ICZM METHODOLOGICAL GUIDANCE TOWARDS REACHING GES

The report was prepared as part of the Transboundary CAMP Otranto project.

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1. Introduction

1.1.
Scope of the Present Work

This document aims to present Drivers-Pressures-State-Impacts-Responses (DPSIR) assessment methodology guidance for evaluating economic activities (drivers), environmental pressures and status components, along with the analysis and prioritisation of their interactions. The methodology was developed in the ambit of Integrated Coastal Zone Management (ICZM), on the basis of the principle described in the Methodological Guidance for Reaching a Good Environmental Status through ICZM, as part of the Common Regional Framework for Integrated Coastal Zone Management (CRF)[1]. The CRF represents the strategic and methodological framework for the application of ICZM Protocol principles in the Mediterranean, providing strategic orientations on the joint implementation of ICZM within the geographical coverage between the external limit of the territorial sea and the limit of the competent coastal units as defined by the Contracting Parties of the Barcelona Convention, using coordinated and harmonised approaches.

ICZM is an essential tool for the Barcelona Convention within the Mediterranean area, as it provides a commonly shared context with specific recommendations focusing on (a) the coherence of policies / strategic documents and orientation of actions, and (b) ways to strengthen integration and regional/sub-regional cooperation, also taking into consideration land-sea interactions and transboundary aspects.

In the context of the present work, a Matrix of Interactions, developed within the CRF, has been upgraded, linking the main relations between the Ecological Objectives (EOs) of the Integrated Monitoring and Assessment Programme (IMAP) and the driving economic activities, as well as the natural (coastal landscape, seascape and ecosystems) and cultural (cultural heritage) elements that are significant for coastal areas, according to the content of the ICZM Protocol. The assessment tool, developed for the application of the DPSIR assessment methodology, examines the entire coastal zone, with the aim of identifying and prioritising the most relevant interactions between EOs and elements of the ICZM Protocol. The tool was initially tested in the Otranto Strait area, with the aim of extending its application to other areas in the Mediterranean.

1.2.
Background and Reference Documents

The present study has been developed in line with the approach reported in Phase A of the CRF Methodological Guidance [1]. In particular, the Matrix of Interactions contained in the CRF Methodological Guidance (Figure 2), provides high-level links between the elements of the ICZM Protocol and EOs, organised into four clusters: (1) Biodiversity, (2) Fisheries, (3) Coast and Hydrography, (4) Pollution and Litter. The matrix was developed as an assessment tool for supporting decision-making processes at different levels (regional, sub-regional, national and sub-national). Furthermore, the identification of the spatial and temporal (short, medium and long-term) scales involved represents an important aspect of the Phase A analysis stages.

Objectives of the CRF on ICZM

1. Sustainable Development and Integrity of the coastal zone
2. Addressing natural hazards and the effects of natural disasters
3. Achieving good governance

Left axis: Economic activities and natural and cultural elements of the ICZM Protocol

Economic activities / natural & cultural elements	EO1: Biodiversity	EO2: Non-indigenous species	EO6: Sea-floor integrity	EO3: Commercial fish and shellfish	EO4: Food webs	EO7: Hydrographic conditions	EO8: Coastal ecosystems and landscapes	EO5: Eutrophication	EO9: Contaminants	EO10: Marine and coastal litter	EO11: Noise
LANDWARD											
Agriculture	red	blue	purple	blue	purple	blue	red	red	red	purple	blue
Industry	red	blue	purple	purple	purple	purple	blue	red	white	purple	purple
Utilization of natural resources: mining	red	blue	white	red	blue	purple	purple	white	red	blue	white
Urban sprawl	red	blue	red	blue	blue	red	red	red	red	red	red
Coastal landscapes	red	blue	blue	blue	white	blue	purple	purple	blue	purple	blue
Coastal forests and woods	purple	white	white	white	white	red	red	white	blue	purple	blue
Cultural heritage	blue	blue	white	white	white	red	red	white	blue	purple	blue
INTERFACE											
Infrastructures: ports, coastal defence and others	red	red	purple	blue	blue	red	red	blue	red	red	red
Energy infrastructures	red	red	purple	blue	blue	red	blue	blue	red	red	red
Tourism, sporting, recreational activities	purple	red	red	blue	blue	red	red	purple	purple	red	purple
Util. of natural resources: desalination plants	purple	white	white	blue	white	red	blue	blue	blue	blue	blue
Wetlands and estuaries	red	purple	blue	blue	purple	blue	red	red	red	blue	blue
Dunes	purple	white	white	white	white	red	red	white	blue	blue	blue
Cultural heritage	blue	blue	white	blue	white	red	red	white	blue	blue	blue
Coastal erosion	red	white	white	white	white	white	red	white	purple	blue	blue
SEAWARD											
Fishing	red	red	red	red	blue	blue	red	purple	red	red	purple
Aquaculture	red	red	red	purple	blue	blue	red	red	red	red	blue
Tourism, sporting, recreational activities	purple	red	red	red	blue	red	red	purple	purple	red	red
Maritime activities: shipping	red	red	blue	blue	blue	blue	blue	blue	red	red	red
Maritime activities: offshore energy	red	red	blue	blue	blue	red	blue	blue	blue	purple	red
Maritime activities: sand / mineral mining	red	blue	red	blue	blue	red	red	blue	blue	red	red
Maritime activities: cables and pipelines	red	blue	red	blue	blue	blue	blue	blue	red	blue	red
Marine habitats and species	red	red	red	red	red	purple	red	red	red	red	purple
Cultural heritage	blue	blue	white	blue	white	red	red	white	blue	blue	blue
ISLAND											
Cultural heritage	blue	blue	white	white	white	red	red	white	blue	purple	blue
Coastal erosion	red	white	white	white	white	white	red	white	purple	blue	blue

Figure 1. Matrix of Interactions as per UNEP/MED IG.24/22

Figure 2 shows the economic activities and the natural and cultural elements (ecosystems, landscapes and cultural heritage) that are significant for the coastal areas according to the ICZM Protocol. The elements are clustered into four ICZM zones, which represent a continuum throughout the coastal areas (landward coastal zone, land-sea interface, seaward coastal zone and islands). The considered elements of the ICZM Protocol are classified either as pressures (indicated in blue) or as states (indicated in black). EOs are listed and classified into four groups, identified by the corresponding colours.

Cell colours identify the relevance of the interactions between EOs and elements of the ICZM Protocol (red for high relevance, yellow for moderate relevance, blue for low relevance, while white represents an absence of interactions). The level of relevance should be evaluated considering the knowledge of both existing interactions and interactions that are expected in the future as a consequence of known strategic programmes and plans.

This general matrix shows the current understanding of interactions between ICZM elements and EOs at the scale of the entire Mediterranean (regional scale). Such an evaluation will change in response to specific dimensional, geographic and temporal conditions considered in the analysis. Therefore, the main aspects considered for the application of the matrix tool are the following:

1. Dimensional aspects, referring to the considered scale of analysis (e.g., regional, sub-regional, national or sub-national).

2. Geographic aspects, referring to the specific characteristic of the area under evaluation.

3. Temporal aspect, referring to the period of the analysis (short, medium or long-term).

In order to support the development of the present environmental assessment approach, a solid basis is represented by the information and methodological approach provided by MEDPOL, based on the DPSIR analysis, as described in the *Example of Overall Inter-*

relationships Between the IMAP and the DPSIR Framework Applied to the Coastal and Marine Ecosystem [2].

In order to further develop the current methodological approach, it was crucial to identify a general and common categorisation of the relevant DPSIR elements (economic activities, pressures, states and impacts) to be included in the analysis. In this regard, the reference documents for the proposed categorisation are listed below:

▪ *Mediterranean Quality Status Report 2017* of the Barcelona Convention [3]

▪ *Example of Overall Interrelationships Between the IMAP and the DPSIR Framework Applied to the Coastal and Marine Ecosystem*, UNEP/MED WG.463/Inf.9 [2]

▪ *Integrated Monitoring and Assessment Guidance*, UNEP/MED WG.463/Inf.9 [4]

▪ *Significance of the CAMP Italy Project Compared to the Inter-Relations Between MSP, ICM, and LSI*, CAMP Italy Report [5]

▪ Marine Strategy Framework Directive – Annex III [6]

▪ Commission Decision (EU) 2017/ 848 of 17 May [7].

1.3.
DPSIR Approach

The causal framework underlying the proposed Methodological Approach is represented by the DPSIR chain (Driving Forces, Pressures, State, Impact and Responses). The DPSIR framework was applied according to what is reported in Section 2.

The proposed methodology is intended as a supporting tool aiding the formulation of expert judgement, based on a flexible and modular DPSIR toolset for the evaluation and synthesis of environmental information, which is useful for the identification of the main causal links and interactions between Economic Drivers, Environmental Pressures and Status elements, providing a solid base from which operational responses can be derived and contextualised.

The proposed approach can be applied to different target areas with variable degrees of synthesis and increasing levels of geographical detail and/or magnification.

2. Analysis and Methods

This section provides a general overview of the DPSIR model on the basis of which the architecture and workflow of the methodology are developed. Detailed and operative descriptions of the workflow and analysis steps to be undertaken by the Expert(s) are given in the following dedicated sections.
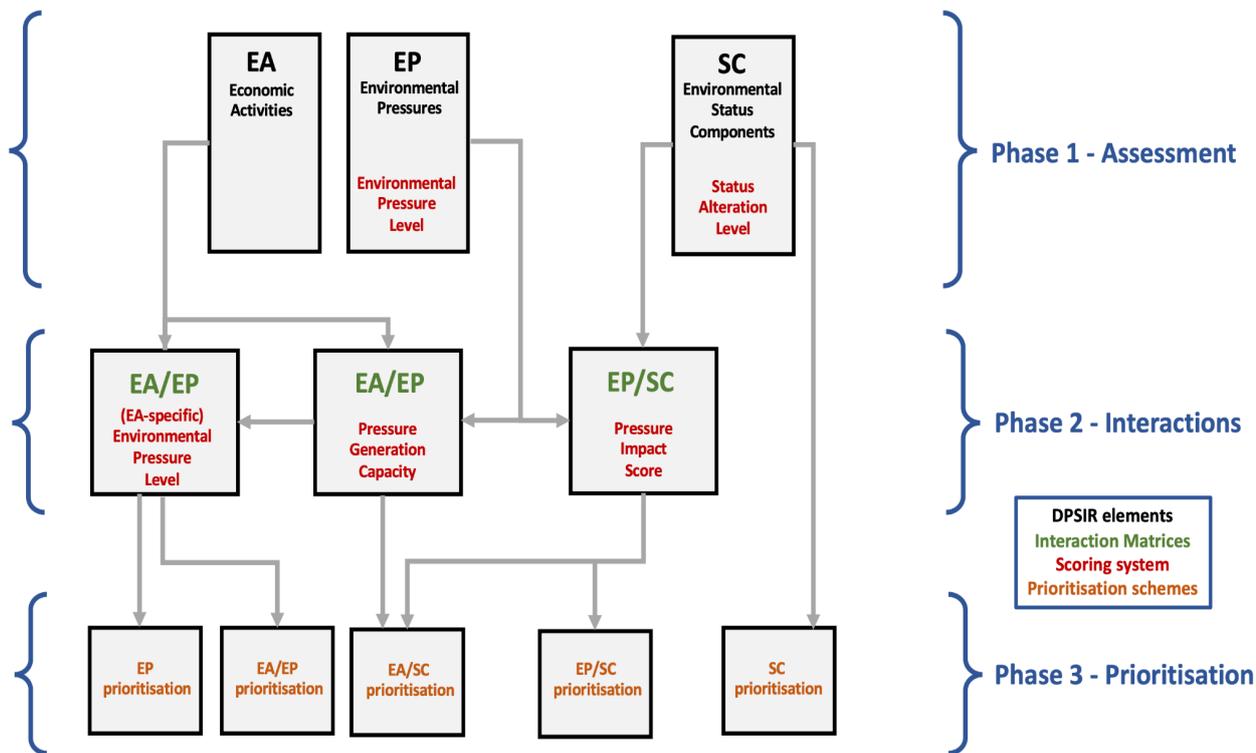
Figure 2. Architecture of the developed DPSIR approach.

The main concepts and elements of the methodological approach are hereby presented, along with a description of the main indicators and scores employed. The latter will be recalled in the following sections and their usage described accordingly.

2.1.
Analysis Workflow

The assessment workflow is based on three main phases discussed below. These assessment steps are carried out relying on the provided Excel Environmental Interactions Assessment Tool (EIAT).

Phase 1 – Assessment

In the assessment phase, the Expert(s) will proceed with the collection and analysis of all the available information and data that is relevant to the identification and analysis of the main Economic Activities (EAs) as drivers, Environmental Pressures (EPs) and altered Status Components (SCs). These elements are framed using a quali-quantitative scoring system in the corresponding tables listed below:

1. Economic Activities Table (EA Table), which provides an overview of the Economic Activities (EAs) present in the area.

2. Environmental Pressure Table (EP Table), providing an overview of the Environmental Pressures affecting the area.

3. Status Components Table (SC Table), describing the level of alteration of the Environmental Status Components (SC) with respect to a good environmental status (GES) for the area under assessment.

Phase 2 – Interactions

In the interaction analysis phase, the Expert(s) will deal with the study and evaluation of the potential interactions and causal links existing between the elements identified in Phase 1. The Interactions are examined in the following analysis steps.

1. **Economic Activities / Environmental Pressures Analysis (EA/EP Analysis)**, to evaluate the correlation between the Environmental Pressures present in the area and the underlying Economic Activities that generate them.

2. **Environmental Pressures / Status Components Analysis (EP/SC Analysis)**, examining the impact of the Environmental Pressures in terms of their correlation with the detected altered Status Components.

The purpose of the EA/EP Analysis is to study and trace the flow of pressures affecting the environment, and to identify the EAs that most significantly generate them. The Expert(s) will analyse the relationships between EPs and the underlying EAs through the use of specific indicators and scores, studying the EAs that are most significant for each EP category, and correlating the information with the EP assessment carried out in Phase 1. This step will allow EAs to be compared, by providing an estimation of their overall pressure output level.

The purpose of the EP/SC Analysis is to evaluate how the effects of EPs in the area can be linked to the detected SC alteration levels. These potential environmental impacts are examined as possible causal links between a given altered SC and the detected EP. Whenever possible, their relative significance is evaluated by the Expert(s) following dedicated assessment stages, based on indicators, references and principles provided by the methodology. Such an approach provides a guide to the formulation of expert judgements, aiming to achieve the highest degree of information and analysis uniformity.

As a result, Phase 2 analysis will allow the profile EA→EP→SC flow of interactions to be used in the later analysis and operational recommendation steps.

Phase 3 – Prioritisation

During the Prioritisation Phase, the Expert(s) will deal with the synthesis and prioritisation of the interactions analysed in the previous steps. By tracing back the EA→EP→SC flow of interactions, the effects of EAs – and their combination in terms of pressures and their impact on the Status components – can be synthesised, classified and prioritised in terms of their environmental relevance. This will allow us to provide context to the Operational Recommendations and Responses. Within Phase 3, the Expert(s) will also perform an analysis of any transboundary effects of EPs that might be present.

3. Analysis Methodology

3.1.
Phase 1 – Assessment

3.1.1.
Evaluation of Economic Activities

The EA classification was carried out using as a starting point the EA classification contained in CAMP Italy – Annex 38, which was derived from the MSFD – Annex III. On this basis, a comparative analysis between the latter and the matrix contained in the CRF was carried out, resulting in the development of the Unified Classification, with the aim of improving the model flexibility and its capability to bridge the two classification systems. The links between the CRF and MSFD identified during the analysis are also presented in Figure 3. Figure 3 presents the classification of Economic Activities, including 10 main sectors (A1-A10) and the relative categories of EAs. The EA acronym hereby employed refers to a specific EA category (e.g. "Fishing: harvesting" or "Energy infrastructure: renewable").

ECONOMIC ACTIVITES CLASSIFICATION

TYPE	ECONOMIC ACTIVITIES FROM MSFD ANNEX III	CORRESPONDING CRF-ICZM CLASSIFICATION	UNIFIED CLASSIFICATION	CODE
Physical restructuring of rivers, coastline or seabed (water management)	Land claim	Urban sprawl Agricultural uses	Land take for urban industrial and agricultural uses	A1.1
	Canalisation and other watercourse modifications	Infrastructures: ports, coastal defence and others	Infrastructure related to coastal/watercourse morphology alteration (dams, canalisattion, trenching, ports)	A1.2
	Coastal defence and flood protection	Infrastructures: ports, coastal defence and others	Infrastructure for coastal resilience/defence and flood protection	A1.3
	Offshore structures (other than for oil/gas/renewables)	-	Offshore structures (other than for oil/gas/renewables)	A1.4
	Restructuring of seabed morphology, including dredging and depositing of materials	Maritime activities: sand / mineral mining - Utilization of natural resources: mining. Infrastructures: ports, coastal defence and others.	Utilization of natural resources: dredging and depositing (coastal and maritime areas)	A1.5
Extraction of non-living resources	Extraction of minerals (rock, metal ores, gravel, sand, shell)	Maritime activities: sand / mineral mining - Utilization of natural resources: mining	Utilization of natural resources: extraction/mining of sand, gravel, rocks, minerals	A2.1
	Extraction of oil and gas, including infrastructure	Energy infrastructures	Utilization of natural resources: extraction of oil and gas and relative infrastructures	A2.2
	Extraction of salt	Util. of natural resources: desalination plants	Utilization of natural resources: desalination plants	A2.3
	Extraction of water	Util. of natural resources	Utilization of natural resources: water extraction	A2.4
Production of energy	Renewable energy generation (wind, wave and tidal power), including infrastructure	Energy infrastructures	Energy infrastructures: renewables	A3.1
	Non-renewable energy generation	Energy infrastructures	Energy infrastructures: non-renewables	A3.2
	Transmission of electricity and communications (cables)	Maritime activities: cables and pipelines	Energy transmission (including cables and pipelines)	A3.3
Extraction of living resources	Fish and shellfish harvesting (professional, recreational)	Fishing	Fish and shellfish harvesting	A4.1
	Fish and shellfish processing	Fishing	Fish and shellfish processing	A4.2
	Marine plant harvesting	-	Marine plant harvesting	A4.3
	Hunting and collecting for other purposes	Bird hunting	Hunting, collecting and predator control (including birds)	A4.4
Cultivation of living resources	Aquaculture – marine, including infrastructure	Aquaculture	Marine aquaculture	A5.1
	Aquaculture – freshwater	Aquaculture	Freshwater aquaculture	A5.2
	Agriculture	Agriculture	Agriculture	A5.3
	Forestry	-	Forestry (silviculture)	A5.4
Transport	Transport infrastructure and ports	Infrastructures: ports, coastal defence and others	Transport infrastructures (including ports)	A6.1
	Transport – shipping	Maritime activities: shipping	Transport – shipping	A6.2
	Transport – air	-	Transport – air	A6.3
	Transport – land	-	Transport – land	A6.4
Urban and industrial uses	Urban uses	-	Urban uses	A7.1
	Industrial uses	Industry	Industry and industrial uses	A7.2
	Waste treatment and disposal	Infrastructures: ports, coastal defence and others	Waste treatment and disposal infrastructure	A7.3
Tourism and leisure	Tourism and leisure infrastructure	Tourism, sporting, recreational activities	Tourism, sporting, recreational (infrastructure)	A8.1
	Tourism and leisure activities	Tourism, sporting, recreational activities	Tourism, sporting, recreational (activities)	A8.2
Security/defence	Military operations (subject to Article 2(2))	Infrastructures: ports, coastal defence and others	Military operations and infrastactures	A9.1
Education and research	Research, survey and educational activities	-	Research, survey and educational activities	A10.1

Figure 3. EA classification

In order to classify the EAs present in the area, the Expert will at first identify which EA sub-categories are present in the area, by marking them with a "p" flag (implying their presence) in the EIAT – EA Table sheet (whose template is shown in Figure 4).

EA TABLE				
TYPE	**ECONOMIC ACTIVITY**	**CODE**	**RLP**	**DATA GAPS**
Physical restructuring of rivers, coastline or seabed (water management)	Land take for urban industrial and agricultural uses	A1.1		
	Infrastructure related to coastal/watercourse morphology alteration (dams, canalisatition, trenching, ports)	A1.2		
	Infrastructure for coastal resilience/defence and flood protection	A1.3		
	Offshore structures (other than for oil/gas/renewables)	A1.4		
	Utilization of natural resources: dredging and depositing (coastal and maritime areas)	A1.5		
Extraction of non-living resources	Utilization of natural resources: extraction/mining of sand, gravel, rocks, minerals	A2.1		
	Utilization of natural resources: extraction of oil and gas and relative infrastructures	A2.2		
	Utilization of natural resources: desalination plants	A2.3		
	Utilization of natural resources: water extraction	A2.4		
Production of energy	Energy infrastructures: renewables	A3.1		
	Energy infrastructures: non-renewables	A3.2		
	Energy transmission (including cables and pipelines)	A3.3		
Extraction of living resources	Fish and shellfish harvesting	A4.1		
	Fish and shellfish processing	A4.2		
	Marine plant harvesting	A4.3		
	Hunting, collecting and predator control (including birds)	A4.4		
Cultivation of living resources	Marine aquaculture	A5.1		
	Freshwater aquaculture	A5.2		
	Agriculture	A5.3		
	Forestry (silviculture)	A5.4		
Transport	Transport infrastructures (including ports)	A6.1		
	Transport – shipping	A6.2		
	Transport – air	A6.3		
	Transport – land	A6.4		
Urban and industrial uses	Urban uses	A7.1		
	Industry and industrial uses	A7.2		
	Waste treatment and disposal infrastructure	A7.3		
Tourism and leisure	Tourism, sporting, recreational (infrastructure)	A8.1		
	Tourism, sporting, recreational (activities)	A8.2		
Security/defence	Military operations and infrastuctures	A9.1		
Education and research	Research, survey and educational activities	A10.1		

Figure 4. EA Table template

For each identified EA, the Expert needs to extract from the available data – and keep track of – the following elements to be used in later analysis phases:

▪ Composition, distribution and characteristics of the specific EA category in the area (e.g. types of plants/sub-activities present in the area); and

▪ Spectrum of the EPs generated by the analysed EA category and their localisation with respect to the 4 ICZM zones.

After determining this primary information, in the EA Table, the Expert(s) can provide an indication of the relevance of each EA with respect to the reference geographical context, using a quali-quantitative Relative level of Presence (RLP) score, using the following values:

▪ RPL = 0 → EA not present
▪ RPL = 10 → very low presence
▪ RPL = 20 → low presence
▪ RPL = 30 → moderate presence
▪ RPL = 40 → high presence
▪ RPL = 50 → very high presence

3.1.2.
Environmental Pressure Evaluation

The proposed Pressure classification was carried out using the classification contained in Annex X (*Common Typology of Pressures on the Natural Environment Resulting from Anthropogenic Activities and their Interlinking Impacts*) of the *Integrated Monitoring and Assessment Guidance*, UNEP/MED WG.463/Inf.9 document [4], as a starting point. On this basis, a

comparative analysis between the latter and the pressure classification contained in MSFD – Annex III [6] and GES Decision 848 [7] was carried out, resulting in the developed Unified Classification, with the aim of improving the model flexibility and its capability of bridging the two classification systems. The EP acronym hereby employed refers to a specific EP category (e.g. "Input of nutrients – including organic matter" or "Input of litter – solid waste matter, microsized litter").

The Expert will rely on the EIAT – EP Table tool for the EP analysis (a template of the EP Table is presented in Figure 6). The proposed classification table for Pressures is presented in Figure 5, including the 5 main pressure types (P1-P5) and relative categories. References to the relevant EOs and the main IMAP CIs are also shown. The details of the EOs and of the corresponding CIs referenced in the analysis are shown in Figure 5 (as per WG.463/Inf.9 [4]). Pressure classification is linked to the relevant IMAP indicators, as shown in Figure 5, so that the expert involved in the analysis will be able to refer to such CIs, when applicable. As shown in Figure 6, the classification of the EP levels is split across the 4 ICZM zones.

TYPE	CODE	UNIFIED PRESSURE CLASSIFICATION	CORRESPONDING PRESSURES FROM IMAP (IG.22/Inf.7-2016)	CORRESPONDING PRESSURES FROM MSFD ANNEX III	REFERENCE IMAP INDICATORS	REFERENCE MSDF CRITERIA	REFERENCE PRESSURE-BASED EOs	POTENTIALLY AFFECTED STATUS-BASED EOs
Physical	P1.1	Physical damage/disturbance and morphological alteration (substrate, sea-floor, coast, land, shoreline, including erosion/accretion)	Alteration of sea-floor/water body morphology; Change of sea-floor substrate; Disturbance/damage to sea-floor	Physical disturbance to seabed (temporary or reversible)	- ; - ; -	D6C1, D6C2, D6C3	- ; - ; -	EO6, EO8
	P1.2	Extraction of sea-floor and land (soil and subsoil)	Extraction of sea-floor and subsoil minerals (e.g. sand, gravel, rock, oil, gas)	Physical loss (due to permanent change of seabed substrate or morphology and to extraction of seabed substrate)	-	D6C1	-	EO6, EO8
Hydrological	P2.1	Changes to hydrological conditions (e.g. wave action, currents, salinity, temperature, input/extraction of water)	Changes to hydrological conditions; Water discharges (with/without contaminants); Water movement changes; Water extraction	Changes to hydrological conditions; Input of water - point sources (e.g. brine); -	CI15	D7C1, D7C2	EO7	EO1, EO3-C17, EO4, EO6, EO8
Energy	P3.1	Input of sound	Input of sound	Input of anthropogenic sound (impulsive, continuous)	CI26, CI27	D11C1, D11C2	EO11	EO1, EO3-C17, EO4
	P3.2	Input of electromagnetic fields or light	Input of electromagnetic and seismic waves	Input of other forms of energy (including electromagnetic fields, light and heat)	-	-		
	P3.3	Input of seismic waves	Input of light		-	-		
	P3.4	Input of heat	Input of heat		-	-		
Biological	P4.1	Translocation of (native) species, introduction/spread of non-indigenous or genetically modified species	Translocation of (native) species; Introduction of genetically modified species; Introduction or spread of non-indigenous species	Input of genetically modified species and translocation of native species; Input or spread of non-indigenous species	CI6	- ; D2C1, D2C2, D2C3	EO2	EO1, EO3-C17, EO4
	P4.2	Introduction of microbial pathogens	Introduction of microbial pathogens	Input of microbial pathogens	CI21	-		
	P4.3	Removal of species (target/non-target, selective extraction)	Removal of species (target/non-target, selective extraction)	Removal of species (targeted, non-targeted)	CI8 to CI12	D3C1, D3C2, D3C3	EO3	EO1, EO3-C17
	P4.4	Disturbance, injury and death to species	Disturbance, injury and death to species	Extraction of, or mortality/injury to, wild species (by commercial and recreational fishing and other activities); Injury/death to species; Disturbance of species (e.g. where they breed, rest and feed) due to human presence	CI9 to CI12	D6C3, D7C2; D2C3		
	P4.5	Cultivation/artificialisation of natural habitat	Cultivation/artificialisation of natural habitat	Loss of, or change to, natural biological communities due to cultivation of animal or plant species	-	-	-	EO1, EO6, EO8
Chemical, pollution, litter	P5.1	Input of nutrients and organic matter (diffuse/point sources, atmospheric deposition)	Nutrient enrichment (N, P, organic matter)	Input of nutrients – diffuse sources, point sources, atmospheric deposition; Input of organic matter – diffuse sources and point sources	CI17 to CI21, CI13, CI14	D5C1, D5C2, D5C3, D5C4, D5C5, D5C6, D5C7, D5C8	EO9, EO5	EO1, EO3-C17, EO4, EO6, EO8
	P5.2	Input of contaminants (synthetic, non-synthetic, radionuclides) – diffuse/point sources, atmospheric deposition, acute events	Input of contaminants (synthetic substances, non-synthetic substances, radionuclides) - diffuse sources, point sources, acute events	Input of other substances (e.g. synthetic sub-stances, non-synthetic substances, radionu- clides) – diffuse sources, point sources, at- mospheric deposition, acute events	CI17 to CI21	D8C1, D8C2, D8C3, D8C4, D9C1	EO9	
	P5.3	Input of litter (solid waste matter, microsized litter)	Input of litter (solid waste matter, microsized litter)	Input of litter (solid waste matter, including micro-sized litter)	CI22 to CI24	D10C1, D10C2, D10C3, D10C4	EO10	
	P5.4	Input of CO2 and greenhouse gases	Input of CO2 and other greenhouse gases	-	-	-	-	

Figure 5. EP classification

EP TABLE								
TYPE	**ENVIRONMENTAL PRESSURE**	**CODE**	EPL				**DATA GAPS**	
Physical	Physical damage/disturbance and morphological alteration (substrate, sea-floor, coast, land, shoreline, including erosion/accretion)	P1.1						
Physical	Extraction of sea-floor and land (soil and subsoil)	P1.2						
Hydrological	Changes to hydrological conditions (e.g. wave action, currents, salinity, temperature, input/extraction of water)	P2.1						
Energy	Input of sound	P3.1						
Energy	Input of electromagnetic fields or light	P3.2						
Energy	Input of seismic waves	P3.3						
Energy	Input of heat	P3.4						
Biological	Translocation of (native) species, introduction/spread of non-indigenous or genetically modified species	P4.1						
Biological	Introduction of microbial pathogens	P4.2						
Biological	Removal of species (target/non-target, selective extraction)	P4.3						
Biological	Disturbance, injury and death to species	P4.4						
Biological	Cultivation/artificialisation of natural habitat	P4.5						
Chemical, pollution, litter	Input of nutrients and organic matter (diffuse/point sources, atmospheric deposition)	P5.1						
Chemical, pollution, litter	Input of contaminants (synthetic, non-synthetic, radionuclides) – diffuse/point sources, atmospheric deposition, acute events	P5.2						
Chemical, pollution, litter	Input of litter (solid waste matter, microsized litter)	P5.3						
Chemical, pollution, litter	Input of CO_2 and greenhouse gases	P5.4						
			LW	IN	SW	IS		
			ICZM ZONES					

Figure 6. EP Table template

In the EP Table, a quali-quantitative Environmental Pressure Level (EPL) score is used to quantify the intensity of EPs affecting the area. On the basis of the available data and reports, the Expert will assign an EPL score of 0 to 50 according to the following quali-quantitative scale:

- EPL = 0 → no pressure,
- EPL = 10 → very low pressure intensity,
- EPL = 20 → low level of pressure intensity,
- EPL = 30 → moderate level of pressure intensity,
- EPL = 40 → severe level of pressure intensity,
- EPL = 50 → very severe level of pressure intensity.

3.1.3.
Environmental Status Evaluation

The main elements embedded in the SC classifications are the EOs [4] and GES Decision 848 [7]. The degree of good-status alteration was framed on the basis of the 5 (status) ecological objectives of the IMAP: EO1, EO3, EO4, EO6 and EO8. The classification table for SC analysis is presented in Figure 7, along with the relevant Common Indicators and Descriptions.

CODE	STATUS COMPONENTS	DESCRIPTION	REFERENCE EOs	REFERENCE INDICATORS/CRITERIA		
				IMAP	MSFD	DESCRIPTION
S1	Biodiversity	Biological diversity is maintained or enhanced. The quality and occurrence of coastal and marine habitats and the distribution and abundance of coastal and marine species are in line with prevailing physiographic, hydrographic, geographic and climatic conditions.	EO1	CI1		Habitat distributional range (EO1) to also consider habitat extent as a relevant attribute
				CI2		Condition of the habitat typical species and communities
				CI3		Species distributional range (EO1 related to marine mammals, seabirds, marine reptiles and coastal protected species)
				CI4		Population abundance of selected species (EO1, related to marine mammals, seabirds, marine reptiles and coastal protected species)
				CI5		Population demographic characteristics (EO1, e.g. body size or age class structure, sex ratio, fecundity rates, survival/mortality rates related to marine mammals, seabirds, marine reptiles and coastal protected species)
S2	Marine and coastal food webs and fish stocks	Alterations to components of marine and coastal food webs caused by resource extraction or human-induced environmental changes do not have long-term adverse effects on food web dynamics and related viability	EO4	-	D4C1	The diversity (species composition and their relative abundance) of the trophic guild is not adversely affected due to anthropogenic pressures
				-	D4C2	The balance of total abundance between the trophic guilds is not adversely affected due to anthropogenic pressures.
				-	D4C3	The size distribution of individuals across the trophic guild is not adversely affected due to anthropogenic pressures
				-	D4C4	Productivity of the trophic guild is not adversely affected due to anthropogenic pressures (to be used in support of criterion D4C2, where necessary)
		Populations of selected commercially exploited fish and shellfish are within biologically safe limits, exhibiting a population age and size distribution that is indicative of a healthy stock	EO3	CI7		Spawning stock Biomass
S3	Sea-floor and coastal integrity		EO6	-	D6C4	The extent of loss of the habitat type, resulting from anthropogenic pressures, does not exceed a specified proportion of the natural extent of the habitat type in the assessment area
				-	D6C5	The extent of adverse effects from anthropogenic pressures on the condition of the habitat type, including alteration to its biotic and abiotic structure and its functions (e.g. its typical species composition and their relative abundance, absence of particularly sensitive or fragile species or species providing a key function, size structure of species), does not exceed a specified proportion of the natural extent of the habitat type in the assessment area.
S4	Coastal ecosystems, landscapes, seascape coastal wetlands, estuaries, coastal forest and wood, dunes	The natural dynamics of coastal areas are maintained and coastal ecosystems and landscapes are preserved	EO8	CI16		Length of coastline subject to physical disturbance due to the influence of man-made structures
				CI25		Land use change

Figure 7. SC classification

The Expert will rely on the **EIAT − SC Table** tool for the SC analysis (a template of the SC Table is presented in Figure 8). The SC classification provides a comprehensive snapshot of the environmental status and its altered components, along with the corresponding EOs and CIs involved. As shown in Figure 8, the classification of the SC alteration levels is split across the 4 ICZM zones.

STATUS COMPONENTS TABLE

	STATUS COMPONENTS		SAL			
S1	Biodiversity	EO1				
S2	Marine and coastal food webs	EO4, EO3				
S3	Sea-floor and coastal integrity	EO6				
S4	Coastal ecosystems and landscapes	EO8				
			LW	IN	SW	IS
			ICZM ZONES			

Figure 8. SC Table template

In the SC Table, a quali-quantitative Status Alteration Level (SAL) score is used to classify the alteration level of each SC with respect to GES. On the basis of the available data and reports, the Expert will rank each of the analysed SCs with a SAL, with reference to the following values:

- SAL = 0 → no alteration,
- SAL = 10 → very low alteration,
- SAL = 20 → low alteration,
- SAL = 30 → moderate alteration,
- SAL = 40 → severe alteration,
- SAL = 50 → very severe alteration (with respect to GES).

3.2.
Phase 2 – Interactions

3.2.1.
EA/EP Analysis

Having completed the Phase 1 – EA assessment step, and having identified the spectrum of EPs generated by each EA, the Expert(s) will rely on a quali-quantitative Pressure Generation Capability (PGC) score to qualify the ability of a given EA to generate a specific EP. The Expert(s) will use the PGC scores to populate the PGC Matrix, which quantifies how strongly a particular EP is correlated to each given underlying EA. A template of the EIAT – PGC Matrix sheet to be used by the Expert(s) is shown in Figure 9.

Figure 9. PGC Matrix template

For the assignment of the PGC scores, the Expert(s) will proceed by analysing each EP category individually, on the basis of the available data and reports. For any given EP, the Expert(s) will assign individual PGC scores to each of the EAs previously identified. For each analysed EA/EP pair, the PGC scores have values in the 0 to 50 range, according to the following scoring:

- PGC = 0 → the EA does not generate EP,
- PGC = 10 → the EA has a very low capability to generate EP,
- PGC = 20 → the EA has a low capability to generate EP,
- PGC = 30 → the EA has a moderate capability to generate EP,

- PGC = 40 → the EA has a high capability to generate EP,
- PGC = 50 → the EA has a very high capability to generate EP.

PGC scoring is split across the 4 ICZM zones, so that a dedicated score is employed to describe how each EP (and underlying EAs) is affecting each area. This localisation is based on the geographical distribution of the generated EPs (not the EAs), since a specific EA, while localised in a confined zone, can produce a spectrum of pressures able to extend over all 4 ICZM zones.

The assignment of each PGC score is carried out through the following steps:

1. Identification of the spectrum of pressures generated by each EA (as per Phase 1 – EA Table).

2. Identification of the distribution of such pressures in the 4 ICZM zones.

3. Quantification, for each pressure type and ICZM zone, of the EA/EP correlation.

After assigning PGC scores for each row of the EA/EP Matrix, the EIAT automatically computes the EA/EP Matrix. The EIAT – EA/EP Matrix (Figure 10) explodes the EP Table, identifying the individual contributions due to the EAs present in the area, whose cumulation results in the spectrum of EPL scored in Phase 1 – EP Table. The values presented in the EA/EP Matrix are (specific) Environmental Pressure Level (EPL) scores, which are used to identify the individual contributions of all EAs with values in the 0-50 range.

The EA/EP Matrix also reports and compares the total EPL scores for each EA, as an estimation of their overall pressure output level. The latter information will be referred to during the subsequent prioritisation and operational response steps.

Figure 10. EA/EP Matrix template

3.2.2.
EP/SC Analysis

The purpose of the EP/SC PIS Matrix (Figure 11) is to evaluate how the effects of EPs in the area can be linked to the detected SC alteration levels. Each pressure can potentially impact a spectrum of different status components, via different paths and with variable degrees of interaction. The correlations existing between each of the EPs and the affected SCs identified during Phase 1 are identified through expert judgement as potential impacts.

Figure 11. EP/SC PIS Matrix

The EP/SC analysis involves the following matrices and scoring system.

Pressure Impact Score (PIS). PISs examine how strongly a detected EP can impact a given SC. PISs are assigned by the Expert(s) to provide an indication of the strength of each EP/SC correlation under examination, according to the following score:

- PIS = 0 → no EP/SC correlation
- PIS = 10 → very low relevance of the EP/SC correlation
- PIS = 20 → low relevance of the EP/SC correlation
- PIS = 30 → moderate relevance of the EP/SC correlation
- PIS = 40 → high relevance of the EP/SC correlation
- PIS = 50 → very high relevance of the EP/SC correlation.

EIAT – EP/SC PIS Matrix. In the EIAT – PIS Matrix, the Expert(s) will examine possible causal links between the altered SCs and the detected EPs, relying on the usage of PIS values to identify and evaluate all possible EP/SC interactions. PIS scores are listed in the EIAT – PIS Matrix. A template PIS Matrix is shown in Figure 11. PIS scores are assigned for each of the four ICZM zones.

The Expert(s) will rely on the following two-step approach for the EA/EP correlation analysis:

1. Preliminary cross-check. In the PIS Matrix, for each EP/SC pair, the Expert(s) should cross-check the coherence of each altered SC (and the composition of the relative indicators) with each EP (and sub-pressure spectrum). The cross-check should verify coherence in terms of the spatial localisation of the EP and SC alteration, along with the plausibility of their causal interaction. In the absence of dedicated data (allowing the direct identification of such a causal links), it is recommended that the Expert refers to the general list of potential impacts presented in the MEDPOL Table [2]. If the EP/SC pair under examination passes the cross-check and qualifies as a possible correlation, the Expert(s) should keep track of this outcome by marking the corresponding cell of the PIS matrix with a "p" flag (implying the plausibility of the link).

2. Pressure Impact Score. For the EP/SC pairs flagged in the previous steps – whenever possible in relation to the availability and applicability of specific data – the Expert(s) can override the "p" flag with an appropriate PIS score, according to the score values listed before.

3.3.
Phase 3 – Prioritisation

During the Prioritisation Phase, the Experts(s) will deal with the synthesis and prioritisation of the main interactions analysed in the previous steps. By tracing back the EA→EP→SC flow of interactions, the effects of the EAs and EPs can be synthesised, classified and prioritised in terms of their environmental relevance and their impact on SCs. It is subsequently possible to trace which pressures and EAs are more strongly linked to a given status component alteration, by relying on the previously used scores and matrices. The following

prioritisation schemes can be employed, as detailed in the EIAT.

Prioritisation of EAs with respect to EPs. EAs can be listed in terms of their relative EP generation capability, ranked by their aggregated EPL scores (detailed in the above EA/EP Matrix), as an indication of their overall pressure output level.

Prioritisation of EAs with respect to a given EP. EAs are ranked on the basis of their EA-specific EPL score for a given EP as presented in the EA/EP Matrix.

Prioritisation of EPs. EPs are prioritised on the basis of their EPL score as presented in the above EP Table.

Prioritisation of altered SCs. Altered SCs are prioritised on the basis of their SAL score, as presented in the SC Table.

Prioritisation of EPs with respect to a given SC. For any given SC, EPs can be ranked with respect to their PIS value (detailed in the above SC/EP Matrix), in terms of their relative impact. In the absence of dedicated data allowing the direct identification of PIS scores (all plausible interactions are marked as "p" and no PIS value is provided), the prioritisation scheme falls back to the "Prioritisation of EPs" (all EP/SC links are assumed to be equally relevant).

Prioritisation of EAs with respect to a given SC. EAs can be ranked, given the spectrum of generated EPs, in terms of their relative impact on any given SC. This prioritisation is carried out on the basis of the PGC Matrix and PIS values, as detailed in the EIAT.

On the basis of the aforementioned prioritisation schemes, the Expert(s) will contextualise the identification of the most critical paths relative to the EA→EP→SC flow of interactions, and the understanding of their environmental relevance. The analysis of the

critical paths should be object of a dedicated short written comment elaborated by the Expert(s) as a starting point for the operational recommendations.

3.3.1.
Transboundary Aspects

To correctly assess the presence and relevance of potential transboundary aspects, the following key characteristics should be investigated among the analysed DPSIR elements:

- The presence of EAs with an intrinsic transnational scope (e.g., marine transport or pipelines) or EAs with a localisation close to or beyond/across transnational borders (e.g., offshore plants); and

- The presence of EAs with the potential to generate EPs capable of diffusing, propagating, or acting at a transnational level (e.g., input of contaminants, marine litter/micro-litter).

Taking into consideration these two key characteristics, the presence of exogenous inputs of EP – with respect to the assessed area should be investigated. On the contrary, the potential outward diffusion and impact of an EP detected and localised within the bounds of the assessed area should also be kept under consideration.

3.4.
Reference Information

3.4.1.
Summary of the Scoring System Employed

A summary table containing an overview of all the scored indicators and relative DPSIR categories employed in the analysis is presented in Figure 12. A detail of the scored values and ranges is presented in Figure 13.

RLP	**Relative Level of Presence,** representing the relevance of the EA with respect to the reference geographical context
PGC	**Pressure Generation Capacity** score, qualifing the ability of a given EA to generate a specific EP
EPL	**Environmental Pressure Level** score, quantifying the intensity of EPs affecting the area
SAL	**Status Alteration Level** score, classifying the alteration level of SCs with respect to the GES
PIS	**Pressure Impact Score,** examining how strongly a detected EP can impact on a given SC

Figure 12. Overview of the scoring system

DPSIR elements / score value	Economic Activities	Economic Activities/ Environmental Pressures	Environmental Pressures	Status Components	Status Components/ Environmental Pressures
	RLP	**PGC**	**EPL**	**SAL**	**PIS**
0	not present	the EA does not generate EP	no pressure	no alteration	no EP/SC correlation
10	very low presence	the EA has a very low capability to generate EP	very low pressure intensity	very low alteration	very-low relevance of the EP/SC correlation
20	low presence	the EA has a low capability to generate EP	low level of pressure intensity	low alteration	low relevance of the EP/SC correlation
30	moderate presence	the EA has a moderate capability to generate EP	moderate level of pressure intensity	moderate alteration	moderate relevance of the EP/SC correlation
40	high presence	EA has a high capability to generate EP	severe level of pressure intensity	severe alteration	high relevance of the EP/SC correlation
50	very high presence	the EA has a very high capability to generate EP	very severe level of pressure intensity	very severe alteration	very high relevance of the EP/SC correlation.

Figure 13. Scoring system values and ranges

3.4.2.
EOs, CIs and Descriptors

The following summary table (Figure 14) contains an overview of the IMAP EOs and CIs related to the relative MSFD Descriptors. The reported EOs and CIs are taken into consideration as primary sources of information from the available monitoring reports and data relative to environmental pressures and status components in the area under assessment.

D1-MSFD		**BIODIVERSITY (EO1): CI1-CI5**
	CI1	CI1. Habitat distributional range (EO1) to also consider habitat extent as a relevant attribute
	CI2	CI2. Condition of the habitat's typical species and communities
	CI3	CI3. Species distributional range (EO1 related to marine mammals, seabirds, marine reptiles);
	CI4	CI4. Population abundance of selected species (EO1, related to marine) mammals, seabirds, marine reptiles
	CI5	CI5. Population demographic characteristics (EO1, e.g. body size or age class structure, sex ratio, fecundity rates, survival / mortality rates related to marine mammals, seabirds, marine reptiles)
D2-MSFD		**NON-INDIGENOUS SPECIES (EO2): CI6**
	CI6	CI6. Trends in abundance, temporal occurrence, and spatial distribution of non-indigenous species, particularly invasive, non-indigenous species, notably in risk areas (EO2, in relation to the main vectors and pathways of spreading of such species)
D3-MSFD		**FISHERIES (EO3): CI7-CI12**
	CI7	CI7. Spawning stock Biomass
	CI8	CI8. Total landings
	CI9	CI9. Fishing Mortality
	CI10	CI10. Fishing effort
	CI11	CI11. Catch per unit of effort (CPUE) or Landing per unit of effort (LPUE) as a proxy
	CI12	CI12. Bycatch of vulnerable and non-target species (EO1 and EO3)
D4-MSFD		**MARINE FOOD WEBS (EO4)**
D5-MSFD		**EUTHROPICATION (EO5)**
	CI13	CI13. Concentration of key nutrients in water column
	CI14	CI14. Chlorophyll-a concentration in water column
D6-MSFD		**SEA FLOOR INTEGRITY (EO6)**
D7-MSFD		**HYDROGRAPHY (EO7)**
	CI15	CI15. Location and extent of the habitats impacted directly by hydrographic alterations (EO7) to also feed the assessment of EO1 on habitat extent
No MSFD Descriptor		**COAST (EO8)**
	CI16	CI16. Length of coastline subject to physical disturbance due to the influence of man-made structures (EO8) to also feed the assessment of EO1 on habitat extent
	CI25	candidateCI25. Candidate Indicator: Land use change
D8-MSFD		**CONTAMINATION (EO9)**
	CI17	CI17. Concentration of key harmful contaminants measured in the relevant matrix (EO9, related to biota, sediment, seawater)
	CI18	CI18. Level of pollution effects of key contaminants where a cause and effect relationship has been established
	CI19	CI19. Occurrence, origin (where possible), and extent of acute pollution events (e.g. slicks from oil, oil products and hazardous substances) and their impact on biota affected by this pollution
D9-MSFD	CI20	CI20. Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels in commonly consumed seafood
Bathing Directive	CI21	CI21. Percentage of intestinal enterococci concentration measurements within established standards
D10-MSFD		**MARINE LITTER (EO10)**
	CI22	CI22. Trends in the amount of litter washed ashore and/or deposited on coastlines (including analysis of its composition, spatial distribution and, where possible, source)
	CI23	CI23. Trends in the amount of litter in the water column including microplastics and on the seafloor
	CI24	candidateCI24. Candidate Indicator: Trends in the amount of litter ingested by or entangling marine organisms focusing on selected mammals, marine birds and marine turtles
D11-MSFD		**ENERGY (EO11)**
	CI26	candidateCI26. Candidate indicator: Proportion of days and geographical distribution where loud, low, and mid-frequency impulsive sounds exceed levels that are likely to entail significant impact on marine animals
	CI27	candidate27. Candidate Indicator: Levels of continuous low frequency sounds with the use of models as appropriate

Figure 14. IMAP EOs − CIs and related MSFD descriptors

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