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PAP/RAC **Meeting of the Ecosystem Approach Correspondence Group on Monitoring (CORMON) on Coast and Hydrography**

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Introduction

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 of EcAp, and on 11 ecological objectives, operational objectives and indicators for the Mediterranean.

At COP18, in 2013, the targets were adopted for achieving GES of the Mediterranean Sea and its coastal zone by 2020. 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. Among the ecological objectives included in IMAP adopted at COP 19 were EO7 “Alteration of hydrological conditions” and EO8 “Coastal ecosystems and landscapes”.

In accordance with the UNEP/MAP Programme of Work 2016-2017 adopted by COP 19, Athens, Greece, 9-12 February 2016, the PAP/RAC is organizing the Meeting of the Ecosystem Approach Correspondence Group on Monitoring (CORMON) on Coast and Hydrography on 3 March 2017 in Madrid, Spain (Port Authorities premises).

1. The main objectives of the meeting are to:

   a) review and discuss the concept for the preparation of the 2017 Quality Status Report (with focus on the chapters of EO7 and EO8)
   b) discuss the Assessment Fact Sheet for the indicators, i.e. the format in which the countries will provide the monitoring results for EO7 and EO8;
   c) review and discuss open questions regarding the monitoring for all common and candidate indicators concerning EO7 Hydrography and EO8 Coastal ecosystems and landscapes, which will also serve as an input to the existing indicator fact sheets;
   d) share and exchange information with countries’ representatives on the current status of national monitoring programmes; and
   e) give specific recommendations for further work to the UNEP/MAP Secretariat on the above.

Agenda item 3: **Progress on the Preparation of the Mediterranean Quality Status Report**

The Integrated Monitoring and Assessment Programme (IMAP), including the indicators, was adopted at the Conference of the Parties to the Barcelona Convention (COP 19) in February 2016. The 2017 Quality Status Report (QSR) will be the first report on the IMAP-based Ecological Objectives and the related common indicators. The approach for the development of the Quality Status Report will be based on common indicators assessment fact sheets that will allow assessments to be linked via metadata to the underlying datasets, methods, authors, ensuring increased transparency and repeatability. It will be linked and published on the UNEP/MAP Barcelona Convention Integrated Data and Information System. It is planned to finalize the QSR report until October 2017 so that it can be submitted to COP 20 (December 2017).

The concept for the preparation of the QSR2017 will be presented, as well as the process timeline and how the report can follow similar approaches to other Regional Seas and find an appropriate balance between quantitative and qualitative information where data gaps exist. The current status regarding EO7 and EO8 indicators in the context of 2017 QSR will be briefly presented.

Agenda item 4: **Assessment Fact Sheets for the indicators**

The Assessment Fact Sheets serve as templates in which the countries will provide the monitoring results for the EcAp indicators. These fact sheets will allow the assessment of the indicators to be linked via metadata to the underlying datasets, methods, authors, increasing transparency, and repeatability. The Assessment Fact Sheets will be linked and published on the UNEP/MAP Barcelona Convention Integrated Data and Information System. The fact sheets will also serve as an input to the web-based Mediterranean Quality Status Report (QSR). The template of the Assessment fact sheet can be found in the Information document. The template for Assessment Fact Sheets will be presented and discussed.

Agenda item 5: **Common Indicator Guidance Fact Sheets**

The Integrated Monitoring and Assessment Guidance presented at COP 19 in February 2016 provides guidance on how to monitor and measure the adopted indicators. Draft indicator guidance factsheets for EO7 Hydrography common indicator and both candidate and common indicators for EO8 Coastal ecosystems and landscapes have been developed in order to better assist the countries in the revision of their monitoring programmes. The PAP/RAC will present the draft indicator guidance factsheets for discussion, review and advice by the CORMON for their further development. The latest versions of indicator factsheets can be found in the Information document.

a) **EO7 Hydrography Common Indicator 15: Location and extent of the habitats impacted directly by hydrographic alterations**

The 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 the 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).

The open questions that need to be discussed during the meeting are the following:

a1.) **Which new developments are taken into consideration (type, dimension)?**

At locations with strong longshore sediment transport, even "medium-size" structures can have a relatively important impact on their surrounding hydrographical conditions (particularly cross-shore structures). Accordingly, defining a threshold of footprint area from which the new structure has to be considered under EO7 indicator is not so simple.
So, perhaps, different threshold values could be defined, depending on the nature of the coast, the depth reached by the future structure (to take into account habitat distribution, linked to EO1). Threshold values could be defined by: a surface in m^2, a surface for a particular depth or for a range of depths (to avoid habitat "segmentation"), a length in m in cross-shore direction from the coast line…?

a2.) **What kind of hydrographical alterations must be considered?**

Depending on the hydrographical conditions of the site, their natural variability, and the new structure and its future functions, various physical characteristics could be considered. Monitoring the changes in these physical processes will allow for the assessment of impacts on natural habitats.
At least the hydrodynamic alterations (waves and currents changes) induced by the new development should be considered.
For sandy sites, with natural sediment dynamics, sediment transport processes and induced changes in morphology of the coast should also be considered.
If the new structure involves water discharge or water extraction or changes in fresh water movements, assessment of temperature and/or salinity alterations should also be carried out.

a3.) **How to define the base-line conditions (and then "with structure" conditions)?**

The base-line conditions are the actual conditions. Defining the base-line conditions consist in characterising the actual hydrographical conditions and their natural variability.
Depending on the physical characteristics considered and on the means and data available, the definition of the base-line conditions can vary.

For hydrodynamics characteristics (waves and currents) in the area of interest, defining the base-line conditions could consist in defining the main wave climates and currents responsible of the behaviour of the site. To describe these representative hydrodynamic characteristics of a site (in terms of intensity, direction, occurrence…), long sequences of wave data (measured or modelled) and currents data, statistical analyses and eventually modelling (to propagate waves from off-shore to the coast and to calculate currents close to coast) are required.

For sites with sediment dynamics, having the knowledge of sediment transport rate depending on the hydrodynamic conditions would be the ideal case. But as these phenomena are complex and lots of data are needed, understanding the actual evolution

trends (stability, erosion, accretion of the coast) and assessing the rate of change (erosion of x meter/year during such period…) would be a minimum requirement.

As a minimum, the characterisation of the following hydrodynamic conditions is required:
- bathymetric data(with a fairly fine resolution to the coast, less fine resolution off-shore) and knowledge of the bottom nature (could be taken from the habitat map).
- waves/currents data;depending on the location where data are available and the duration of the record, different strategies could be applied.

Once the representative hydrodynamic base-line conditions have been determined and assessed over the entire site of interest (using modelling), the same hydrodynamics conditions are used to model the site including the future structure (maps, plans of new structure are required) to get the hydrographical conditions induced by the structure.

a4.) **Knowing the base-line conditions and the conditions with structure, how to define alterations in hydrographical conditions?**

The hydrographical alterations will be determined by comparing the base-line conditions and the conditions considering the new structure.
This comparison, done for the same off-shore hydrographical conditions (for instance the same off-shore waves are used to model the site without and with the structure), can be expressed as relative changes between both situations or as net/absolute changes between them (example: relative change: increase of 10% of the current velocity; absolute change: increase of 0.5 m/s of the current velocity). Moreover, these changes can be considered for the mean parameters values or for the extreme parameters values.

As the full range of changes could not be taken into account (in particular the /very/ weak changes), thresholds should be used to define values from which the changes are considered as alterations.

So, the alterations in hydrographical conditions could be defined as a percentage of change for a target variable with respect to the base-line value, or it could also be a value for a particular parameter (for instance: currents induced by the structure should not exceed the speed of XX m/s for this bottom nature and habitat).

If thresholds of changes are defined, they should not be too weak (except for particular parameters),because we must keep in mind that these changes should be measured in the field (experimental devices have a certain degree of precision). Moreover, along the same lines, numerical modelling can induce a bias that reflects any reality (due to some approximations, numerical instabilities, etc.).

a5.) **Choice of spatial and temporal scale**

The chosen spatial (area and resolution) and temporal scales (duration, resolution) must be able to show/take into account all the (main) hydrographical alterations induced by the future structure. These scales are highly site-dependent.

Spatial scale:
To begin, anarea of interest (calculation area) of several dozen times the characteristic length of the structure should be used at first (at least, in longshore direction, usually less

in cross-shore direction, depending on the local depth variation). The first results obtained for this area will tell if the area is large enough, if it must be enlarged, or if a zoom on a particular area is possible.
For more complex sites, the area of interest can be larger. For instance, for sites where sediment transport processes are present, taking into account all the sedimentary cell could be better (to assess all the expected changes at the regional scale).

Temporal scale:
The first goal of EO7 indicator is to assess the short-term (0 to few years) alterations induced by the new structure (just after construction).
But mid- and long-term evolutions should also be assessed and monitored for a site with strong natural dynamics (using modelling, expert judgment, field measurements).
It could also depend on the response time of the habitat to the hydrographical changes.

a6.) **What in the case where there are no sufficient data?**

In the cases where the existing data sources do not provide sufficient information or resolution on the area of interest, monitoring may be required as a way of supplementing the existing data and providing sufficient base-line information at different spatial and temporal scales.
If no wave data are available in the vicinity of the site of interest, hindcast regional modelling could be used to provide these data at a different location along the coast.

a7.) **Data required relative to EO1 Biodiversity**
- Map of benthic habitats in the zone of interest (broad habitat types and/or particular sensitive habitats).
- Map of pelagic habitats in the zone of interest??
- Sensitivity/vulnerability of these habitats to hydrographical alterations (to determine which part of the habitats may be impacted)
- Eventually, threshold values for certain parameters relative to particular habitats (for instance for the existing habitat, the current velocity must not exceed this value to maintain the habitat).

b) **EO8 "Coastal ecosystems and landscapes" Common Indicator 16: Length of coastline subject to physical disturbance due to the influence of manmade structures**

One particularity of the EcAp (compared to the EU MSFD) is the inclusion of the Ecological Objective focusing on the coast (EO8-The natural dynamics of coastal areas are maintained and coastal ecosystems and landscapes are preserved). It reflects the aim of the Barcelona Convention to also include or cover coastal areas in the assessment, which became a legal obligation upon the recent entry into force of its ICZM Protocol.
The agreed Coastal Common indicator "Length of coastline subject to physical disturbance due to the influence of manmade structures" belongs to Operational Objective 8.1 The natural dynamics of coastlines is respected and coastal areas are in good condition. It incorporates coastal dynamics as an integral part of the EcAp.
The monitoring aim of the EO8 common indicator is twofold: (i) to quantify the rate and spatial distribution of the Mediterranean coastline artificialisation and (ii) to provide a better understanding of the impact of those structures on the shoreline dynamics.

The open questions that need to be discussed during the meeting are the following:

b1.) Which coastline has to be considered?

Although a widely agreed technical definition of *coastline* is not available, the implementation of EO8 indicator requires a reference coastline on which the length subject to physical disturbance is calculated and so an operational definition is needed in order to identify it. One option is to use 'official' reference coastline whose production and maintenance lies on the responsibility of specific governmental offices.
Unfortunately, it is not unusual to find out that more than one 'official' coastline exists for the same CP produced with different technological techniques (aerial photograph, satellite imageries, …) and reference time period.
In order to assure comparability of results between successive reporting exercises, each CP should choose during all the process a fixed reference coastline.
Coastline changes due to coastal erosion, sea level rise and morphological modifications have to be taken into account in relation to coastline spatial scale resolution. In this regards, a compromise has to be reached between the level of accuracy and details of the coastline and its chance to represent a lasting and homogenous reference between CPs.

b2.) How manmade structures are identified?

Hard coastal defense structures, ports and marinas, land reclamation area and impervious surfaces have to be identified and reported on a GIS tool in order to proceed further in the implementation of EO8 indicator. Technological resources such as Very High Resolution satellite imagery or aerial photographs represent the starting point of a digitalization process where also common procedures have to be agreed in order to map manmade structures in a comparable way between CPs.
In this regards, should some basic criteria on digitalization of structures be agreed between CPs, for ex. showing how to deal with typical situations?
Minimal level of spatial resolution is also crucial for a proper identification and digitalization. As new structures are being built continuously to protect coasts and enlarge transport facilities, two choices are on the table to assure comparability between CPs:
- To agree on fixed reference years when monitoring of manmade structures is done

- To agree on fixed time intervals (for ex. 6 years) where trends of increasing/decreasing of manmade structures are assessed?

b3.) How manmade structures are reported on coastline?

In order to calculate the length of coastline subject to physical disturbance due to the influence of manmade structures, such structures have to be reported on the coastline polyline.
The following options are available, each with its own pros and cons:
- Length of artificial coastline is calculated as equal to the sum of length of polylines representing manmade structures;
- Length of artificial coastline is calculated as the sum of:
    - segments on reference coastline identified as the intersection of polylines representing manmade structures with reference coastline
    - plus, or ignoring, polylines representing manmade structures with no intersection with reference coastline

Another issue is whether to consider natural or artificial segments of coastline lying between very close coastal defense structures.
A minimum distance between coastal defense structures should be set in order to classify such segments as natural or artificial?

b4.) How is represented the length of coastline subject to physical disturbance?

Once natural and artificial segments are set on the coastline, the length of artificial coastline can be reported as:
- the overall percentage on the total length of coastline of the CP
- percentages calculated for each coastal stretch in which the coastline has been subdivided

The second option has the advantage to give evidence to possible increasing trends in specific areas that could otherwise be hidden in an overall analysis.
Should common criteria be set for coastal stretch identification? If yes which ones? Such stretches should be fixed one and for all successive reporting exercises or be modifiable?

b5.) Choice of spatial and temporal scale

Spatial and temporal scale play a crucial role in the implementation of EO8 indicator. If spatial resolution is too low or time period is too old, manmade structures could be poorly identified or completely missed with heavy consequences on the calculation of length of artificial coastline.
Spatial resolution depends both on resolution of data sources as satellite imagery or aerial photographs and on the accuracy assured by the digitalization process. This last issue usually implies the employment of well trained personnel for GIS digitalization and agreed procedures applied uniformly on the overall coastline. Merging products done by different teams, although based on the same data sources, can result in an inhomogeneous final output.

Fixed time intervals for the calculation of length of coastline subject to physical disturbance should be agreed in order to produce comparable trends results between CPs. Furthermore, the first baseline should be produced on an agreed time period, for ex. 2010-2012 or 2014-2016.

(6) How to deal with lack of information?

In order to implement EO8 indicator with an acceptable level of accuracy, recent data sources with proper spatial resolution and complete coastline coverage should be used jointly with adequate GIS tools and expert team.
Capacity building can be readily assessed for each CP as such resources are generally available for the Mediterranean Region also taking into account the increasing efforts on satellite imagery products (ESA Sentinels constellation). So, once a common framework of data sources, GIS procedures and way of representing the output of EO8 indicator are agreed, a common implementation work for all CPs could be in principle settle down.

c.) **EO8 "Coastal ecosystems and landscapes" Candidate Common Indicator 25: Land-use change**

The common indicator 'Land-use change' is currently a candidate indicator. The inclusion of this indicator on the list of IMAP indicators is highly important since urbanisation, or land take, is the most dramatic change given the (almost certain) irreversibility of the process. The associated impacts of land-use change are: (i) habitat loss with the associated impact on related ecosystem functions like C sequestration, regulation of water cycle, or biomass production; and (ii) fragmentation - the division of natural habitats in smaller parcels contributes to the isolation of a number of species, and also compromises its viability. Therefore, the accumulated impacts of urbanisation highly compromise ecosystem integrity. Since impacts are dependent on the scale and pace of changes it is important to consider these aspects when monitoring land-use changes.

The "Land-use change" candidate indicator aims at monitoring the progress towards achieving the first goal of coastal sustainability set out in the ICZM Protocol. The objective is to know the extent to which the coastal zone has been built up over the past several years because this will indicate the degree of pressure on the coast and the likelihood of further changes in the future. We also want to know whether development on the coast has been greater and more intense than in the wider region. It can also help to understand patterns of development and unravel cause-effect relationships.

c1) **What is the GES for land use?**

Given the particularities and complexity of the terrestrial systems, to which the indicator mainly refers, the GES for land use could not be defined by a single value or threshold and needs to take a different approach. In fact, the indicator is a guide to identify to what extent land-use changes are improving the ecosystem condition and integrity or, on the other hand, are leading to increased degradation. This is possible because it is well known which types of changes have stronger impacts on the ecosystems (both positive and negative). A base-line is defined (the first year for which the indicator is calculated) and from there the changes on land use are assessed. The indicator has a specific focus on the artificialisation (also referred to as land take) since this is the change with the strongest impact –it is almost irreversible. However, changes in natural areas are also considered as complementary to the previous one.

The indicator, complemented with the local/regional knowledge*, is well suited to assist in planning and defining objectives. Assessing the trends in different areas over a certain period is useful to identify certain hotspots (areas with higher grades of changes that would require specific attention/actions), or the efficiency of the implementation of planning policies (e.g. maintenance/increase of natural areas). Moreover, the pressures exerted by certain changes can be linked with the local knowledge based on *in situ* information (e.g. species composition), improving the understanding of the process related to ecosystem integrity. Finally, this leads to a better definition of priority areas for action and effectiveness of nature protection measures.

* Given the relevance of the socio-economic, historic and cultural dimensions, in addition to specific geographical conditions, local experts will provide the needed input in support of this indicator

c2.) **Definition of reporting units**

While it is clear that the definition of the coastal zone should adhere to the ICZM Protocol, a further division in subunits or belts is more flexible. There is a consensus on the need to specifically analyse the first 300 m from the coastline as a proxy to the setback zone. Further division landwards is very much subjected to the specific topographic, historical and socio-economic conditions. Three additional subunits have been proposed: a) 300 m – 1 km; b) 1-10 km; and c)>10 km (in case the coastal zone boundary is further than 10 km). This subdivision is intended to better understand the links and influence between the inland and the coast.
Therefore, the provided limits for the buffers could be considered as general guidelines in case no other criteria or local knowledge could provide relevant information. In any case a subdivision to 2 to 4 buffers is suggested according to the regional specificities, with flexibility regarding the distance.

c3.) Data monitoring

Remote sensing based on satellite images is the most cost-effective method for monitoring land-use change. Given that there is no common land-use map of the Mediterranean region, different approaches are possible and need to be considered in light of the existing initiatives in each country:

- Own development of a land-use map for the coastal area. Currently, the Sentinel satellites launched under the Copernicus programme provide satellite imagery which is freely available. This ensures high quality, regular and consistent source with guaranteed continuity. This is a good opportunity to reinforce national capabilities, with a modular development in the sense of further refining land-use classes according to the needs in other policy areas (e.g. LULUCF in the context of climate change).

- Third-party open-source land-use maps. In this case the advantage is the minimum investment required to obtain the map. However, the limitations are related to the constraints imposed by the resolution and land-use classification of each product. Additionally, the continuity of the product in time is not always ensured. The main existing products are listed below:

  - GlobCover. Global land cover dataset at 300m resolution from the MERIS sensor on the ENVISAT satellite. http://due.esrin.esa.int/page_globcover.php

  - Climate Change Initiative Land Cover map. Global land cover dataset at 300m resolution, for 1998-2002, 2003-2007, 2008-2012. http://maps.elie.ucl.ac.be/CCI/viewer/index.php

  -GLC-SHARE: Global Land Cover data combined from 'best available' national land cover maps. 1km resolution. http://www.fao.org/geonetwork/srv/en/main.home?uuid=ba4526fd-cdbf-4028-a1bd-5a559c4bff38

The current cooperation between UNEP/MAP and EEA (MoU signed at COP19) could be extended in order to examine the possibility to provide satellite images from Copernicus for the whole Mediterranean. In this way all countries would have the same source of data.

This also opens a possibility for the indicator to be monitored by one institution (e.g. PAP/RAC) and countries would only have to verify the proposed results. This would reduce the cost of monitoring significantly.

It is expected that the Meeting will propose the inclusion of Land use change indicator on the list of common indicators.

Agenda item 6: **National Monitoring Programmes**

The Decision IG.22/7 on Integrated Monitoring and Assessment Programme (IMAP) of the Mediterranean Sea and Coast and Related Assessment Criteria urges the Contracting Parties, with the support of the Secretariat, to update their national monitoring programmes in light of the new elements of IMAP and report regularly quality assured data. Different countries are fulfilling this obligation in different ways (e.g. the EU countries and those approaching the EU, are performing their national monitoring programmes as part of the obligations relevant to the EU Marine Strategy Framework Directive (2008/56/EC), while some countries of South-East Mediterranean are developing their national monitoring programmes through the EcAp MED II project (seven eligible countries: Algeria, Egypt, Israel, Lebanon, Libya, Morocco and Tunisia).

This CORMON will be a good opportunity to discuss and share experiences and lessons learned, and gather an overview of the different stages of revision and implementation of the national monitoring plans, and the challenges encountered. Best practices and possible mechanisms for follow up, exchange and support among countries will be discussed.