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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 2: EO7 Hydrography: Common Indicator 15 "Location and extent of the habitats impacted directly by hydrographic alterations"

Indicator guidance fact sheet; List of habitats relevant for Common Indicator 15; proposed Data Standards, and proposed alternative version of the factsheet

Contents

Note by the Secretariat

The 19th Meeting of the Contracting Parties (COP 19), held in February 2016, adopted the Integrated Monitoring and Assessment Programme (IMAP) of the Mediterranean Sea and Coast and Related Assessment Criteria (Decision IG. 22/7), with a list of regionally agreed good environmental status descriptions, common indicators and targets, with principles and clear timeline for its implementation. Furthermore, the UN Environment/MAP Programme of Work (PoW) adopted at COP 19, included under Output 1.4.3: "Implementation of IMAP (the EcAp-based integrated monitoring and assessment programme) coordinated, including GES common indicators factsheets". In line with IMAP, indicator guidance factsheets were developed, reviewed and agreed by the Meeting of the Ecosystem Approach Correspondence Group on Monitoring (CorMon) on Coast and Hydrography held in Madrid, Spain, 3 March 2017 and by the Meeting of the PAP/RAC Focal Points, held in Split, Croatia, 3-4 May 2017, for the Common Indicators to ensure coherent monitoring. The indicator guidance factsheets provide concrete guidance to the Contracting Parties supporting implementation of their respective national monitoring programmes aligned with IMAP. The comments received by the Contracting Parties were considered and approved by the 6th Meeting of the Ecosystem Approach Coordination Group, held in Athens, Greece, 11th September 2017. It must be noted that the indicator guidance factsheets were used during the elaboration of the Mediterranean Quality Status Report 2017 (Med QSR 2017).

The present document outlines the indicator guidance factsheets for Common Indicator (CI) 15 related to the Ecological Objective 7 (Hydrography). A specific point to discuss is the List of habitats that has to be taken into account when monitoring impacts on hydrographic alterations. This List has to be harmonised (actually it has to be identical) with the List of habitats that are monitored under the EO1 (provided by SPA/RAC). The List has been agreed by the Meeting of Experts on the finalization of the Classification of benthic marine habitat types for the Mediterranean region and the Reference List of Marine and Coastal Habitat Types in the Mediterranean Rome, Italy, 22-23 January 2019. In order to guarantee harmonisation and linkages between the EOs and indicators the above mentioned List of habitats relevant for EO7 is therefore, expected to be also approved by this meeting. Upon consideration by the Meeting, this list will become Annex I to the indicator guidance factsheet for the CI 15.

Within the EU funded EcAp-MED II Project the development of a Pilot IMAP Compatible Data and Information System (IMAP (Pilot) Info System) was supported. This (Pilot) Info System will enable the CPs to have a harmonised framework for reporting on monitoring for the IMAP indicators, i.e they will be able to receive and process data according to the proposed Data Standards (DSs) and Data Dictionaries (DDs) that set the basic information on data reporting within IMAP. The first drafts of DSs and DDs for the selected IMAP Common Indicators were reviewed by the Regional Meeting on IMAP Implementation: Best Practices, Gaps and Common Challenges (IMAP Best Practices Meeting), Rome, Italy, 10-12 July 2018. The final draft of the DSs and DDs for the CI 15 will be presented by Info/RAC and a discussion will follow. The meeting is expected to review and acknowledge the proposed DSs and DDs for the CI 15.

Finally, the meeting will have the opportunity to comment and suggest on the simplified version of the guidance factsheet for the CI 15 of EO7 Hydrography. The reason to prepare and present a simplified version of this factsheet was expressed by some Contracting Parties at several occasions such as at the PAP/RAC Focal Points meetings, at Sub-regional meeting on Coast and Hydrography (December 2017), in comments on QSR assessment factsheets and

in particular at the 6th EcAp Coordination Group meeting (September 2017), where PAP/RAC promised to prepare a simplified version of the indicator guidance factsheet and present it to the present Cormon meeting. It is believed that this indicator is too complex and not mature enough to be implemented at the Mediterranean scale. Therefore, not feasible to be implemented by all Mediterranean countries, in particular these from the South and East Mediterranean. It should be noted that the EU member states are obliged to implement the Marine Strategy Framework Directive (MSFD) and monitor this indicator according to its EU requirements. The EcAp in the framework of the MAP is not a direct transposition of this Directive to the whole Mediterranean although some coherence and harmonisation is needed as we all share the same sea. However, the human, financial, technical and other capacities and resources needed to implement the approved indicator guidance factsheet vary significantly. Therefore, PAP/RAC drafted a more simplified version, i.e. an 'alternative' Guidance Factsheet, in collaboration with our expert from France. It is believed that as such it will allow for monitoring to all countries, and once enough experience is gained it could be extended to its original requirements. The meeting is expected to provide an opinion on this alternative factsheet and recommend on future steps. This will be taken into account by the EcAp Coordination Group at its next meeting (September 2019).

1. Indicator guidance factsheet for EO7 Hydrography Common Indicator 15 "Location and extent of the habitats impacted directly by hydrographic alterations"

Ecological Objective 7: Alteration of hydrographic conditions does not adversely affect coastal and marine ecosystems.

Indicator Title	Common Indicator 15: Location and extent of the habitats impacted directly by hydrographic alterations	
Relevant GES definition	**Related Operational Objective**	**Proposed Target(s)**
Negative impacts due to new structure are minimal with no influence on the larger scale coastal and marine system.	Alterations due to permanent constructions on the coast and watersheds, marine installations and seafloor anchored structures are minimised.	Planning of new structures takes into account all possible mitigation measures in order to minimize the impact on coastal and marine ecosystem and its services integrity and cultural/historic assets. Where possible, promote ecosystem health.

Rationale

Justification for indicator selection

After agreeing to progressively apply the ecosystem approach (EcAp) to the management of human activities in the Mediterranean at the 15th Meeting of the Contracting Parties to the Barcelona Convention (COP15, 2008), the Contracting Parties agreed, at COP17in 2012, on an overall vision and goals for EcAp, and on 11 ecological objectives for the Mediterranean. Among these ecological objectives was the Ecological Objective 7 („Alteration of hydrographical conditions"), with its clearly outlined operational objectives and indicators. EO7 corresponds to Descriptor 7 (Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems) of the European Marine Strategy Framework Directive (MSFD).

Ecological Objective 7 („Alteration of hydrographical conditions") addresses permanent alterations in hydrographic conditions due to new large-scale developments. An agreed common indicator - 'Location and extent of habitats impacted directly by hydrographic alterations' considers marine habitats which may be affected or disturbed by changes in hydrographic conditions (such as currents, waves, suspended sediment loads, etc*).

There is a clear link between EO7 and other ecological objectives, especially EO1 (Biodiversity). Such link needs to be determined on a case-by-case basis. For example, the definition of functional habitats under EO1 could help identify the priority benthic habitats for consideration in EO7. These priority habitats are are the ones from the reference list of marine and coastal habitat types in the Mediterranean, as approved by the meeting of experts on the finalization of the classification of benthic marine habitat types for the Mediterranean region and the Reference List of Marine and Coastal Habitat Types in the Mediterranean, Rome, Italy, 22-23 January 2019 - UNEP/MED WG.457/5). Ultimately, the assessment of impacts, including cumulative impacts, is a cross-cutting issue for EO1 and EO7.

Scientific References

Indicator Title	Common Indicator 15: Location and extent of the habitats impacted directly by hydrographic alterations

EC JRC (2015). Review of Commission Decision 2010/477/EU concerning MSFD criteria for assessing good environmental status Descriptor 7: Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems

EMEC Ltd (2005).Environmental impact assessment (EIA) guidance for developers at the European Marine Energy Centre.

OSPAR Commission (2012). MSFD Advice document on Good environmental status - Descriptor 7: Hydrographical conditions. A living document - Version 17 January 2012.

OSPAR Commission (2013).Report of the EIHA Common Indicator Workshop.

Royal Haskoning DHV (2012).Environmental Impact Assessment (EIA) and Appropriate Assessment (AA) Evaluation of assessment tools and methods. Lot 2: Analysis of case studies of port development projects in European estuaries. Tidal Rover Development (TIDE) Interreg IVB

Some reference and guidance documents on EIA can be found at :
http://ec.europa.eu/environment/eia/eia-support.htm

Policy Context and targets

Policy context description

Following the COP17 agreement on an overall vision and goals for EcAp, on 11 ecological objectives, operational objectives and indicators for the Mediterranean, a six-year cyclic review process of EcAp implementation was established (EcAp MED I 2012-2015), with the next EcAp cycle set to cover 2016-2021.

At COP18, in 2013, the targets for achieving GES of the Mediterranean Sea and its coastal zone by 2020 were adopted. In addition, through Decision IG. 21/3 (the so called "COP18 EcAp Decision") the EcAp roadmap was agreed on. The Contracting Parties also agreed to design an Integrated Monitoring and Assessment Programme (IMAP) by COP19, which would, for the first time, ensure a common assessment basis for the Mediterranean marine and coastal environment. At COP19, in 2016, the IMAP was adopted. The IMAP provides guidance to the parties on how to practically implement quantitative monitoring and assessment of the ecological status of the Mediterranean Sea and coast in line with the EcAp.

As part of the EcAp roadmap, expert-level monitoring discussions took place in the various Correspondence Groups on Monitoring (CORMONs) meetings on Biodiversity and Fisheries; Pollution and Litter; and Coast and Hydrography sub-clusters. An Integrated Correspondence Group on Monitoring Meeting (Integrated CORMON) took place on 30 March-1 April 2015, to discuss the main elements of the Integrated Monitoring and Assessment Programme.

In relation to EO7, the key recommendation of the Integrated CORMON was to develop a guidance document on how to reflect changes in hydrographical conditions in relevant assessments, such as EIAs and others. In response to this recommendation the „Guidance Document on how to reflect changes in hydrographical conditions in relevant assessments" was made (UNEP/MAP/PAP, 2015), aiming to define a methodological approach for assessing alterations of hydrographical conditions and the impact this may have on habitats due to permanent constructions and activities on the coast or at

Indicator Title	Common Indicator 15: Location and extent of the habitats impacted directly by hydrographic alterations

sea.

As for Protocols of the Barcelona Convention relevant for the EO7, the Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean calls to Contracting Parties of the Barcelona Convection for continuous monitoring of ecological processes, population dynamics, landscapes, as well as the impacts of human activities (Article 7 b). In addition, it calls to Parties to evaluate and take into consideration the possible direct or indirect, immediate or long-term impacts, including the cumulative impact of the projects and activities, on protected areas, species and their habitats (Article 17).

Another Protocol of the Barcelona Convention, the Protocol on the Integrated Coastal Zone Management in the Mediterranean, in its Article 9, calls for Parties to minimize negative impacts on coastal ecosystems, landscapes and geomorphology, coming from infrastructure, energy facilities, ports and maritime works and structures; or where appropriate to compensate these impacts by non-financial measures. In addition, the Article 9 demands maritime activities to be conducted "in such a manner as to ensure the preservation of coastal ecosystems in conformity with the rules, standards and procedures of the relevant international conventions".

Out of other international legislation that can be relevant for the EO7 Ecological Objective, it is essential to mention Marine Strategy Framework Directive – MSFD 2008/56/EC since EcAp's EO7 corresponds to MSFD's Descriptor 7 to large extent. The hydrographical conditions outlined under the MSFD are, to a large extent, comparable to the hydromorphological conditions referred to under the Water Framework Directive (WFD) which calls for the protection of all water resources, including coastal waters. EO7 overlaps with other policy frameworks, such as the Environmental Impact Assessment (EIA) procedure on the assessment of the environmental impacts of certain public and private projects; the Strategic Environmental Assessment (SEA) procedure on the assessment of the effects of certain plans and programs on the environment; assessments undertaken under Marine Spatial Planning (MSP); and in the context of integrated coastal zone management (ICZM).

Targets

Planning of new structures takes into account all possible mitigation measures in order to minimize the impact on coastal and marine ecosystem and its services integrity and cultural/historic assets. Where possible, promote ecosystem health.

Policy documents

Protocol on the ICZM in the Mediterranean - http://www.pap-thecoastcentre.org/pdfs/Protocol_publikacija_May09.pdf

Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean - http://www.rac-spa.org/sites/default/files/protocole_aspdb/protocol_eng.pdf

MSFD Directive - http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0056&from=EN

Other EU-related documents can be found at: http://ec.europa.eu/environment/eia/eia-support.htm

Indicator analysis methods

Indicator Definition

Indicator Title	Common Indicator 15: Location and extent of the habitats impacted directly by hydrographic alterations

The EO7 Common Indicator reflects location and extent of the habitats impacted directly by the alterations and/or the circulation changes induced by them. It concerns area/habitat and the proportion of the total area/habitat where alterations of hydrographical conditions are expected to occur (estimations by modelling or semi-quantitative estimation).

Methodology for indicator calculation

Methodology used for indicator measurement encompasses elaboration on:
(i) Mapping of area where human activities may cause permanent alterations of hydrographical conditions (using i.e. existing EIA, SEA and Maritime Spatial Planning -MSP);and
(ii) Mapping of habitat of interest (broad habitat types or other habitat types) in this area of hydrographical changes; and
(iii) Intersection of the spatial map of the areas of hydrographical changes with spatial maps of habitats to determine the areas of individual habitat types that are impacted directly by hydrographical changes.

A methodological approach of how to reflect the objectives of the Hydrography Common Indicator, in the main steps undertaken in an EIA (and SEA) procedure can be seen in Figure 1.

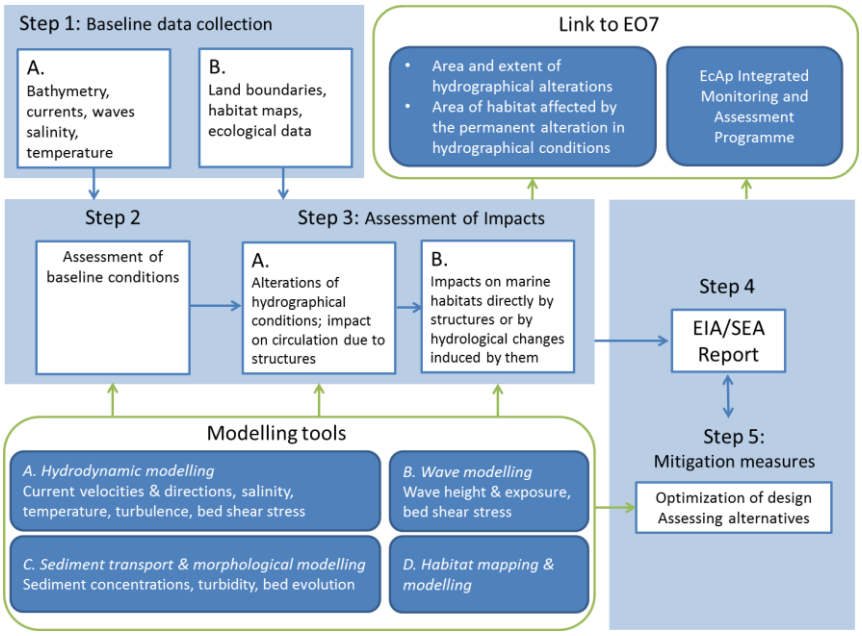

Figure 1. Methodological approach of how to integrate the EIA/SEA process with the implementation of EO7

More details on methodological approach can be found in Chater 4.1.1. of the „Guidance Document on how to reflect changes in hydrographical conditions in relevant assessments" (UNEP/MAP/PAP, 2015).

Interpreting Figure 1, the methodology to assess the indicator can be divided in three main steps:

- (1) Baseline hydrographical conditions characterisation (Monitoring and modelling of actual conditions without structure).
- (2) Assessment of hydrographical alterations induced by new structure (Comparing baseline conditions and with structure conditions, using modelling tools).

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- (3) Assessment of habitats impacted directly by hydrographic alterations (By crossing hydrographical alterations and habitat maps).

It is not possible to propose a unique and well-defined assessment methodology as it strongly depends on the site of interest and its natural hydrographical conditions; on the dimension, the location and the functions of the future structure, and on the data and means available. In order to harmonise the approach the following proposals were agreed by the meeting (CORMON, 3rd March, Madrid):

<u>New structures to be considered under EO7 assessment:</u>

As far as the type and dimension of structures to be taken into account: use the case by case approach depending on the nature of the coast, the function of the structure and the depth reached by the structure where appropriate threshold values are taken into account (such as absolute surface in m², range of depths where structure will be built (to avoid habitat "segmentation")). As an additional criterion it was agreed that all permanent structures, for which an EIA and/or a planning/building permit is required, should be considered.

<u>Hydrographical conditions to be considered:</u>

- At least, waves and currents changes (can be used to assess changes in bottom shear stress, turbulence,…).
- For sandy sites or sites with natural sediment dynamic, changes in sediment transport processes and turbidity and induced changes in morphology of the coast.
- If the new structure involves water discharge, water extraction or changes in fresh water movements: assessment of salinity and/or temperature changes.

Following the previous point, the base-line hydrodynamic conditions are defined by:

- Actual bathymetric data (with fine resolution to the coast or closed to the structure, less fine resolution off-shore) and knowledge of bottom nature (taken from habitat map EO1).
- Water level variations (tide, storm surge).
- Waves and currents characterisation in terms of direction, intensity, occurrence and period for waves (from long duration waves and currents data analysis and hydrodynamic modelling). Seasonal variability should be taken into account (mean/max/min values, quantile).
- For sandy sites or sites with sediment transit: quantitative assessment of sediment transport rate and turbidity, actual evolution tendencies (stability, erosion, accretion of the coast) and rate of change (ex: coast retreat of x meter/year).
- Temperature and salinity actual conditions if the new structure will involve water discharge, water extraction or changes in fresh water movements.

The knowledge of these base-line conditions with the new structure location and dimensions (footprint, height, shape …) will allow assessing the hydrographical conditions induced by the presence of the structure.
Then the comparison of hydrographical conditions without and with structure will allow assessing the significant changes, i.e. the alterations, induced by the structure.

The last step of the EO7 indicator calculation will consist in crossing hydrographical alterations and

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habitats maps. The link to EO1 is so essential, as map of benthic habitats in the zone of interest (broad habitat types and/or particular sensitive habitats) is required.

Indicator units

- km^2 of impacted habitat
- proportion (%) of the total area/habitat impacted

List of Guidance documents and protocols available

UNEP/MAP/PAP (2015). Guidance document on how to reflect changes in hydrographical conditions in relevant assessment (prepared by Spiteri, C.). Priority Actions Programme. Split, 2015.

UNEP(DEPI)/MED IG.22. UNEP(DEPI)/MED IG.22/Inf.7 (2016). Draft Integrated Monitoring and Assessment Guidance

UNEP(DEPI)/MED WG.433/1 (2017) PAP/RAC Meeting of the Ecosystem Approach Correspondence Group on Monitoring (CORMON) on Coast and Hydrography – Working Document

Advice document on hydrographical conditions (Descriptor 7) in the context of MSFD, published by OSPAR Commission (2012);

Scientific and technical review of the MSFD Commission Decision 2010/477/EU in relation to Descriptor 7 carried out by the EC JRC; etc.

Data Confidence and uncertainties

Data used or produced for the monitoring should be in agreement with Shared Environmental Information System (SEIS) principles. More on SEIS principles can be found in Draft Integrated Monitoring and Assessment Guidance.

Methodology for monitoring, temporal and spatial scope

Available Methodologies for Monitoring and Monitoring Protocols

At this stage, there is no clear available methodology and monitoring protocols (see **Known gaps and uncertainties in the Mediterranean).**
Some methodologies or protocols could be proposed, once done an inventory of existing and available data in Mediterranean Sea.

For more details, see "Guidance document on how to reflect changes in hydrographical conditions in relevant assessments".

Available data sources

Global marine data source at the scale of the Mediterranean Sea:

- EMODnet Central Portal (http://www.emodnet.eu/)
- Mediterranean Marine Data (http://www.mediterranean-marinedata.eu/)
- Copernicus, Marine environment monitoring service (http://marine.copernicus.eu/)

Available regional or local data sources (in each country) should be also identified.

Spatial scope guidance and selection of monitoring stations

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The monitoring will focus on habitats of interest, around new permanent constructions (lasting more than 10 years) in coastal waters.
The study area should depend on the footprint of the new construction considered and on the local (or regional) geographical and marine conditions. It should be large enough:

- to show all the hydrographic alterations induced by the construction, even for long term;
- to follow all the habitats of interest that could be potentially impacted.

At first, the spatial scale (in cross-shore and long-shore directions) to be used should be about 10 to 50 times the characteristic length of the structure. Depending on the first results obtained for this area, the area should be enlarged or zoomed in around the structure.

It should be highlighted if monitoring was performed in sensitive areas, such as marine protected areas, spawning, breeding and feeding areas and migration routes of fish, seabirds and marine mammals, since they are priority.

Temporal Scope guidance

To correctly assess changes in time on habitats induced by constructions, different monitoring timescales are proposed:

- Before construction, initial state assessment (baseline conditions):
  Monitoring should provide the initial hydrodynamics conditions surrounding the future construction.
- During construction: monitoring should ensure that impacts due to works are limited in space and in time.
- After construction, short term changes (0 to 5 years after): at least yearly up to 5 years.
  During this period, strong changes should happen on hydrographical, morphological and habitats conditions. The monitoring frequency should be high* enough to assess these changes. It should be annual (at the same period of year) and provide, each year, the changes in hydrodynamic conditions (assessed by comparing present and initial conditions).
- After construction (5 to 10 years after): at least biennium to 10 years.
  Same as before with a lower* monitoring frequency as the changes should be lower.
- Long term changes (10 to15 years after construction)
  Same as before with a lower* monitoring frequency as the changes should be lower.

* The monitoring frequencies to be used in these different phases should depend on the intensity of changes in hydrographical and morphological conditions occurring on the site (case by case).

Data analysis and assessment outputs

Statistical analysis and basis for aggregation

Expected assessments outputs

All the outputs that came out of the monitoring (I.e. trend analysis, distribution maps, etc.) should be listed, along with source(s) where they can be found.

The outputs to be reported are (map and GIS data):

- The area and location where the future structure will be built;

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- The area and location where alterations in hydrographical conditions are expected to occur and those areas where alterations are actually occurring;
- The area and location of the habitats of interest potentially impacted by these alterations;
- The area and location of these habitats of interest previously identified for the whole analysis unit (to assess the proportion of total habitats that are altered).

NOTE: "The exact format of habitats/GIS data will be defined in link with EO1 indicator."
The data on hydrographical conditions concern the waves and currents conditions of the study zone, without and with the construction and the resulting hydrographical alterations. To ensure uniformity and comparability of all these data, their expected characteristics should be defined.

Known gaps and uncertainties in the Mediterranean

There are general difficulties, not particular to the Mediterranean context, that can be identified for the EO7:

- Lack of coherence in definitions, standard approaches in the development and application of indicators and in the assessment of impacts, together with lack of methodological standards.
- Lack of knowledge and understanding on the link between physical pressures and biological impacts and on the cumulative impacts.

Another difficulty comes from the hydrographical alterations that EO7 indicator should assess. These alterations, around a particular coastal construction, often change in intensity, in area and indeed in time, depending on the off-shore hydrographical conditions (calm weather/extreme event; seasonality of waves height and directions; local wind conditions…) and on the morphologic history of the site (the present state is due to the succession of these different conditions).
So, a work to define which hydrographical conditions and temporal scale have to be used to assess hydrographical alterations by numerical modelling must be carried out.

Like everywhere, there is certainly a lack of physical characteristics data in the Mediterranean Sea (bathymetric data, seafloor topography, current velocity, wave exposure, turbidity, salinity, temperature, etc.), that will be the main problem to implement this indicator, in particular to define the base-line conditions. To identify these lacks, a global and clear inventory of existing and available data in Mediterranean Sea should be done.

Nevertheless, data can be collected from regional models (bathymetry, hydrodynamics, salinity, temperature). These data with coarse resolution will need to be refined close to the location of the new structure.

In case of no sufficient data, the use of assessment methods needing less data (empirical formulae, expert judgment, comparison with similar sites) should be considered, as well as acquisition/monitoring of missing data, promoting regional cooperation.

Other difficulties come from the use of numerical model to assess hydrographic alterations: These tools need many data (bathymetry, offshore hydrodynamics data, field data) and can be costly and time-consuming. Moreover, the use of these tools needs some experience and some knowledge about the processes and theories involved.

To conclude, such an integrated assessment of impacts calls for additional research efforts on habitat

Indicator Title	Common Indicator 15: Location and extent of the habitats impacted directly by hydrographic alterations	
modeling, pressure mapping and cumulative impacts, along with monitoring of potentially affected areas.		
Contacts and version Date		
Key contacts within UNEP for further information		
Version No	**Date**	**Author**
V.1	27/6/16	PAP/RAC
V2	11/07/16	Olivier Brivois
V3	13/07/16	Olivier Brivois
V4	16/03/17	Olivier Brivois

2. Draft Updated Reference List of Marine Habitat Types for the Mediterranean region

In accordance with the Decision of the twentieth Ordinary Meeting (Tirana, Albania, 17- 20 December 2017), of the Contracting Parties to the Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Protocols, the Specially Protected Areas Regional Activity Centre (SPA/RAC) was requested to finalize, in consultation with its focal points, the Classification of benthic marine habitat types for the Mediterranean region and the Reference List of Marine and Coastal Habitat Types in the Mediterranean, with a view to submitting them to the Contracting Parties at their Twenty-first Ordinary Meeting (Decision IG.23/8).

This reference list was taken from Annex 4 of the UNEP/MED WG.457/5 document of the Meeting of Experts on the finalization of the Classification of benthic marine habitat types for the Mediterranean region and the Reference List of Marine and Coastal Habitat Types in the Mediterranean Rome, Italy, 22-23 January 2019, provided by SPA/RAC.

LITTORAL

MA1.5 Littoral rock

MA1.51 Supralittoral rock

MA1.51a Supralittoral euryhaline and eurythermal pools (enclave of mediolittoral)

MA1.51b Wracks of dead leaves of macrophytes

MA1.52 Mediolittoral caves

MA1.53 Upper mediolittoral rock

MA1.531 Association with encrusting Corallinales creating belts (e.g. *Lithophyllum bissoides*, *Neogoniolithon* spp.)

MA1.54 Lower mediolittoral rock

MA1.541 Association with encrusting Corallinales creating belts (e.g. *Lithophyllum bissoides*, *Neogoniolithon* spp.)

MA1.542 Association with Fucales

MA1.544 Facies with *Pollicipes pollicipes*

MA1.545 Facies with Vermetidae (*Dendropoma* spp.) (vermetid reefs)

MA1.54a Mediolittoral euryhaline and eurythermal pools (enclave of infralittoral)

MA2.5 Littoral biogenic habitat

MA2.51 Lower mediolittoral biogenic habitat

MA2.511 Association with encrusting Corallinales creating platforms

MA2.512 Facies with *Sabellaria* spp. (reefs of *Sabellaria*)

MA2.513 Facies with Vermetidae (*Dendropoma* spp.) (vermetid reefs)

MA2.51a Banks of dead leaves of macrophytes (*banquette*)

MA3.5 Littoral coarse sediment

MA3.51 Supralittoral coarse sediment

MA3.511 Association with macrophytes

MA3.51a Deposit of dead leaves of macrophytes

MA3.52 Mediolittoral coarse sediment

MA3.521 Association with indigenous marine angiosperms

MA3.52a Deposit of dead leaves of macrophytes

MA4.5 Littoral mixed sediment

MA4.51 Supralittoral mixed sediment

MA4.511 Association with macrophytes

MA4.51a Deposit of dead leaves of macrophytes

MA4.52 Mediolittoral mixed sediment

MA4.521 Association with indigenous marine angiosperms

MA4.52a Deposit of dead leaves of macrophytes

MA5.5 Littoral sand

MA5.51 Supralittoral sands

MA5.511 Association with macrophytes

MA5.51a Deposit of dead leaves of macrophytes

MA5.52 Mediolittoral sands

MA5.521 Association with indigenous marine angiosperms

MA5.52a Deposit of dead leaves of macrophytes

MA6.5 Littoral mud

MA6.51 Supralittoral mud

MA6.511 Association with macrophytes

MA6.52 Mediolittoral mud

MA6.52a Habitats of transitional waters (e.g. estuaries and lagoons)

MA6.521a Association with halophytes (*Salicornia* spp.) or marine angiosperms (e.g. *Zostera noltei*, *Ruppia maritima*)

INFRALITTORAL

MB1.5 Infralittoral rock

MB1.51 Algal-dominated infralittoral rock

MB1.51a Well illuminated infralittoral rock, exposed

MB1.511a Association with Fucales

MB1.513a Association with encrusting Corallinales creating belts (e.g. *Titanoderma trochanter*, *Tenarea tortuosa*)

MB1.514a Association with indigenous Mediterranean *Caulerpa* spp.

MB1.516a Facies with Scleractinia (e.g. *Cladocora caespitosa*)

MB1.51b Moderately illuminated infralittoral rock, exposed

MB1.512b Association with indigenous Mediterranean *Caulerpa* spp.

MB1.515b Facies with Scleractinia (e.g. *Astroides calycularis*)

MB1.51c Well illuminated infralittoral rock, sheltered

MB1.511c Association with Fucales

MB1.514c Association with indigenous Mediterranean *Caulerpa* spp.

MB1.516c Facies with Scleractinia (e.g. *Cladocora caespitosa*)

MB1.51d Moderately illuminated infralittoral rock, sheltered

MB1.512d Association with indigenous Mediterranean *Caulerpa* spp.

MB1.514d Facies with Alcyonacea (e.g. *Eunicella* spp.)

MB1.51e Lower infralittoral rock moderately illuminated

MB1.511e Association with Fucales

MB1.512e Association with Laminariales (kelp beds)

MB1.513e Association with indigenous Mediterranean *Caulerpa* spp.

MB1.515e Facies with Alcyonacea (e.g. *Eunicella* spp.)

MB1.516e Facies with Scleractinia (e.g. *Cladocora caespitosa*)

MB1.52 Invertebrate-dominated infralittoral rock

MB1.52a Moderately illuminated infralittoral rock, sheltered

MB1.521a Association with indigenous Mediterranean *Caulerpa* spp.

MB1.524a Facies with Scleractinia (e.g. *Astroides calycularis*, *Cladocora caespitosa*, *Polycyathus muellerae*, *Pourtalosmilia anthophyllites*)

MB1.525a Facies with Alcyonacea (e.g. *Eunicella* spp., *Paramuricea clavata*, *Corallium rubrum*)

MB1.53 Infralittoral rock affected by sediments

MB1.532 Facies with large and erect sponges (e.g. *Axinella polypoides*, *Axinella cannabina*)

MB1.533 Faciès with Scleractinia (e.g. *Cladocora caespitosa*)

MB1.534 Facies with Alcyonacea (e.g. *Eunicella* spp., *Leptogorgia* spp.)

MB1.537 Facies with endolitic species (e.g. *Lithophaga lithophaga*, *Cliona* spp.)

MB1.54 Habitats of transitional waters (e.g. estuaries and lagoons)

MB1.541 Association with marine angiosperms or other halophyta

MB1.542 Association with Fucales

MB1.55 Coralligenous (enclave of circalitoral, see MC1.51)

MB1.56 Semi-dark caves and overhangs (see MC1.53)

MB2.5 Infralittoral biogenic habitat

MB2.51 Reefs in algal-dominated habitat

MB2.511 Facies with Vermetidae (*Dendropoma* spp.) (vermetid reefs)

MB2.52 Reefs on fine sand in very shallow waters

MB2.521 Facies with *Sabellaria* spp. (reefs of *Sabellaria*)

MB2.53 Reefs of *Cladocora caespitosa*

MB2.54 *Posidonia oceanica* meadows

MB2.541 *Posidonia oceanica* meadow on rock

MB2.542 *Posidonia oceanica* meadow on matte

MB2.543 *Posidonia oceanica* meadow on sand, coarse or mixed sediment

MB2.545 Natural monuments/Ecomorphoses of *Posidonia oceanica* (fringing reef, barrier reef, atolls)

MB2.546 Association of *Posidonia oceanica* with *Cymodocea nodosa* or *Caulerpa* spp.

MB2.547 Association of *Cymodocea nodosa* or *Caulerpa* spp. with dead matte of *Posidonia oceanica*

MB3.5 Infralittoral coarse sediment

MB3.51 Infralittoral coarse sediment mixed by waves

MB3.511 Association with maërl or rhodolithes (e.g. *Lithothamnion* spp., *Neogoniolithon* spp., *Lithophyllum* spp., *Spongites fruticulosa*)

MB3.52 Infralittoral coarse sediment under the influence of bottom currents

MB3.521 Association with maërl or rhodolithes (e.g. *Lithothamnion* spp., *Neogoniolithon* spp., *Lithophyllum* spp., *Spongites fruticulosa*)

MB5.5 Infralittoral sand

MB5.52 Well sorted fine sand

MB5.521 Association with indigenous marine angiosperms

MB5.53 Fine sand in sheltered waters

MB5.531 Association with indigenous marine angiosperms

MB5.533 Association with indigenous Mediterranean *Caulerpa* spp.

MB5.539 Facies of *Tritia neritea* and nematodes (in hydrothermal vents)

MB5.54 Habitats of transitional waters (e.g. estuaries and lagoons)

MB5.541 Association with marine angiosperms or other halophyta

MB5.542 Association with Fucales

MB6.5 Infralittoral mud sediment

MB6.51 Habitats of transitional waters (e.g. estuaries and lagoons)

MB6.511 Association with marine angiosperms or other halophyta

CIRCALITTORAL

MC1.5 Circalittoral rock

MC1.51 Coralligenous

MC1.51a Algal-dominated coralligenous

MC1.512a Association with Fucales or Laminariales

MC1.51b Invertebrate-dominated coralligenous

MC1.512b Facies with large and erect sponges (e.g. *Spongia lamella, Sarcotragus foetidus, Axinella* spp.)

MC1.514b Facies with Alcyonacea (e.g. *Eunicella* spp., *Leptogorgia* spp., *Paramuricea* spp., *Corallium rubrum*)

MC1.516b Facies with the Zoantharia *Savalia savaglia*

MC1.517b Facies with Scleractinia (e.g. *Dendrophyllia* spp., *Leptopsammia pruvoti*, *Madracis pharensis*)

MC1.518b Facies with Vermetidae and/or Serpulidae

MC1.519b Facies with Bryozoa (e.g. *Reteporella grimaldii*, *Pentapora fascialis*)

MC1.51c Invertebrate-dominated coralligenous covered by sediment (See MC1.51b for examples of reference facies)

MC1.52 Shelf edge rock

MC1.52a Coralligenous outcrops

MC1.523a Facies with Alcyonacea (e.g. *Alcyonium* spp., *Eunicella* spp., *Leptogorgia* spp., *Paramuricea* spp., *Corallium rubrum*)

MC1.524a Facies with Antipatharia (e.g. *Antipathella subpinnata*)

MC1.525a Facies with Scleractinia (e.g. *Dendrophyllia* spp., *Madracis pharensis*)

MC1.526a Facies with Bryozoa (e.g. *Reteporella grimaldii*, *Pentapora fascialis*)

MC1.52b Coralligenous outcrops covered by sediment (See MC1.52a for examples of reference facies)

MC1.52c Deep banks

MC1.521c Facies with Antipatharia (e.g. *Antipathella subpinnata*)

MC1.522c Facies with Alcyonacea (e.g. *Nidalia studeri*)

MC1.523c Facies with Scleractinia (e.g. D*endrophyllia* spp.)

MC1.53 Semi-dark caves and overhangs

MC1.53a Walls and tunnels

MC1.531a Facies with sponges (e.g. *Axinella* spp., *Chondrosia reniformis, Petrosia ficiformis*)

MC1.533a Facies with Alcyonacea (e.g. *Eunicella* spp., *Paramuricea* spp., *Corallium rubrum*)

MC1.534a Facies with Scleractinia (e.g. *Leptopsammia pruvoti*, *Phyllangia mouchezii*)

MC1.536a Facies with Bryozoa (e.g. *Reteporella grimaldii*, *Pentapora fascialis*)

MC1.53b Ceilings (See MC1.53a for examples of reference facies)

MC1.53c Detritic bottom (See MC3.51 for examples of reference associations and facies)

MC1.53d Brackish water caves or caves subjected to freshwater runoff

MC1.531d Facies with *Lithistida* spp. sponges

MC2.5 Circalittoral biogenic habitat

MC2.51 Coralligenous platforms

MC2.512 Association with Fucales

MC2.515 Facies with large and erect sponges (e.g. *Spongia lamella*, *Sarcotragus foetidus*, *Axinella* spp.)

MC2.517 Facies with Alcyonacea (e.g. *Alcyonium* spp., *Eunicella* spp., *Leptogorgia* spp., *Paramuricea* spp., *Corallium rubrum*)

MC2.518 Facies with the Zoantharia *Savalia savaglia*

MC2.519 Facies with Scleractinia (e.g. *Dendrophyllia* spp., *Madracis pharensis,Phyllangia mouchezii*)

MC2.51A Facies with Vermetidae and/or Serpulidae

MC2.51B Facies with Bryozoa (e.g. *Reteporella grimaldii*, *Pentapora fascialis*)

MC3.5 Circalittoral coarse sediment

MC3.51 Coastal detritic bottoms (without rhodoliths)

MC3.511 Association with Laminariales

MC3.512 Facies with large and erect sponges (e.g. *Spongia lamella*, *Sarcotragus foetidus*, *Axinella* spp.)

MC3.514 Facies with Alcyonacea (e.g. *Alcyonium* spp., *Eunicella* spp., *Leptogorgia* spp.)

MC3.515 Facies with Pennatulacea (e.g. *Pennatula* spp., *Virgularia mirabilis*)

MC3.518 Facies with Bryozoa (e.g. *Turbicellepora incrassata*, *Frondipora verrucosa*, *Pentapora fascialis*)

MC3.519 Facies with Crinoidea (e.g. *Leptometra* spp.)

MC3.52 Coastal detritic bottoms with rhodoliths

MC3.521 Association with maërl (e.g. *Lithothamnion* spp., *Neogoniolithon* spp., *Lithophyllum* spp., *Spongites fruticulosa*)

MC3.522 Association with *Peyssonnelia* spp.

MC3.523 Association with Laminariales

MC3.524 Facies with large and erect sponges (e.g. *Spongia lamella*, *Sarcotragus foetidus*, *Axinella* spp.)

MC3.526 Facies with Alcyonacea (e.g. *Alcyonium* spp., *Paralcyonium spinulosum*)

MC3.527 Facies with Pennatulacea (e.g. *Veretillum cynomorium*)

MC4.5 Circalittoral mixed sediment

MC4.51 Muddy detritic bottoms

MC4.512 Facies with Alcyonacea (e.g. *Alcyonium* spp., *Spinimuricea* spp.)

MC4.513 Facies with Pennatulacea (e.g. *Veretillum cynomorium*)

MC6.5 Circalittoral mud sediment

MC6.51 Coastal terrigenous muds

MC6.511 Facies with Alcyonacea (e.g. *Alcyonium* spp.) and Holothuroidea (e.g. *Parastichopus* spp.)

MC6.512 Facies with Pennatulacea (e.g. *Pennatula* spp., *Virgularia mirabilis*)

OFFSHORE CIRCALITTORAL

MD1.5 Offshore circalittoral rock

MD1.51 Offshore circalittoral rock invertebrate-dominated

MD1.512 Facies with large and erect sponges (e.g. *Spongia lamella*, *Axinella* spp.)

MD1.513 Facies with Alcyonacea (e.g. *Alcyonium* spp., *Callogorgia verticillata*, *Ellisella paraplexauroides*, *Eunicella* spp., *Leptogorgia* spp., *Paramuricea* spp., *Swiftia pallida*, *Corallium rubrum*)

MD1.514 Facies with Antipatharia (e.g. *Antipathella subpinnata*)

MD1.515 Facies with Scleractinia (e.g. *Dendrophyllia* spp., *Madracis pharensis*)

MD1.517 Facies with the Zoantharia *Savalia savaglia*

MD1.51B Facies with Bryozoa (e.g. *Myriapora truncata*, *Pentapora fascialis*)

MD1.52 Offshore circalittoral rock invertebrate-dominated covered by sediments (See MD1.51 for examples of reference facies)

MD1.53 Deep offshore circalittoral banks

MD1.531 Facies with Antipatharia (e.g. *Antipathella subpinnata*)

MD1.532 Facies with Alcyonacea (e.g. *Nidalia* spp.)

MD1.533 Facies with Scleractinia (e.g. *Dendrophyllia* spp.)

MD2.5 Offshore circalittoral biogenic habitat

MD2.51 Offshore reefs

MD2.511 Facies with Vermetidae and/or Serpulidae

MD2.52 Thanatocoenosis of corals, or Brachiopoda, or Bivalvia (e.g. *Modiolus modiolus*) (See MD1.51 for examples of reference facies)

MD3.5 Offshore circalittoral coarse sediment

MD3.51 Offshore circalittoral detritic bottoms

MD3.511 Facies with the Bivalvia *Neopycnodonte* spp.

MD3.514 Facies with Crinoidea (e.g. *Leptometra* spp.)

MD4.5 Offshore circalittoral mixed sediment

MD4.51 Offshore circalittoral detritic bottoms (See MD3.51 for examples of reference facies)

MD5.5 Offshore circalittoral sand

MD5.51 Offshore circalittoral sand (See MD3.51 for examples of reference facies)

MD6.5 Offshore circalittoral mud

MD6.51 Offshore terrigenous sticky muds

MD6.511 Facies with Pennatulacea (e.g. *Pennatula* spp., *Virgularia mirabilis*)

MD6.513 Facies with the Bivalvia *Neopycnodonte* spp.

UPPER BATHYAL

ME1.5 Upper bathyal rock

ME1.51 Upper bathyal rock invertebrate-dominated

ME1.512 Facies with large and erect sponges (e.g. *Spongia lamella*, *Axinella* spp.)

ME1.513 Facies with Antipatharia (e.g. *Antipathes* spp., *Leiopathes glaberrima*, *Parantipathes larix*)

ME1.514 Facies with Alcyonacea (e.g. *Acanthogorgia* spp., *Callogorgia verticillata, Placogorgia* spp., *Swiftia pallida, Corallium rubrum*)

ME1.515 Facies with Scleractinia (e.g. *Dendrophyllia* spp., *Madrepora oculata, Desmophyllum cristagalli*, *Lophelia pertusa, Madracis pharensis*)

ME1.516 Facies with Cirripeda (e.g. *Megabalanus* spp., *Pachylasma giganteum*)

ME1.517 Facies with Crinoidea (e.g. *Leptometra* spp.)

ME1.518 Facies with the Bivalvia *Neopycnodonte* spp.

ME1.52 Caves and ducts in total darkness

ME2.5Upper bathyal biogenic habitat

ME2.51 Upper bathyal reefs

ME2.512 Facies with large and erect sponges (e.g. *Leiodermatium* s pp.)

ME2.513 Facies with Scleractinia (e.g. *Madrepora oculata, Desmophyllum cristagalli*)

ME2.514 Facies with the Bivalvia *Neopycnodonte* spp.

ME2.515 Facies with Serpulidae reefs (e.g. *Serpula vermicularis*)

ME2.52 Thanatocoenosis of corals, or Brachiopoda, or Bivalvia, or sponges (see ME1.51 for examples of reference facies)

ME3.5 Upper bathyal coarse sediment

ME3.51 Upper bathyal coarse sediment

ME3.511 Facies with Alcyonacea (e.g. *Alcyonium* spp., *Chironephthya mediterranea, Paralcyonium spinulosum, Paramuricea* spp., *Villogorgia bebrycoides*)

ME4.5 Upper bathyal mixed sediment

ME4.51 Upper bathyal mixed sediment

ME4.511 Facies with the Bivalvia *Neopycnodonte* spp.

ME5.5 Upper bathyal sand

ME5.51Upper bathyal detritic sand

ME5.512 Facies with Pennatulacea (e.g. *Pennatula* spp., *Pteroeides griseum*)

ME5.513 Facies with Crinoidea (e.g. *Leptometra* spp.)

ME5.515 Facies with the Bivalvia *Neopycnodonte* spp.

ME5.517 Facies with Bryozoa

ME5.518 Facies with Scleractinia (e.g. *Caryophyllia cyathus*)

ME6.5 Upper bathyal muds

ME6.51 Upper bathyal muds

ME6.512 Facies with Pennatulacea (e.g. *Pennatula* spp., *Funiculina quadrangularis*)

ME6.513 Facies with Alcyonacea (e.g. *Isidella elongata*)

ME6.514 Facies with Scleractinia (e.g. *Dendrophyllia* spp., *Madrepora oculata*, *Desmophyllum cristagalli*)

ME6.516 Facies with Crinoidea (e.g. *Leptometra* spp.)

ME6.518 Facies with the Bivalvia *Neopycnodonte* spp.

ME6.51B Facies with Bryozoa (e.g. *Candidae* spp., *Kinetoskias* spp.)

ME6.51C Facies with giant Foraminifera (e.g. Astrorhizida)

LOWER BATHYAL

MF1.5 Lower bathyal rock

MF1.51 Lower bathyal rock

MF1.512 Facies with Alcyonacea (e.g. *Dendrobrachia* spp.)

MF1.513 Facies with Scleractinia (e.g. *Dendrophyllia* spp., *Madrepora oculata*, *Desmophyllum cristagalli*, *Lophelia pertusa*)

MF1.514 Facies with chemiosynthetic benthic species (e.g. Siboglinidae, *Lucinoma* spp.)

MF2.5 Lower bathyal biogenic habitat

MF2.51 Lower bathyal reefs

MF2.511 Facies with Scleractinia (e.g. *Dendrophyllia* spp., *Madrepora oculata*, *Desmophyllum cristagalli*, *Lophelia pertusa*)

MF2.52 Thanatocoenosis of corals, or Brachiopoda, or Bivalvia, or sponges (See MF1.51 for examples of reference facies)

MF6.5 Lower bathyal muds

MF6.51 Sandy muds

MF6.512 Facies with Alcyonacea (e.g. *Isidella elongata*)

MF6.514 Facies with Pennatulacea (e.g. *Pennatula* spp., *Funiculina quadrangularis*)

ABYSSAL

MG1.5 Abyssal rock

MG1.51 Abyssal rock

MG1.512 Facies with Alcyonacea

MG6.5 Abyssal mud

MG6.51 Abyssal mud

MG6.512 Facies with Alcyonacea (e.g. *Isidella elongata*)

There are some geomorphologic / hydrologic features not included in the above list because their presence is independent from the depth zone and the substrate type, but they must also be considered due to the role they play in the Mediterranean ecosystem. They can hold a "complex of habitats" and geoforms that cannot be treated isolated, and therefore, they do not fit inside other categories. Among them:

- Hydrothermal vents
- Cold seeps (sulfide, methane – e.g. pockmarks, mud volcanoes)
- Brine pools
- Freshwater resurgences
- Seamounts (including banks, hills, etc.)
- Submarine canyons
- Escarpments
- Boulders fields

3. Information Standards for the Common Indicator 15

Content	Description
Ecological Objective	**EO7. Alteration of hydrographical conditions**
IMAP Common Indicator	**CI15. Location and extent of the habitats impacted directly by hydrographic alterations**
Parameter	**Location and extend of coastal or offshore infrastructures**
Attribute table	Specify the following information in the attribute table associated with the GIS information layer: • CPCODE: Two-letter code of Country • ASDES: Description of coastal or offshore infrastructure • EXT: In case the coastal or offshore infrastructure is an extension of a pre-existing one, it is necessary to specify if the polyline corresponds to such extension - Use the following codes: 1=Yes, it is the extension; 0=No, it is part of the pre-existing infrastructure
Variables	Border on the sea side of the coastal or offshore infrastructure
Spatial resolution	5 mt or higher as produced by CAD (Computer Aided Design) software
Vertical coverage	At least 2 levels, one at sea surface and one at the sea bottom
Coordinate Reference System	WGS 84 or ETRS 89 decimal degrees
Temporal coverage	Every 6 years
Data format	GIS Layer: polyline or polygons

Content	Description
Ecological Objective	**EO7. Alteration of hydrographical conditions**
IMAP Common Indicator	**CI15. Location and extent of the habitats impacted directly by hydrographic alterations**
Parameter	**Location and extend of hydrographical changes**
Attribute table	Specify the following information in the attribute table associated with the GIS information layer: • CPCODE: Two-letter code of Country • PAR: Parameter that is significantly and permanently changed due to coastal or offshore infrastructure. Choose one from the following list: o current velocity o temperature o salinity o sea surface height o turbidity o wave o other • PAR_OTH: In case the PAR field is 'other' specify the hydrographical parameter
Variables	Border on the sea side of the area where the specified hydrographical parameter is significantly and permanently changed due to coastal or offshore infrastructure
Spatial resolution	25 mt or higher as produced by numerical model assimilated and validated with in-situ monitoring data and preferably nested in Copernicus CMEMS products for boundary conditions (0.063degree x 0.063degree)
Vertical coverage	At least 2 levels, one at sea surface and one at the sea bottom
Coordinate Reference System	WGS 84 or ETRS 89 decimal degrees
Temporal coverage	Every 6 years
Data format	GIS Layer: polygons

Content	Description
Ecological Objective	**EO7. Alteration of hydrographical conditions**
IMAP Common Indicator	**CI15. Location and extent of the habitats impacted directly by hydrographic alterations**
Parameter	**Current Velocity**
Geographical coverage	Specify the geographical bounding box that includes the sea area that is covered by the data representation. Such area should be large enough to capture permanent and significant hydrographical changes due to coastal or offshore infrastructures. The bounding box shall be expressed with westbound and eastbound longitudes, and southbound and northbound latitudes in decimal degrees, with a precision of at least two decimals in WGS 84 or ETRS 89 geographical reference systems. The four data to provide are: • North Bound Latitude • East Bound Longitude • South Bound Latitude • West Bound Longitude
Observations/ Models	Numerical model assimilated and validated with in-situ monitoring data and preferably nested in Copernicus CMEMS current velocity products for boundary conditions (0.063degree x 0.063degree)
Data assimilation	In-situ monitored data provided by acoustic or mechanical current meter
Variables	Eastward sea water velocity (UV) Northward sea water velocity (UV)
Spatial resolution	25 mt or higher nested in Copernicus CMEMS current velocity grids products (0.063degree x 0.063degree)
Vertical coverage	10 or more levels from surface to sea floor. Copernicus CMEMS current velocity product provide 72 levels
Coordinate Reference System	WGS 84 or ETRS 89 decimal degrees
Temporal coverage	5 years or more
Temporal resolution	Monthly mean
Data format	NetCDF or raster grid

Content	Description
Ecological Objective	**EO7. Alteration of hydrographical conditions**
IMAP Common Indicator	**CI15. Location and extent of the habitats impacted directly by hydrographic alterations**
Parameter	**Temperature**
Geographical coverage	Specify the geographical bounding box that includes the sea area that is covered by the data representation. Such area should be large enough to capture permanent and significant hydrographical changes due to coastal or offshore infrastructures. The bounding box shall be expressed with westbound and eastbound longitudes, and southbound and northbound latitudes in decimal degrees, with a precision of at least two decimals in WGS 84 or ETRS 89 geographical reference systems. The four data to provide are: • North Bound Latitude • East Bound Longitude • South Bound Latitude • West Bound Longitude
Observations/ Models	Numerical model assimilated and validated with satellite and in-situ monitoring data and preferably nested in Copernicus CMEMS temperature products for boundary conditions (0.063degree x 0.063degree)
Data assimilation	In-situ monitored data provided by CTD probe and satellite sea surface temperature (SST)
Variables	Sea water potential temperature. Potential temperature is the temperature a parcel of water would have if it were moved adiabatically (i.e. without loss of heat) to a reference pressure. The reference pressure used for the ocean is the ocean surface (water pressure = 0 dbar).
Spatial resolution	25 mt or higher nested in Copernicus CMEMS temperature grids products (0.063degree x 0.063degree)
Vertical coverage	10 or more levels from surface to sea floor. Copernicus CMEMS temperature product provide 72 levels
Coordinate Reference System	WGS 84 or ETRS 89 decimal degrees
Temporal coverage	5 years or more
Temporal resolution	Monthly mean and daily mean
Data format	NetCDF or raster grid

Content	Description
Ecological Objective	**EO7. Alteration of hydrographical conditions**
IMAP Common Indicator	**CI15. Location and extent of the habitats impacted directly by hydrographic alterations**
Parameter	**Salinity**
Geographical coverage	Specify the geographical bounding box that includes the sea area that is covered by the data representation. Such area should be large enough to capture permanent and significant hydrographical changes due to coastal or offshore infrastructures. The bounding box shall be expressed with westbound and eastbound longitudes, and southbound and northbound latitudes in decimal degrees, with a precision of at least two decimals in WGS 84 or ETRS 89 geographical reference systems. The four data to provide are: • North Bound Latitude • East Bound Longitude • South Bound Latitude • West Bound Longitude
Observations/ Models	Numerical model assimilated and validated with in-situ monitoring data and preferably nested in Copernicus CMEMS salinity products for boundary conditions (0.063degree x 0.063degree)
Data assimilation	In-situ monitored data provided by CTD probe
Variables	Sea water salinity
Spatial resolution	25 mt or higher nested in Copernicus CMEMS salinity grids products (0.063degree x 0.063degree)
Vertical coverage	10 or more levels from surface to sea floor. Copernicus CMEMS salinity product provide 72 levels
Coordinate Reference System	WGS 84 or ETRS 89 decimal degrees
Temporal coverage	5 years or more
Temporal resolution	Monthly mean and daily mean
Data format	NetCDF or raster grid

Content	Description
Ecological Objective	**EO7. Alteration of hydrographical conditions**
IMAP Common Indicator	**CI15. Location and extent of the habitats impacted directly by hydrographic alterations**
Parameter	**Sea Surface Height**
Geographical coverage	Specify the geographical bounding box that includes the sea area that is covered by the data representation. Such area should be large enough to capture permanent and significant hydrographical changes due to coastal or offshore infrastructures. The bounding box shall be expressed with westbound and eastbound longitudes, and southbound and northbound latitudes in decimal degrees, with a precision of at least two decimals in WGS 84 or ETRS 89 geographical reference systems. The four data to provide are: • North Bound Latitude • East Bound Longitude • South Bound Latitude • West Bound Longitude
Observations/ Models	Numerical model assimilated and validated with satellite and in-situ monitoring data and preferably nested in Copernicus CMEMS Sea Surface Height products for boundary conditions (0.063degree x 0.063degree)
Data assimilation	Satellite and In-situ monitored data provided by tide gauge observations
Variables	Sea surface height above sea level
Spatial resolution	25 mt or higher nested in Copernicus CMEMS Sea Surface Height grids products (0.063degree x 0.063degree)
Vertical coverage	1 level
Coordinate Reference System	WGS 84 or ETRS 89 decimal degrees
Temporal coverage	5 years or more
Temporal resolution	Monthly mean and daily mean
Data format	NetCDF or raster grid

Content	Description
Ecological Objective	**EO7. Alteration of hydrographical conditions**
IMAP Common Indicator	**CI15. Location and extent of the habitats impacted directly by hydrographic alterations**
Parameter	**Turbidity**
Geographical coverage	Specify the geographical bounding box that includes the sea area that is covered by the data representation. Such area should be large enough to capture permanent and significant hydrographical changes due to coastal or offshore infrastructures. The bounding box shall be expressed with westbound and eastbound longitudes, and southbound and northbound latitudes in decimal degrees, with a precision of at least two decimals in WGS 84 or ETRS 89 geographical reference systems. The four data to provide are: • North Bound Latitude • East Bound Longitude • South Bound Latitude • West Bound Longitude
Observations/ Models	Satellite or in-situ observations
Data assimilation	
Variables	Satellite: • Surface ratio of upwelling radiance emerging from sea water to downwelling radiative flux in air (RRS) • Volume attenuation coefficient of downwelling radiative flux in sea water (KD) • Volume absorption coefficient of radiative flux in sea water due to dissolved organic matter and non algal particles (CDM) • Volume absorption coefficient of radiative flux in sea water due to phytoplankton (APHY) • Volume backwards scattering coefficient of radiative flux in sea water due to particles (BBP) In-situ observations: • Turbidity sensor probe • Secchi disk
Spatial resolution	25 mt or higher
Vertical coverage	Satellite: 1 level; In-situ observations turbidity sensor probe: 3 or more levels, at least one on the sea floor, one on sea subsurface (1mt depth) and one in the middle
Coordinate Reference System	WGS 84 or ETRS 89 decimal degrees
Temporal coverage	5 years or more
Temporal resolution	Satellite: Daily mean; In-situ observations: at least monthly
Data format	NetCDF or raster grid

Content	Description
Ecological Objective	**EO7. Alteration of hydrographical conditions**
IMAP Common Indicator	**CI15. Location and extent of the habitats impacted directly by hydrographic alterations**
Parameter	**Bathymetry**
Geographical coverage	Specify the geographical bounding box that includes the sea area that is covered by the data representation. Such area should be large enough to capture permanent and significant hydrographical changes due to coastal or offshore infrastructures. The bounding box shall be expressed with westbound and eastbound longitudes, and southbound and northbound latitudes in decimal degrees, with a precision of at least two decimals in WGS 84 or ETRS 89 geographical reference systems. The four data to provide are: • North Bound Latitude • East Bound Longitude • South Bound Latitude • West Bound Longitude
Observations/ Models	Digital Terrain Model from in-situ observations by multibeam
Data assimilation	
Variables	Digital Terrain Model elaborated from multibeam survey
Spatial resolution	25 mt or higher resolution
Vertical coverage	1 level
Coordinate Reference System	WGS 84 or ETRS 89 decimal degrees
Temporal coverage	Every 5 years or more
Temporal resolution	
Data format	raster grid

Content	Description
Ecological Objective	**EO7. Alteration of hydrographical conditions**
IMAP Common Indicator	**CI15. Location and extent of the habitats impacted directly by hydrographic alterations**
Parameter	**Wave**
Geographical coverage	Specify the geographical bounding box that includes the sea area that is covered by the data representation. Such area should be large enough to capture permanent and significant hydrographical changes due to coastal or offshore infrastructures. The bounding box shall be expressed with westbound and eastbound longitudes, and southbound and northbound latitudes in decimal degrees, with a precision of at least two decimals in WGS 84 or ETRS 89 geographical reference systems. The four data to provide are: • North Bound Latitude • East Bound Longitude • South Bound Latitude • West Bound Longitude
Observations/ Models	Numerical model assimilated and validated with in-situ monitoring data and preferably nested in Copernicus CMEMS wave products for boundary conditions (0.042degree x 0.042degree)
Data assimilation	In-situ monitored data provided by accelerometer mounted on buoy
Variables	Sea surface wave significant height (SWH) Sea surface wave mean period from variance spectral density inverse frequency moment (MWP) Sea surface wave mean period from variance spectral density second frequency moment (MWP) Sea surface wave from direction (VMDR) Sea surface wave stokes drift x velocity (VSDXY) Sea surface wave stokes drift y velocity (VSDXY) Sea surface wind wave significant height (WW) Sea surface wind wave mean period (WW) Sea surface wind wave from direction (WW) Sea surface primary swell wave significant height (SW1) Sea surface primary swell wave mean period (SW1) Sea surface primary swell wave from direction (SW1) Sea surface secondary swell wave significant height (SW2) Sea surface secondary swell wave mean period (SW2) Sea surface secondary swell wave from direction (SW2) Sea surface wave period at variance spectral density maximum () Sea surface wave from direction at variance spectral density maximum ()
Spatial resolution	25 mt or higher nested in Copernicus CMEMS wave grids products (0.042degree x 0.042degree)
Vertical coverage	1 level
Coordinate Reference System	WGS 84 or ETRS 89 decimal degrees
Temporal coverage	5 years or more
Temporal resolution	hourly-instantaneous
Data format	NetCDF or raster grid

Content	Description
Ecological Objective	**EO7. Alteration of hydrographical conditions**
IMAP Common Indicator	**CI15. Location and extent of the habitats impacted directly by hydrographic alterations**
Parameter	**Benthic habitat**
Geographical coverage	Specify the geographical bounding box that is covered by the data representation. The bounding box shall be expressed with westbound and eastbound longitudes, and southbound and northbound latitudes in decimal degrees, with a precision of at least two decimals in WGS 84 or ETRS 89 geographical reference systems. The four data to provide are: • North Bound Latitude • East Bound Longitude • South Bound Latitude • West Bound Longitude
Observations/ Models	In-situ monitoring observations
Data assimilation	
Variables	Type of habitat according to the 'Reference List of Marine and Coastal Habitat Types in the Mediterranean' – Annex I of the CI15 Guidance Fact Sheet. Use the highest level of identification, for example 'MA1.531 Association with encrusting Corallinales creating belts (e.g. Lithophyllum bissoides, Neogoniolithon spp.)' for Littoral rock/Upper mediolittoral rock.
Spatial resolution	100 mt or higher for separation length between in-situ monitoring sampling station
Vertical coverage	1 level
Coordinate Reference System	WGS 84 or ETRS 89 decimal degrees
Temporal coverage	5 years or more
Temporal resolution	Every 3 years
Data format	GIS polygon with attribute table with the following fields beyond unique identifier of the GIS polygon: • MHT-MED – code of habitat type as reported in Annex I of the CI15 Guidance Fact Sheet. For example, 'MA1.531'. If not present in the list use the code '9999' • DESC – Description of the habitat as reported in Annex I of the CI15 Guidance Fact Sheet. For example, 'Association with encrusting Corallinales creating belts (e.g. Lithophyllum bissoides, Neogoniolithon spp.)' • DESC_OTH – Description of the habitat if not present in Annex I of the CI15 Guidance Fact Sheet.

4. Alternative (simplified) version of the indicator guidance factsheetfor the Common Indicator 15

Ecological Objective 7: Alteration of hydrographic conditions does not adversely affect coastal and marine ecosystems.

Indicator Title	Location and extent of the habitats impacted directly by hydrographic alterations	
Relevant GES definition	**Related Operational Objective**	**Proposed Target(s)**
Negative impacts due to new structure are minimal with no influence on the larger scale coastal and marine system.	Alterations due to permanent constructions on the coast and watersheds, marine installations and seafloor anchored structures are minimised.	Planning of new structures takes into account all possible mitigation measures in order to minimize the impact on coastal and marine ecosystem and its services integrity and cultural/historic assets. Where possible, promote ecosystem health.

Rationale

Justification for indicator selection

After agreeing to progressively apply the ecosystem approach (EcAp) to the management of human activities in the Mediterranean at the 15th Meeting of the Contracting Parties to the Barcelona Convention (COP15, 2008), the Contracting Parties agreed, at COP17 in 2012, on an overall vision and goals for EcAp, and on 11 ecological objectives for the Mediterranean. Among these ecological objectives was the Ecological Objective 7 („Alteration of hydrographical conditions"), with its clearly outlined operational objectives and indicators. EO7 corresponds to Descriptor 7 (Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems) of the European Marine Strategy Framework Directive (MSFD).

Ecological Objective 7 („Alteration of hydrographical conditions") addresses permanent alterations in the hydrographical regime of currents, waves and sediments due to new large-scale developments that have the potential to alter hydrographical conditions. An agreed common indicator - 'Location and extent of habitats impacted directly by hydrographic alterations' considers marine habitats which may be affected or disturbed by changes in hydrographic conditions (currents, waves, suspended sediment loads).

There is a clear link between EO7 and other ecological objectives, especially EO1 (Biodiversity). Such link needs to be determined on a case-by-case basis. Refer to Annex 1 for habitats to be considered in EO7. Ultimately, the assessment of impacts, including cumulative impacts, is a cross-cutting issue for EO1 and EO7.

Scientific References

EC JRC (2015). Review of Commission Decision 2010/477/EU concerning MSFD criteria for assessing good environmental status Descriptor 7: Permanent alteration of hydrographical

Indicator Title	Location and extent of the habitats impacted directly by hydrographic alterations

conditions does not adversely affect marine ecosystems

EMEC Ltd (2005). Environmental impact assessment (EIA) guidance for developers at the European Marine Energy Centre.

OSPAR Commission (2012). MSFD Advice document on Good environmental status - Descriptor 7: Hydrographical conditions. A living document - Version 17 January 2012.

OSPAR Commission (2013). Report of the EIHA Common Indicator Workshop.

Royal Haskoning DHV (2012). Environmental Impact Assessment (EIA) and Appropriate Assessment (AA) Evaluation of assessment tools and methods. Lot 2: Analysis of case studies of port development projects in European estuaries. Tidal Rover Development (TIDE) Interreg IVB

Some reference and guidance documents on EIA can be found at : http://ec.europa.eu/environment/eia/eia-support.htm and in the „Guidance Document on how to reflect changes in hydrographical conditions in relevant assessments" (UNEP/MAP/PAP, 2015).

Policy Context and targets

Policy context description

Following the COP17 agreement on an overall vision and goals for EcAp, on 11 ecological objectives, operational objectives and indicators for the Mediterranean, a six-year cyclic review process of EcAp implementation was established (EcAp MED I 2012-2015), with the next EcAp cycle set to cover 2016-2021.

At COP18, in 2013, the targets for achieving GES of the Mediterranean Sea and its coastal zone by 2020 were adopted. In addition, through Decision IG. 21/3 (the so called "COP18 EcAp Decision") the EcAp roadmap was agreed on. The Contracting Parties also agreed to design an Integrated Monitoring and Assessment Programme (IMAP) by COP19, which would, for the first time, ensure a common assessment basis for the Mediterranean marine and coastal environment. At COP19, in 2016, the IMAP was adopted. The IMAP provides guidance to the parties on how to practically implement quantitative monitoring and assessment of the ecological status of the Mediterranean Sea and coast in line with the EcAp.

As part of the EcAp roadmap, expert-level monitoring discussions took place in the various Correspondence Groups on Monitoring (CORMONs) meetings on Biodiversity and Fisheries; Pollution and Litter; and Coast and Hydrography sub-clusters. An Integrated Correspondence Group on Monitoring Meeting (Integrated CORMON) took place on 30 March-1 April 2015, to discuss the main elements of the Integrated Monitoring and Assessment Programme.

As for Protocols of the Barcelona Convention relevant for the EO7, the Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean calls to Contracting Parties of the Barcelona Convection for continuous monitoring of ecological processes, population dynamics, landscapes, as well as the impacts of human activities (Article 7 b). In addition, it calls to Parties to evaluate and take into consideration the possible direct or

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indirect, immediate or long-term impacts, including the cumulative impact of the projects and activities, on protected areas, species and their habitats (Article 17).

Another Protocol of the Barcelona Convention, the Protocol on the Integrated Coastal Zone Management in the Mediterranean, in its Article 9, calls for Parties to minimize negative impacts on coastal ecosystems, landscapes and geomorphology, coming from infrastructure, energy facilities, ports and maritime works and structures; or where appropriate to compensate these impacts by non-financial measures. In addition, the Article 9 demands maritime activities to be conducted "in such a manner as to ensure the preservation of coastal ecosystems in conformity with the rules, standards and procedures of the relevant international conventions".

Out of other international legislation that can be relevant for the EO7 Ecological Objective, it is essential to mention Marine Strategy Framework Directive – MSFD 2008/56/EC since EcAp's EO7 corresponds to MSFD's Descriptor 7 to large extent. The hydrographical conditions outlined under the MSFD are, to a large extent, comparable to the hydromorphological conditions referred to under the Water Framework Directive (WFD) which calls for the protection of all water resources, including coastal waters. EO7 overlaps with other policy frameworks, such as the Environmental Impact Assessment (EIA) procedure on the assessment of the environmental impacts of certain public and private projects; the Strategic Environmental Assessment (SEA) procedure on the assessment of the effects of certain plans and programs on the environment; assessments undertaken under Marine Spatial Planning (MSP); and in the context of integrated coastal zone management (ICZM).

Targets

Planning of new structures takes into account all possible mitigation measures in order to minimize the impact on coastal and marine ecosystem and its services, integrity and cultural/historic assets. Where possible, promote ecosystem health.

Policy documents

Protocol on the ICZM in the Mediterranean - http://www.pap-thecoastcentre.org/pdfs/Protocol_publikacija_May09.pdf

Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean - http://www.rac-spa.org/sites/default/files/protocole_aspdb/protocol_eng.pdf

MSFD Directive - http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0056&from=EN

Other EU-related documents can be found at: http://ec.europa.eu/environment/eia/eia-support.htm

Indicator analysis methods

Indicator Definition

The EO7 Common Indicator reflects location and extent of the habitats impacted directly by

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the alterations and/or the circulation changes induced by them. It concerns area/habitat and the proportion of the total area/habitat where alterations of hydrographical conditions are expected to occur (estimations by modeling or semi-quantitative estimation).

Methodology for indicator calculation

Methodology used for indicator measurement encompasses elaboration on:
(i) Mapping of area where human activities may cause permanent alterations of hydrographical conditions (using i.e. existing EIA, SEA and Maritime Spatial Planning -MSP); and
(ii) Mapping of habitats of interest in this area of hydrographical changes; and
(iii) Intersection of the spatial map of the areas of hydrographical changes with spatial maps of habitats to determine the areas of individual habitat types that are impacted directly by hydrographical changes.

<u>New structures to be considered under EO7 assessment:</u>

As far as the type and dimension of structures to be taken into account: use the case by case approach depending on the nature of the coast, the function of the structure and the depth reached by the structure where appropriate threshold values are taken into account (such as absolute surface in m², range of depths where structure will be built (to avoid habitat "segmentation")). As an additional criterion it was agreed that all permanent structures, for which an EIA and/or a planning/building permit is required, should be considered.

<u>Hydrographical conditions to be considered:</u>

- At least, waves and currents changes (can be used to assess changes in bottom shear stress, turbulence and alike).
- For sandy sites or sites with natural sediment dynamic, changes in sediment transport processes and turbidity and induced changes in morphology of the coast.
- If the new structure involves water discharge, water extraction or changes in fresh water movements: assessment of salinity and/or temperature changes.

Steps to assess hydrographical alterations:
In case of insufficient data and resources and if the implementation of hydrodynamic modeling is not feasible, a simplified approach for assessing hydrographical alterations is proposed.
This approach aims to focus on :

1. The hold of the structure (location and extend on the sea floor). In this area, the presence of the structure will definitively alter the existing habitats (physical loss).
2. Permanent bathymetric changes related to the structure and due to human activities. For instance, the creation of a port often requires the digging of basins and the dumping of materials at sea. These diggings and discharges, leading to permanent bathymetric changes and modifying waves and currents propagation, will also definitively alter the existing habitats.
3. Effects of the structure on hydrographical conditions in its neighbourhood. The existence of the structure will modify the regime of currents and agitation and also the coastal transit with creation of erosion and deposition zones. For instance, in a harbour,

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the presence of dikes attenuates the currents and the swell inside the basins and leads to decantation of suspended material (vases, organic matter, debris plants.) inducing changes in benthic settlements.

First level of assessment: assessment of physical loss induced by the structure itself (on sea floor and in water column)

The objective here is to represent by a polygon (GIS data) the exact location and extend on sea floor of the expected construction, i.e. a footprint (and not only the extent of the submerged part of the structure). These data can be taken from the construction plan of the structure that should be present in the EIA or another planning document.

A proposal for attribute's GIS data can be found in Chapter „Expected assessment outputs“ below.

Second level of assessment: assessment of permanent changes in bathymetry due to human activities (related to the construction and the use of the structure)

The objective here is to represent by a polygon (GIS data) the exact location and extend of dredged and disposal areas leading to permanent changes in bathymetry. These changes can happen during the construction of the structure (digging of basins) or for its normal use (channels dredging to maintain a certain depth).

Information relative to these activities can be found in the EIA or can be asked to the project manager responsible for its construction or to the structure owner.

Third level of assessment: assessment of hydrographical changes induced by the structure in the surrounding area

The first possibility to assess these alterations is to use the information provided by the EIA if available. Even if the EIA does not fully meet the needs of this indicator, it should at least provide some information on the main expected hydrographic changes since they may compromise the use or sustainability of the structure. For instance, in case of a port or a marina, the attenuation of agitation, being the objective, should be well studied. The same way, on a coast with strong sediment transit, the impact of the structure on erosion and sedimentation changes should be studied as they could compromise the use or the durability of the structure.

If the EIA does not provide a sufficient level of information, other available sources of information concerning similar or close sites have to be explored: historical evolution of sediment supply, analysis of the evolution of the coastline and the seabed, analysis of the impact of existing defence structures and ports on the morphodynamics of the coastline and alike.

These available data and studies are not directly applicable to assess hydrographical alterations induced by the new structure. Nevertheless, they can be used by experts to extrapolate evolution tendencies on the site of interest, thus providing a first level of characterization of expected hydrographic alterations and allowing to roughly specify their extent and location.

For the first level of assessment, it is clear that under the hold of the structure the hydrographical conditions and the habitats will be definitively and permanently altered. On the other side, for the second and third levels of assessment, depending on the available data, the actual knowledge and the assumptions followed, there may be some degree of uncertainty in the assessment of location and extend of expected hydrographical alterations. To take into

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account these uncertainties and the limits of the assessments, it is proposed to notify them in the attribute table relative to these assessments (A proposal for attribute's GIS data can be found in „Expected assessment outputs“). These notifications will help to identify and subsequently improve the evaluations deemed to be the least reliable.
At the end, the results of the above assessments are integrated on one single GIS layer (i.e. hydrographical alterations GIS layer). The last step of the EO7 indicator calculation consists of overlaying hydrographical alterations GIS layer with habitats GIS maps/layer. Calculations are made with GIS tools in order to define habitats impacted directly by hydrographic alterations.

If the assessment of hydrographic alterations presents a high level of uncertainty, a risk-based approach can be used to identify habitats that are most sensitive to expected alterations. To do this sensitivity matrix can be used (see for instance: La Rivière M. et al., 2018. *An assessment of French Mediterranean benthic habitats' sensitivity to physical pressures.* UMS PatriNat, AFB-CNRS-MNHN. Paris, 86 pp.).

Due to the ecological importance of *Posidonia* meadows in the Mediterranean Sea and their vulnerability to coastal development, a specific paragraph for this habitat is presented.

Particular considerations for *Posidonia* meadows:

In addition to direct impacts, induced by the structure itself, which will definitively destroy the meadow by recovery, some construction techniques and then indirect impacts, following its construction, on currents and sedimentary transport, may also alter this habitat, on areas much larger than the structure footprint.

Indeed, the *Posidonia* is very sensitive to water turbidity, even transient. Also, during the construction of the structure, a turbid cloud can be generated (discharge at sea of fine materials). This turbid cloud will decrease the transparency of the water, and therefore photosynthesis, in the short term; it can also be deposited on the seagrass meadow that can cause smothering by hyper sedimentation. The thinnest sediments can also be resuspended during storms, thus decreasing the transparency of the water in the long term. Major seagrass meadow destructions due to these phenomena have been observed, for example, in France following the construction of the ports of Pointe Rouge in Marseille and Mouillon in Toulon.
Moreover, the construction machines are often fixed on the bottom, for stability reasons, directly and / or by means of anchors, which has a very negative impact on the bottoms: digging holes (feet of the machines) or furrows (chains of anchors) in the *Posidonia oceanica* meadows.

Once the structure is built, its presence can modify the sedimentary transit and induce areas of erosion and accumulation around it. These modifications will alter the equilibrium between the sedimentation rate and the vertical growth of *Posidonia*. So, if the rate of sedimentation **exceeds 5-7cm / year**, the vegetative points die; conversely, if this rate is zero or negative (sediment departure), the rhizomes are loosened; they are then very sensitive to breakage (hydrodynamism, anchors, trawling, etc.)
It should also be noted that it is extremely rare for a seagrass meadow to survive in a harbor basin in the medium or long term.

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In order to avoid all these phenomena, it is therefore advisable to:

- Use materials and construction techniques that minimize the suspension of fine particles that can induce turbidity in the surrounding waters. (for example: the dumping of fine materials (diameter less than 1 mm) at sea, or of blocks mixed with fine materials, is to be excluded completely; when rockfill is installed, it is advisable to rinse the blocks of rock; geotextile protective screens must be put in place around the site to minimize turbidity induced).
- Avoid the use of construction machines located at sea by favouring the use of machines lying on the ground. if it is essential to use them at sea, they must not be anchored or relied on *Posidonia* meadows.
- Avoid carrying out construction work in summer, when the plant rebuilds its reserves for the following year
- Build a new development at several tens of meters from the closest living *Posidonia* meadow
- Avoid including *Posidonia* meadow in a port basin
- Monitor the condition of the surrounding seagrass, both during and at the end of the work.

(These elements on *Posidonia* meadows have been taken from : Boudouresque et al., 2006, Préservation des herbiers à *Posidonia oceanica*. RAMOGE pub.: 1-202, N°ISBN 2-905540-30-3)

Indicator units

- km2 of impacted habitats
- proportion (%) of the total area/habitats impacted

List of Guidance documents and protocols available

UNEP/MAP/PAP (2015). Guidance document on how to reflect changes in hydrographical conditions in relevant assessment (prepared by Spiteri, C.). Priority Actions Programme. Split, 2015.

UNEP(DEPI)/MED IG.22. UNEP(DEPI)/MED IG.22/Inf.7 (2016). Draft Integrated Monitoring and Assessment Guidance

UNEP(DEPI)/MED WG.433/1 (2017) PAP/RAC Meeting of the Ecosystem Approach Correspondence Group on Monitoring (CORMON) on Coast and Hydrography – Working Document

Advice document on hydrographical conditions (Descriptor 7) in the context of MSFD, published by OSPAR Commission (2012);

Scientific and technical review of the MSFD Commission Decision 2010/477/EU in relation to Descriptor 7 carried out by the EC JRC; etc.

Data Confidence and uncertainties

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Data used or produced for the monitoring should be in agreement with Shared Environmental Information System (SEIS) principles. More on SEIS principles can be found in Draft Integrated Monitoring and Assessment Guidance.

Methodology for monitoring, temporal and spatial scope

Available Methodologies for Monitoring and Monitoring Protocols

At this stage, there is no clear available methodology and monitoring protocols (see **Known gaps and uncertainties in the Mediterranean).**
Some methodologies or protocols could be proposed, once done an inventory of existing and available data in Mediterranean Sea.

For more details, see "Guidance document on how to reflect changes in hydrographical conditions in relevant assessments".

Available data sources

Global marine data source at the scale of the Mediterranean Sea:

- EMODnet Central Portal (http://www.emodnet.eu/)
- Mediterranean Marine Data (http://www.mediterranean-marinedata.eu/)
- Copernicus, Marine environment monitoring service (http://marine.copernicus.eu/)

Available regional or local data sources (in each country) should be also identified.

Spatial scope guidance and selection of monitoring stations

The monitoring will focus on habitats of interest, around new permanent constructions (lasting more than 10 years) in coastal waters.
The study area should depend on the footprint of the new construction considered and on the local (or regional) geographical and marine conditions. It should be large enough:

- to show all the hydrographic alterations induced by the construction, even for long term;
- to follow all the habitats of interest that could be potentially impacted.

At first, the spatial scale (in cross-shore and long-shore directions) to be used should be about 10 to 50 times the characteristic length of the structure. Depending on the first results obtained for this area, the area should be enlarged or zoomed in around the structure.

It should be highlighted if monitoring was performed in sensitive areas, such as marine protected areas, spawning, breeding and feeding areas and migration routes of fish, seabirds and marine mammals, since they are priority.

Temporal Scope guidance

To correctly assess changes in time on habitats induced by constructions, different monitoring timescales are proposed:

- Before construction, initial state assessment (baseline conditions):
  Monitoring should provide the initial hydrodynamics conditions surrounding the future

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construction.

- During construction: monitoring should ensure that impacts due to works are limited in space and in time.
- After construction, short term changes (0 to 5 years after): at least yearly up to 5 years. During this period, strong changes should happen on hydrographical, morphological and habitats conditions. The monitoring frequency should be high* enough to assess these changes. It should be annual (at the same period of year) and provide, each year, the changes in hydrodynamic conditions (assessed by comparing present and initial conditions).
- After construction (5 to 10 years after): at least biennium to 10 years.
  Same as before with a lower* monitoring frequency as the changes should be lower.
- Long term changes (10 to15 years after construction)
  Same as before with a lower* monitoring frequency as the changes should be lower.

* The monitoring frequencies to be used in these different phases should depend on the intensity of changes in hydrographical and morphological conditions occurring on the site (case by case).

Data analysis and assessment outputs

Statistical analysis and basis for aggregation

Expected assessments outputs

All the outputs that came out of the monitoring (I.e. trend analysis, distribution maps, etc.) should be listed, along with source(s) where they can be found.

The outputs to be reported are (map and GIS data):

- The area and location where the future structure will be built;
- The area and location where alterations in hydrographical conditions are expected to occur and those areas where alterations are actually occurring;
- The area and location of the habitats of interest potentially impacted by these alterations;
- The area and location of these habitats of interest previously identified for the whole analysis unit (to assess the proportion of total habitats that are altered).

For the area and location where the future structure will be built, additionally to the surface representation of the structure, some information has to be provided as attributes of the GIS layer. The following attributes are proposed:

Country	*Locality / District*	*ID of the structure*	*Role of structure*	*Type of structure*	*Materials*	*Extend on the sea floor (in m², ha or km²)*
Specify the country	*Specify the location of the structure*	*The ID must be unique to identify the structure. It could be a number or a nummered code using*	*Harbour, coastal defense, marine energy,...*	*Quay, groynes, wind farm,...*	*Concrete, rockfill, ...*	*Area of the structure on sea floor. The used unity has to be provided*

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		letters from the previous column				*in the name of the field*

If the structure is composite (in terms of type, materials, ...), several GIS surface objects could be defined.

For the area and location of expected hydrographical alterations, additionally to the surface representation of these alterations, some information has to be provided as attributes of the GIS layer. The following attributes are proposed:

Country	*Locality / District*	*ID of the structure*	*Nature of expected hydrographic alterations*	*Data used*	*Method of alterations assessment*	*Level of assessment confidence*	*Extend of hydrographical alteration (in m², ha or km²)*
Specify the country	*Specify the location of the structure*	*The ID must be unique to identify the structure. It could be a number or a nummered code using letters from the previous column*	*Waves/currents attenuation; anthropic changes of bathymetry; changes in sediment transit inducing erosion/sedimentation;*	*Data provided by EIA ; dredging/disposal scheme ; ...*	*Modeling; expert judment ; Analogy with similar and close site;...*	*Low/Medium/Good*	*Area of the structure on sea floor. The used unity has to be provided in the name of the field*

If different extend of hydrographical alterations can be identified (in terms of nature, intensity, …) several GIS surface objects could be defined.

For each GIS data layer produced, a metadata file must be added. This file must provide information on: creation date of the GIS data, GIS data author, contact information, source agency, map projection and coordinate system, scale, error, explanation of symbology and attributes, data dictionary, data restrictions, and licensing (see for instance INSPIRE Directive).

Known gaps and uncertainties in the Mediterranean

There are general difficulties, not particular to the Mediterranean context, that can be identified for this EO7:

- Lack of coherence in definitions, standard approaches in the development and application of indicators and in the assessment of impacts, together with lack of methodological standards.
- Lack of knowledge and understanding on the link between physical pressures and biological impacts and on the cumulative impacts.

Another difficulty comes from the hydrographical alterations that EO7 indicator should assess. These alterations, around a particular coastal construction, often change in intensity, in area and indeed in time, depending on the off-shore hydrographical conditions (calm weather/extreme event; seasonality of waves height and directions; local wind conditions…) and on the morphologic history of the site (the present state is due to the succession of these different conditions).
So, a work to define which hydrographical conditions and temporal scale have to be used to assess hydrographical alterations by numerical modelling must be carried out.

Like everywhere, there is certainly a lack of physical characteristics data in the Mediterranean

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Sea (bathymetric data, seafloor topography, current velocity, wave exposure, turbidity, salinity, temperature, etc.), that will be the main problem to implement this indicator, in particular to define the base-line conditions. To identify these lacks, a global and clear inventory of existing and available data in Mediterranean Sea should be done.

Nevertheless, data can be collected from regional models (bathymetry, hydrodynamics, salinity, temperature). These data with coarse resolution will need to be refined close to the location of the new structure.

In case of no sufficient data, the use of assessment methods needing less data (empirical formulae, expert judgment, comparison with similar sites) should be considered, as well as acquisition/monitoring of missing data, promoting regional cooperation.

Contacts and version Date

Key contacts within UNEP for further information

Version No	**Date**	**Author**
V.1	27/6/16	PAP/RAC
V2	11/07/16	Olivier Brivois
V3	13/07/16	Olivier Brivois
V4	16/03/17	Olivier Brivois
V5	19/06/18	Olivier Brivois
V6	26/07/18	Olivier Brivois

Annex 1. List of habitats to be considered