tools, such as the Ocean Health Index (OHI) or the Environmental Vulnerability Index (EVI) (UNEP, 2014).

3. IMAP EOs RELATIONSHIPS TO ASSESS GES

33. The relationships between the UN Environment/MAP Ecological Objectives, the status of the ecosystem elements and pressures, and the IMAP Common Indicators are important to ensure the integrated assessment of GES. Building on the relevant best practices coming from the EU MSFD implementation (European Commission, 2017). Table 4 presents indicative interrelations between Ecological Objectives (EOs), whilst Table 5 further presents a possible framework enabling the integrated assessment of GES taking into account the relationship among different IMAP Ecological Objectives.

Table 4. Indicative interrelations between Ecological Objectives (EOs)

	EO1	EO2	EO3	EO4	EO5	EO6	EO7	EO8	EO9	EO10	EO11
EO1											
EO2											
EO3											
EO4											
EO5											
EO6											
EO7											
EO8											
EO9											
EO10											
EO11											

	No relation
	Limited relations
	Significant relations
	Extended relations

34. In order to make best use of this integrated framework within a DPSIR-based approach, the following logical sequence of assessments is recommended:

- Map the distribution and intensity of human uses and activities and identify the main areas of activity (Drivers). This can be used as proxy pressure assessment to support later identification of measures (Responses);
- Assess the Pressures in terms of spatial distribution and intensity (including temporal aspects, where necessary). This may be less relevant for the assessment of mobile species (e.g. birds and cetaceans), for which it is more difficult to know the place and time of exposure to particular pressures (pressure-based CIs);
- Assess the environmental Impacts/extent of Impacts in relation to the elements to be used for the state-based and the pressure-based assessments (state-based CIs);
- Assess the State as derived from the assessments of impacts in previous step, to lead to an overall assessment of status.

Table 5: A possible framework for integrated GES assessment, 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	?	?

35. Table 5 is built on best practices from the EU countries on MSFD implementation, taking also into account IMAP and Mediterranean region specificities.

36. In order to reach a clear conclusion on whether GES is achieved or not for a specific area, there is a need for aggregation and integration across the individual assessments and data sets relating to the 11 Ecological Objectives. Geographical aggregation and integration of the various indicators need to take into consideration the scales for identifying and implementing any necessary management actions.

37. The integration of individual assessments at Common Indicator and Ecological Objectives' level into a unique status assessment entails a number of challenges, including the following:

i) Some Ecological Objectives may aim at mitigating a pressure relevant for other Ecological Objectives (for example, NIS can be a threat to biodiversity and food web);
ii) Not all the Ecological Objectives have an equal weighting when assessing the overall GES;
iii) Some pressure-related Ecological Objectives may affect other Ecological Objectives;
iv) Integration at the Ecological Objectives' level may be based on partly redundant information given by Common Indicators (for example, under EO 10 on marine litter, CI 22 is partly related to CI 23);
v) Assessment integration and scaling up requires Contracting Parties' assessments to be comparable.

38. In line with the above, the following recommendations may be considered:

- The integration across levels of different complexity should accommodate different alternatives, i.e. integration at indicator level (across indicators within EOs) could certainly differ from integration at Ecological Objectives' level;

- Integration across state-based Ecological Objectives (EO1 to 3, EO6) is different than across pressure-based Ecological Objectives (EO 2, 5, 8, 9 to 11);
- There is a different contribution of the two main types of Ecological Objectives to the overall GES evaluation, as GES for pressure-based Ecological Objectives should also be met when GES for state-based Ecological Objectives (EO1, 3, 4, 6) is achieved.

39. Decisions on a 'boundary' between ‘in GES’ and ‘not in GES’ are needed at various steps (levels) in this process:

a. There is need to determine appropriate threshold values for each Common Indicator used to assess the elements, enabling a clear distinction on whether GES for an Ecological Objective has been achieved or not. Where several Ecological Objectives are used per ecosystem element, a specified method of aggregation across the Ecological Objectives is needed in order to assess whether the element has achieved GES or not. These rules could include the one-out-all-out principle or other specified approaches. In this sense GES can be defined as having been achieved for specified elements of the marine environment (e.g. related to specific EOs or biodiversity elements) rather than as a whole; this allows for a more step-wise approach to assessments and for a means to communicate that GES has been achieved for certain elements but not yet for others;

b. For multiple elements (e.g. multiple species or contaminants) in a broader functional group (e.g. demersal fish, heavy metals etc.), a way to express overall status of the broader group is needed. In this situation, a minimum list of elements, which ‘represent’ the broader group, should be specified and then used for assessment of that group. In these cases, all the listed elements within the group should achieve the specified quality levels in order to say that the broader group has achieved GES. Progress towards GES for the group could be expressed as the proportion (percentage) of the minimum list of elements, which have achieved GES.

3.1. Geographical aggregation and integration

40. Integration at a higher geographical scale to achieve consistent conclusions on the extent to which GES is achieved for each of the different topics remains a key step to support assessments.

41. The 2011 Initial Integrated Assessment of the Mediterranean Sea and Coastal Areas undertaken by the UN Environment/MAP Barcelona Convention Secretariat and its Contracting Parties delivered a region-wide assessment report complemented by four sub-regional assessment reports. The 2017 MED QSR followed the regional approach only. Further discussion is needed and should start well in advance to define the level of aggregation of assessments for the 2023 MED QSR.

42. This raises the question of how the assessment of complementary elements is taken into account when presenting the overall extent to which GES is being achieved.

43. A proposed scheme is to base the regional assessment on the geographical aggregation of IMAP-based national indicators and their incorporation into the assessment for each sub-regional/ regional assessment unit. The assessment outputs for presenting the extent to which GES is achieved can take different forms depending on the purpose of the presentation and communication.

44. These options include:

- To combine all assessment results in an integrated scheme for presenting assessment results which provides a concise presentation of GES status in relation to all IMAP Common Indicators at the relevant geographic scales.

- To provide details on the assessment results which are relevant for management. Needs and options are specific for the Ecological Objectives and Common Indicators. In general, possible approaches include:

    - 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 normalised on a scale 0–1 or differentiated classification on both sides of the good/not good boundary.

45. Consideration will be then given to the envisaged level of integration of Common Indicators and Ecological Objectives; the flow/sequence of assessment and integration steps the possible nodes of integration; and the associated integration rules. Comparable outputs should be agreed to be delivered as part of the assessment process within the UN Environment/MAP - Barcelona Convention, taking into consideration some differences for purposes of the management of pressures in national waters. Contracting Parties are then expected to deliver the assessment of the environmental status at sub-regional level through regional cooperation and common regional assessment frameworks, understanding that some regional indicators may not be ready, or be only of national relevance

3.2. Assessment scale

46. IMAP Decision recognized that further work is necessary during the initial phase of its implementation on assessment scales. A nested system (Figure 2.) provides a flexible approach to defining the scales for assessment (for the different EOs) in a way that also provides consistency and clarity on the scales/areas to be used for assessment. It enables a linkage between state-based and pressure-based assessments, which facilitates linkages to measures. Whilst an outline approach to defining and using such a nested system is presented here, it would be necessary for Contracting Parties, working together on regional level, to develop this into an operational mechanism, by:

a. Assigning the elements (drivers, pressure, state or impacts) to be assessed to the most appropriate scale, taking account of the most appropriate ecological scales for state-based elements and relating these to appropriate scales for pressure-based assessments; an initial generic proposal for this is given in Table 6 below, noting that this needs further discussion and adaptation;
b. Defining suitable boundaries for the areas (sub-region, sub-division or smaller) to be used for each scale within the region;
c. Adjusting the proposal to accommodate practical implementation issues, e.g. the occurrence of national boundaries, the foreseen assessment process, balancing the number of areas for assessment with implementation needs, such as links to measures and management etc.

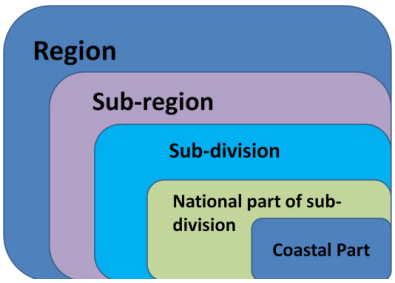

Figure 2. Schematic representation of a nested set of assessment scales to be used to cover all assessment needs for IMAP.

47. In the Mediterranean Sea the sub-regions (as defined in the 2011 Initial Integrated Assessment) provide the basis for assessments and reporting, and thus, the Contracting Parties are required to cooperate to ensure a common and coordinated approach in their monitoring and effectiveness of measures. However, assessments of whether GES has been achieved can be at a finer scale, as deemed appropriate.

48. The broad range of topics to be assessed across the eleven Ecological Objectives and related Common Indicators calls for a variety of scales to be used. For example, wide-ranging species such as sea turtles are more appropriately assessed at the regional scale, whilst nutrient enrichment and contaminant hotspots may be more appropriately assessed at finer scales linked to their land-based sources and management needs. In addition, there may be several populations of particular species (e.g. commercial fish) in the region and in sub-regions, which should be assessed separately.

49. A variety of assessment scales are therefore necessary to reflect ecologically-relevant scales for the various ecosystem elements (species, habitats, ecosystems) and management and administratively-relevant scales for pressure elements. Additionally, the outcome of the assessment is intrinsically linked to the scale of assessment. Assessing pressures and their impacts at too broad a scale can hide significant areas of impact in certain parts of a sub-region. On the other hand, it should be also borne in mind that IMAP must be applied across the entire regional waters and adoption of too fine a scale could lead to burdensome assessment processes.

50. Developing suitable mapping/dissemination tools to show the environmental status of the different Ecological Objectives across the whole region should use a nested scale system, accommodating state and pressure aspects to provide a reference layer for information management at regional level. An initial proposal for assignment to appropriate scales for elements' assessment is provided below (Table 6) building on best practices from MSFD implementation for further development in the framework of IMAP implementation and possible adaptation to sub-regional needs.

Table 6: Initial proposal for assignment to appropriate scales of elements to be assessed (as a basis for discussion and further development during the initial phase of IMAP).

Elements for assessment	Region	Sub-region	Sub-division	National part of sub-division	Coastal waters
State elements					
Species groups (EO1)	Large cetaceans, deep-sea fish	Offshore birds, small cetaceans, turtles, pelagic & demersal fish	Coastal birds, seals, coastal fish		
Water column and seabed habitats (EO1)			Water column habitats, seabed habitats beyond 1nm		Seabed habitats
Ecosystems (EO1 and 7)		Ecosystems			
Pressure elements					
Physical loss and damage, hydrographical changes (EO6, 7)			Linked to seabed habitats		EO7
UW noise (EO11)	Linked to large cetaceans	Linked to small cetaceans			
Eutrophication (EO5)				X	MED POL practice
Contaminants (EO 9)				X	MED POL practice
Litter (EO10)				X	
Removal of species (EO3)	As fish groups/GFCM	As fish groups/GFCM	As fish groups/GFCM		

Elements for assessment	Region	Sub-region	Sub-division	National part of sub-division	Coastal waters
	practice	practice	practice		
Non-indigenous species (EO2)				NIS	

51. Working at different spatial scales does not necessary imply that in principle the identified areas should be nested. But such nesting characteristic is of the outmost importance when integration of different spatial scales is required within the same EO or CI or between EOs or CIs in order to produce an assessment at the regional or sub-regional level as IMAP requires. Furthermore, a key benefit of such an agreed approach is that it enables visualization of the outcomes of assessments in a map form at different scales. In addition, it would still need an agreement among the Contracting Parties on the common criteria to be used to define smallest entity for each assessment and on the borders for delimitation of transnational areas. This may well vary between and within Ecological Objectives but pragmatic approaches are needed which allow assessment and management at all relevant levels.

Table 7: Proposed assessment scales for IMAP Common Indicators (after 2017 MED QSR and 2017 MEDCIS workshop) to be further reviewed and developed by CORMON meetings. The assessment scales will be further developed taking into account specific elements (e.g. species of bird, mammal, certain habitat type).

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
EO10	CI 22 Beached litter	Harmonized protocol				
	CI 23 Litter at sea	Surface litter and microplastics			Seafloor litter	

52. Regarding existing challenges, data may be of limited availability and implementation is still at an early phase, as a number of countries are in the process of revising their national monitoring programs to align them with IMAP. However, previous projects have produced results, outcomes and recommendations for a nested system (Action Med, PERSEUS, DEVOTES, etc.) that can be considered by the Contracting Parties in an easy-to-use format (see indicative proposed scales for IMAP Common Indicators in table 7 above).

53. As stated previously, the nested approach is considered as one of the best-fitted approaches in the view of GES assessment. As a prerequisite, harmonized approaches must be highlighted and the best approaches should be further identified for monitoring and assessment scales for some of the Ecological Objectives and/ or Common Indicators. Considering the practical steps for its implementation, and given the number of different assessments to be undertaken, it is recommended to first minimise the number of areas defined, using the same areas for several species and habitats, pelagic or benthic, keeping in mind the need for ecologically-relevant scales. Secondly, the areas used for pressure-based and ecosystem-based assessments must be associated with each other (e.g. areas for assessment of physical disturbance are the same as used for the assessment of seabed habitats or nested within the area).

54. The outcomes from the EU-funded project MEDCIS can be also considered. The Project agreed, in line with the new reporting format adopted for the update of Art. 8 - 10 of MSFD in 2018, on the same nested principle, proposing Mediterranean Marine Reporting Units (Med MRU), including the Mediterranean basin as region, the marine sub-regions as defined by the UN Environment/MAP 2011 Initial Integrated Assessment, sub-divisions to be further discussed, national parts of sub-divisions and territorial waters (possibly the WFD zones for the Contracting Parties, which are EU Member States). In this context, the term Reporting rather than Assessment qualifies such units as areas that should cover the all process envisaged by IMAP that is: monitoring, assessment and responses or measures to achieve or maintain GES.

55. All initiatives also recognised that (i) the sub-divisions are still uncertain (nationally and internationally) although information is shared, (ii) the scale of reporting for each Ecological Objective and Common Indicator is not always defined, and (iii) more coordination is foreseen.

56. An indicative set of proposed assessment scales is provided in Table 7 above, building on the initial proposal for assignment to appropriate scales of elements (see Table 6) and considering the key findings of the 2017 MED QSR and work in progress within MEDCIS Project, for further discussion and development by the CORMON meetings.

4. THE CONVERGENCE OF TRENDS AND STATUS ASSESSMENTS: FURTHER IMAP IMPLEMENTATION

57. Across the Mediterranean Sea, most of the reduction targets adopted by CPs are trends, expressed as reduction in percentage over time, in a reasonable and achievable period. The setting of threshold values overcomes this problem by committing to lower pressure or impacts to an agreed and 'acceptable' level in relation to GES. The threshold values should ensure protection of the environment and human health and can be referred to concentration levels as well as impact, pressure or state-indicator levels that should not be exceeded.

58. The Contracting Parties have approved the most recent update of the pollution assessment criteria and thresholds as presented in Annex II of Decision IG 23/6 and encouraged themselves and the Secretariat to test them for indicative purposes in the different contexts that exist in the Mediterranean. This progress is a continuation of many years of MED POL's work on continual introduction and implementation of the assessment criteria and thresholds. The updated criteria have been tested during the preparation of the 2017 MED QSR contaminant factsheets. Because of their satisfactory testing at this initial stage, their future application is recommended for indicative purposes.

59. Further work on assessment criteria refinement and establishment of new quantitative thresholds need to be set at appropriate geographical scales, thereby taking into account the different biotic and abiotic characteristics of regions, sub-regions and sub-divisions (see chapter 2 above). Defining threshold values will require involvement of relevant UN Environment/MAP Components' Focal Points as well as experts from related areas of expertise.

60. Threshold value means a value or range of values that allows for an assessment of the quality level achieved for a particular Common Indicator or Ecological Objective, thereby contributing to the assessment of the extent to which GES is being achieved. While they are expressed as numerical values, it should be kept in mind that they have been derived from underlying data, which often entails uncertainties. Applying ample safety factors to the threshold values in order to take knowledge gaps and uncertainty effect into account is a necessary process as well as an on-going revision to be up-to-date to the state-of-the-art knowledge.

61. Thresholds should ideally meet the following requirements: be based on scientific knowledge and sound and reliable monitoring data programme; consider different harm end points; be expressed in numerical values; be based on comparable reporting units; be set at appropriate geographic scales (see chapter 2 above); be set on the basis of the precautionary principle; be consistent across different Common Indicators and Ecological Objectives and consider pressures/impacts interactions; reflect natural ecosystem dynamics and fit with defined assessment scales.

62. Depending on the Common Indicators and Ecological Objectives, the definition of thresholds can include different level of warnings, such as thresholds of no concern, thresholds of toxicological concern (TTC), end points of effects, or the precautionary principle. If a threshold applies to a pressure, impact or state-indicator also the actual definition of the indicator itself has to be thoroughly explicated in terms of its metric or formulation. Translating this concept into IMAP Common Indicators, it could be summarized as irreversible changes in populations communities, assemblages and ecosystems (EOs 1 & 2); toxicological action mode (EOs 5, 9 & 10), physical damage (EOs 6, 10 & 11), disruption of human activities (EO 9/ CIs 20 & 22) and irreversible changes in habitats, or components of the environment (EOs 1, 5, 6 & 7). This approach may be however complicated by various types of harm for a specific pressure with different end points that must be considered for threshold setting. The *Risk* approach, based on cross-mapping data on pressures and impacts, enables a better definition of areas where interactions occur. It could be used for many indicators through a quantitative risk assessment framework, supporting the prioritization of efforts against specific pressures.

4.1. Options for the definition of thresholds

63. Table 8 presents different options and concepts for the definition of thresholds within IMAP.

64. There are few existing baseline values and targets defined for the IMAP Common Indicators (CIs 13- 14, 17-18, 20-24; see UN Environment, 2017a) with some of them, as defined by experts, based on percentage reduction over time in the pressure or impact level (CIs 22-24). Some will have to be refined, considering sub-regional constraints, when appropriate. Thresholds are still to be defined and/or updated by CORMON meetings including the definition of proportion/percentage to meet GES.

While thresholds for some Ecological Objectives in the different compartments of the marine environment (beach/surface/seabed or Pelagic/benthic) may follow the same basic concepts, they may each require specific approaches and the different marine compartments need to be discussed. For sure, the setting of quantitative thresholds requires the possibility for a quantification of the pressure and an appropriate formulation of the threshold unit. Finally, as measures aimed to reduce impacts over marine environment from pressures might be targeted for specific species, contaminants, items (litter) classes, groups, etc. thresholds should be set for single items, types, groups, classes, accordingly. As an example, measures to reduce impacts related to a specific contaminant (e.g. cadmium), or a type of litter (e.g. plastic bags) will need the definition of specific baselines and thresholds to support both monitoring and the evaluation of measures efficiency.

65. It might be advisable to derive "provisional and commonly agreed thresholds" rather than moving towards a situation with many different approaches across regions, sub-regions or Contacting Parties. The contribution by stakeholders with different backgrounds will be then beneficial. Setting priorities, depending on the availability of data, the relevance of metrics, and the most impacted Common Indicators is the proposed scheme prior to the second phase of IMAP implementation (2019-2023).

66. In Table 8, for the threshold category 'Zero option', the Common Indicators 17 and 19 related to contaminants (EO9) have been included. This 'zero option' threshold should be the ideal criteria to evaluate GES in terms of synthetic contaminants (which should not be present in the environment) and oil spills (which should not occur in the sea), respectively. For CI17 (synthetic chemicals) and CI19, the threshold 'zero option' is already the norm to define targets.

67. Nevertheless, the majority of the thresholds for EO5 and EO9 classify in the 'Lowest-end point' option, as shown in Table 8, therefore, the eutrophication processes or environmental toxicity scenarios appear when non-effect concentration levels for these substances are surpassed.

68. Finally, it should be mentioned here, the strong link between the thresholds already set for EO5 and EO9 and the scales of monitoring. The environmental information gathered in the field allows to set and refine continuously the 'threshold' for pollution (namely, assessment criteria); and thus, the monitoring scales should be considered for the use of the derived thresholds information for EO5 and EO9.

Table 8. Options and concepts for the setting of thresholds within IMAP with possible associated Common Indicators

Threshold	Concept	IMAP Common Indicators	Comments
Zero option	Possible option when the pressure does not exist in nature, by definition (litter, synthetic contaminants, man-made noise)	CI 12, CI 21, CI17, CI19	*"zero pressure" appears unreasonable, since impossible to reach when the pressure is a common situation*
Value-of-no-return	Values that alter irreversibly (or through significant effects) the indicator when exceeded/going below	CI 1-5, CI 6, CI 7, CI 14, CI 9, CI 18	*This approach is well adapted to population, communities, assemblages that may be altered beyond recovery.*
Cut-off values	Agreement that the reduction of a pressure can be defined on a concentration/ significant value when scientific evidence of impact is still investigated	CI 1-5, CI 6, CI 7, CI 9, CI 13, CI17, CI 18, CI 21	*Thresholds based on the mapping of areas where concentration/abundance of a particular high impact may support this approach*
Expert judgement	Approach based on the expertise of a wide range of contributors, a subjective opinion based on scientific evidence.	CI 8, CI 15-16	*The setting of low provisional threshold values is a way to initiate provisional thresholds. This couldbe an Expert Judgment*

Threshold	Concept	IMAP Common Indicators	Comments
Public acceptance	Societal agreement to reduce a pressure in the marine ecosystem while research is investigating the impacts. Human well-being disturbance is a component of socioeconomic considerations	CI 8, CI 16, CI 22	*Based on concentration/abundance mapping, areas of particular high impact can be determined and tackled.*
Lowest end point	Lowest concentration causing an adverse effect on one of the specific endpoints (Non-effect Concentration)	CI22, CI23, C13-14, C17-21, CI23	*The lowest concentration approach is relevant when it is impossible to balance different adverse effects of a single pressure (toxicological, physiological effect, socioeconomic impact)*
Hot spot areas	Possible definitions of areas or situations, which are clearly unacceptable from a societal point of view.	CI 1-7, CI 23	
Precautionaryprinciple	No conclusive scientific knowledge but evidence of harm, thresholds may be defined to provide maximum protection against adverse effects	Pressure indicators	
Significantdecrease	Relevant when no metric is available to measure the impact	Pressure indicators	
Calculation of reduction	Based on defined target. The threshold is defined as the baseline minus a desired percentage of reduction until deadline.	Pressure indicators	*Thresholds defined through predefined targets, possibly by policy makers*

Annex I
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