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Workshop on Science Policy Interface (SPI) strengthening for the implementation of the UNEP/MAP IMAP in relation to Marine Litter, Biodiversity & fisheries, Hydrography, with a focus on the Risk Based Approach (RBA) for monitoring.

Madrid, Spain, 2nd March 2017

Agenda item 4: Background working document on the RBA for monitoring

Background document on Risk-Based Approach (RBA) and its usefulness for EcAp and IMAP - Strengthening for the implementation of the UNEP/MAP IMAP for Marine Litter, Biodiversity & fisheries, Hydrography & coast

Note from Plan Bleu

Disclaimer This document has been prepared by Plan Bleu in view of this workshop. This document is intended to be discussed and amended by the participants of the workshop. As such, the content of this document does not necessarily reflect the opinions of Plan Bleu nor of the UNEP/MAP.

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INTRODUCTION

1. Pursuant to several decisions of the meetings of the Contracting Parties to the Barcelona Convention, specific efforts were made during the past decade by UNEP/MAP to implement the ecosystem approach (EcAp) with the objective to achieve Good Environmental Status (GES) of the Mediterranean Sea and Coast.

2. GES has been defined through eleven Ecological Objectives (EOs), listed in Annex 1, and their achievement is being monitored through 27 related indicators. These indicators are at the heart of the UNEP/MAP Integrated Monitoring and Assessment Programme (IMAP) Decision IG.22/7 - COP 19, February 2016, to be implemented in the Mediterranean (see brief IMAP description in Annex 2).

3. To enable the implementation of the IMAP, it is crucial to bridge existing gaps between the scientific and policy making spheres. Therefore, one of the key activities of the second phase of EcAp, the EcAp MED II project (2015-2018) supported by the European Union, focuses on the science-policy interface strengthening.

4. Plan Bleu is mandated by UNEP/MAP to coordinate this activity, so a first workshop was organized by Plan Bleu in December 2015. The objective was to bring together key stakeholders (scientists and managers) to discuss the implementation of science-policy interface (SPI) activities for IMAP. During this workshop, a first set of around 15 key cross-cutting and topic-specific knowledge gaps to be filled for the implementation of IMAP has been identified along with proposed actions to be taken to address these gaps. Participants convened by Plan Bleu have made it clear that SPI is currently a real issue perceived by scientists and decision makers. The workshop opened up perspectives to develop SPI for IMAP, namely by pointing out the need to formalize SPI along with its structure and processes and to identify dedicated resources to support it.

5. Until 2018, several other thematic SPI workshops are planned following this model, aiming to further identify scientific needs in programmes that contribute to achieving the GES and detail solutions to fill them. A good coordination with the corresponding thematic UNEP/MAP regional activity centres (RACs), having to support IMAP implementation at regional and national scales, is essential to involve environmental policy makers beside scientists and the principle of SPI workshops joined to thematic events organised by RACs has been agreed. Thus the second SPI workshop focusing on IMAP pollution issues has been held as a specific session of a UNEP/MAP CORMON (Correspondence Group on Monitoring) on Pollution issues (19-21 October 2016, Marseille, France).

6. The Regional Activity Centre for Specially Protected Areas (RAC/SPA) is in charge of both supporting IMAP implementation with a specific expertise on the biodiversity aspects and implementing the UNEP/MAP Roadmap for a Comprehensive Coherent Network of Well-Managed MPAs to Achieve Aichi Target 11 in the Mediterranean. In consequence, it has been decided to hold a session on SPI with regard to biodiversity and MPAs jointly with the 2016 Forum of Marine Protected Areas (MPAs) in the Mediterranean, co-organized by MedPAN, RAC/SPA and the Haut Commissariat aux Eaux et Forêts et à la Lutte Contre la Désertification (Morocco). This third SPI workshop took effectively place on the 28th November.

7. Two working documents have been prepared to facilitate proposal of actions (scientific actions, arrangements to sustain SPI) by the participants to this workshop to respond to the science needs in order to support the full implementation of decisions, roadmaps and action plans.

8. Considering that the participants to the workshops came from various horizons, the working documents aimed to provide them with basic information on the following topics: contaminants and

eutrophication regarding the workshop held in October 20161 and Marine Biodiversity and MPA regarding the workshop held in November 20162.

9. Further to the decision IG. 22/7 of COP19 of the Barcelona Convention in February 2016 adopting the Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast (IMAP), **the objective of this workshop is to highlight the usefulness of the Risk-based Approach (RBA) to elaborate or reinforce strategies for monitoring to marine ecosystem and supporting the implementation of IMAP at regional and national levels. Here, the "risk" concerns the non-achievement of GES for the Mediterranean Sea following the 11 Ecological Objectives of the Ecosystem Approach.**

10. The workshop will be held back to back with the Meetings of the Ecosystem Approach (EcAp) Integrated Correspondence Group (CORMON) on Marine Litter, Biodiversity and fisheries, and Hydrography and coast co-organized by UNEP/MAP, MEDPOL, SPA RAC and PAP RAC. Joining the different events will enable to gather scientific researchers invited by Plan Bleu for the SPI workshop, scientific experts designated by governments of Contracting Parties to the Barcelona Convention to participate to the CORMON meetings, National Focal Points of UNEP MAP and RACs.

11. The meeting will underscore the importance for countries to strengthen SPI in order to achieve Good Environmental Status (GES) and specifically for the following topics: marine litter, biodiversity & fisheries, hydrography and coast. It will be organized as a workshop highlighting the need to address the risk of non- achievement of GES of Mediterranean marine and coastal environments. In particular, the session will focus on the Risk-based Approach (RBA), a transversal approach which was identified as an overarching principle for the IMAP of EcAp.

12. **This workshop will be the fourth event after a series of SPI workshops:**

- The Inception workshop on SPI held at Sophia Antipolis, France, on December 15-16th, 2015 (see the **report of the workshop**),
- The SPI workshop on science Policy Interface (SPI) strengthening for the implementation of the UNEP/MAP Integrated Monitoring and Assessment Programme, for Pollution, held in Marseille on the 20-21 October 2016
- The SPI workshop on Science Policy Interface (SPI) strengthening in the field of Marine Protected Areas and Marine biodiversity in the Mediterranean held in Tangiers on the 28th November 2016

[1] http://planbleu.org/sites/default/files/upload/files/WG427_8_Enhancing_SPI.pdf
[2] http://planbleu.org/sites/default/files/upload/files/Working_document%20_Plan_Bleu_21_11_final-EN.pdf

1. STATE OF PLAY IN THE MATTER OF SPI

13. This section presents some useful information, in particular for those who are not familiar with the SPI concept applied to environmental issues and the conditions contributing to make some SPIs more effective than others. Plan Bleu has also edited a brief on the IMAP SPI action, available online3.

1.1. The effective Science Policy Interface

Why is science important for Environment Policy?

14. To be robust, environment policy needs to be based on sound evidence, which may be transposed in the environment field as scientific evidence on the state of the environment and trends in environmental indicators (Zamparutti et al., 2012). In an era of increasing environmental evolution as a result of human activity and climate change, policy responses for the future need to be based on a scientific foundation as strong as possible, particularly given increasing public demands for transparency and accountability.

15. In parallel, environmental policy generally influences the evolution of biodiversity scientific and technical matters. This has been illustrated about biodiversity in the Mediterranean by Pino-Diaz et al. (2014) who showed that the period run since the adoption of the Strategic Action Plan on Biodiversity (SAP/BIO) in 2003 by the Parties to the Barcelona Convention has been characterised by a strong boosting of research topics relevant to the conservation of the Mediterranean. (See Annex 3, Extract of the Pino-Diaz article).

What is a science-policy interface (SPI)?

16. Science Policy Interfaces have been intensively studied in the EU funded SPIRAL4 FP7 project, that has analysed these "Science Policy Interfaces" between biodiversity research and policy to draw lessons and improve the conservation and sustainable use of biodiversity. According to the SPIRAL Resource book on science policy interface (Young et al., 2013), SPIs are the many ways in which scientists, policy makers and others link up to communicate, exchange ideas, and jointly develop knowledge for enriching policy and decision making processes and/or research. They involve exchange of information and knowledge leading to learning, and ultimately to changed behaviour that in turn represents the practical impact of SPIs. SPIs can be very formal structures, such as the Intergovernmental Panel on Climate Change (IPCC), or the newly created Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). Many research projects include a component specifically for improving the interactions between the project, the policy makers and other stakeholders and ways in which results are communicated to policy actors – this is also a SPI. Many SPIs, however, are less formal structures.

What makes SPIs effective?

17. Following the SPIRAL Resource book, some forms of communication are unlikely to result in effective knowledge exchange and learning. One-way communication, for example writing a scientific paper or giving a talk at a conference, is usually not enough on its own and they need to be backed up with opportunities for exchange and learning. Similarly, planning research without considering the needs of policy, or setting questions for research without involving scientists are unlikely to be successful.

18. Effective SPI communication is best seen as an on-going deliberate process. This can involve spending time on developing common language, building trust, and developing capacities to

[3] http://planbleu.org/sites/default/files/upload/files/EcAp_SPI_Brief_EN_WEB.pdf
[4] http://www.spiral-project.eu/content/about-spiral

understand others' positions, views, needs and constraints. People working in SPIs should remain conscious of these dynamic links and learn from them – for this, formal review and updating procedures may help.

19. It is also important to acknowledge possible pitfalls of SPIs. Common pitfalls can include unclear or poorly thought-through SPIs, power influences, negative interactions with the media, over-reliance on key individuals, and lack of necessary resources. These aspects and what are the key features of a deliberate SPI are developed in the SPIRAL Resource book (Young et al., 2013)

1.2. Preliminary analysis and results of the Inception SPI workshop

20. The preliminary analysis of the IMAP science needs has been prepared by Plan Bleu. The resulting table was presented as a working document of the SPI inception workshop held in December 2015 in Sophia-Antipolis, France. This analysis has been reviewed by the scientific experts and environmental managers participating to this workshop. During working sessions in both, thematic sub-groups and plenary discussions, the workshop participants have identified a number of knowledge gaps that need to be filled for the full implementation of UNEP/MAP's IMAP. The participants' comments have been listed in three categories: general, transversal and thematic, the latter according to the MAP EcAp clusters (biodiversity, pollution and eutrophication, hydrography and coasts). Only comments on the biodiversity objectives are reported here, in line with the focus of this workshop. It should be noted that some of the recommendations issued by participants go beyond the current IMAP definition as agreed by the Decision IG.22/7 - COP 19, February 2016. The full results of the IMAP inception workshop are available in the meeting report (Plan Bleu, 2016), available on the Plan Bleu web site5.

21. **General comments:**

- ***A recognized lack of knowledge.*** The workshop acknowledges that scientists are not in all areas currently able to provide necessary knowledge to policymakers to support the goal of achieving GES. Participants also recognize that additional efforts for identification, hierarchizing and synthesis of knowledge gaps are currently required.
- ***Heterogeneous spatial distribution of knowledge availability.*** It is highlighted that knowledge availability differs along Contracting Parties. Generally, a gap between Northern and Southern Mediterranean countries can be observed, which can impact the robustness of models and knowledge.
- ***Monitoring versus obtaining new knowledge.*** Workshop participants point out the difference between routine activity with the purpose of monitoring and scientific activities for obtaining new original knowledge. Furthermore, if new knowledge is considered GES relevant, a sustainable monitoring process should be developed.
- ***Scientific results to inform different processes.*** It is pointed out that the scientific research results produced need to be suitable to cater different purposes integrated in IMAP: (i) monitoring, (ii) integrated environmental assessment and (iii) IMAP further revisions.
- ***Ecosystem functioning.*** Workshop participants consider that currently available knowledge about the functioning of Mediterranean marine and coastal ecosystems is still lacking, although they also acknowledge that the mobilization around EcAp and the MSFD has so far succeeded in developing new knowledge.

22. **Transversal issues:**

- ***Mapping results.*** It is recommended that outputs of the integrated assessments be mapped under a GIS using a harmonized grid resolution for a better understanding of environmental processes.

[5] http://planbleu.org/sites/default/files/upload/files/Rapport_atelier_EcAp-SPI_EN.pdf

- ***Cost-benefit analysis.*** Workshop participants bring forward the interest of conducting cost-benefit analyses of monitoring.
- ***Scales.*** The workshop recommends that relevant scales and timelines for the integrated assessment need to be clearly defined for the implementation of the integrated assessment.
- ***Aggregation rules***. Aggregation rules for the results of monitoring if the GES has been achieved or not need to be clarified.
- ***Guidelines for Risk-based Approach.*** The IMAP document recommends applying the Risk-based Approach for the definition of monitoring procedures. The workshop approves this recommendation but calls for the development of guidelines to apply such an approach.
- ***Empowerment of national task forces.*** It is recommended to develop a mechanism for expertise and capacity building aiming at establishing operational national task forces to support IMAP.
- ***Filling knowledge gaps with remote sensing.*** The workshop recommends making use of the results of remote sensing for monitoring physical elements, especially for establishing baseline data for coast and hydrography issues, where no field data is available. However, in some cases, more detailed data will require field work.

2. DEFINITION OF THE RISK BASED APPROACH FOR MONITORING AS AN OVERARCHING PRINCIPLE

In the IMAP Guidance document (UNEP(DEPI)/MED IG.22; 2016)

23. As mentioned in the previous section, the Risk-based Approach has been identified as a transversal issue during the launching workshop in December 2015. After analysing some reference documents (listed in the next section), we have gathered definitions regarding the Risk-based Approach.

24. In the IMAP Guidance document, the "Risk-based Approach to monitoring and assessment" is presented as an overarching principle (n°5). Indeed, the overarching principles guiding the development of the IMAP include:

i. adequacy;
ii. coordination and coherence;
iii. data architecture and interoperability based on common parameters;
iv. concept of adaptive monitoring;
v. Risk-based Approach to monitoring and assessment, and
vi. the precautionary principle, in addition to the overall aim of integration.

25. "Areas that are under higher pressures and the biota that are known to be more sensitive should be identified, and monitoring efforts should be prioritised in the areas and topics that most risk not to achieve or maintain GES. These areas should be monitored more frequently in relation to those quality components at risk to achieve/maintain GES and associated relevant pressures than other areas that have maintained GES for a long period of time and are under less pressure. Furthermore, increased monitoring effort may be needed in areas that are close to the boundary of GES in order to increase confidence in assessments and, consequently, in the decision to take measures.

26. In the Risk-based Approach (Cardoso et al. 2010), pragmatic prioritization is made, which enables general statements about environmental status at large scales while keeping monitoring requirements manageable.

27. This Risk-based Approach is particularly effective for Ecological Objectives that are spatially patchy and where pressures are applied at specific locations. It is recommended to map the pressures that most likely have the largest impacts, and the vulnerability of various properties of the ecosystem.

28. Cardoso et al. (2010) recommend prioritization by prior assessment of:

i. the distribution of the intensity or severity of the pressures across the region at large;
ii. the spatial extent of the pressures relative to the ecosystem properties possibly being impacted;
iii. the sensitivity/vulnerability or resilience of the ecosystem properties to the pressures;
iv. the ability of the ecosystem properties to recover from impacts, and the rate of such recovery;
v. the extent to which ecosystem functions may be altered by the impacts; and
vi. where relevant, the timing and duration of the impact relative to the spatial and temporal extent of particular ecosystem functions (e.g. shelter, feeding, etc.).

29. Variation in the scale of both environmental conditions and impacts of pressures means that assessments of GES could begin with sub-areas of both greatest sensitivity and highest pressures. If the environmental status in these areas is "good", then it can be assumed that the status over the larger area is good. In contrast, if the environmental status in the sub-areas is not "good", then monitoring and assessments would be conducted stepwise at additional sites along the gradients of pressure or sensitivity. The size of the appropriate steps along the gradient will depend on the nature of the gradient and the way the environmental conditions are degraded. It may vary significantly with different cases (Cardoso et al., 2010)."

References to RBA in the Decision IG.22/7 Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria

30. "As it is not possible or even necessary to monitor all attributes and components of biological diversity throughout the region, the IMAP monitoring is focusing, in line with the Risk-based Approach, on some representative sites and species, which can showcase the relationship between environmental pressures and their main impacts on the marine environment".

31. "The spatial distribution of the monitoring stations should thus, prior to the establishment of the eutrophication status of the marine sub-region/area, be risk-based and proportionate to the anticipated extent of eutrophication in the sub-region under consideration as well as its hydrographic characteristics aiming for the determination of spatially homogeneous areas. Consequently, each Contracting Party would be required to determine the optimum frequency per year and optimum locations for their monitoring/sampling stations".

3. STATE OF PLAY IN MATTER OF RISK BASED APPROACH FOR MONITORING IN THE MEDITERRANEAN REGION

The RBA is mentioned for 5 Ecological Objectives

EO 1 Biodiversity EO 2 Non-indigenous species	EO 5 Eutrophication EO 9 Pollution	EO 10 Marine litter

3.1. The application of the Risk-based Approach to Biodiversity and NIS monitoring

3.1.1. An appropriate definition of the RBA for monitoring Biodiversity exists in the report "Marine Strategy Framework Directive. Task Group 1 Report. Biological diversity" (April 2010):

32. "The risk to biodiversity of being adversely affected by pressures caused by human activities is used to prioritised monitoring requirements. Monitoring is targeted towards those aspects of biodiversity and locations within an assessment area which are considered to be at risk of failing to meet targets set for GES. This is achieved through an evaluation of which pressures from human activities are considered most likely to cause failure to achieve GES targets. Monitoring programmes need to include areas at high risk and reference sites (low or no risk). A risk- based approach is not as useful when causal links between pressures and the state of some species (e.g. top predators) is not clear."

33. It is not practical, possible or even necessary to monitor all attributes and components of biological diversity, throughout the region or sub-region. The relationship between environmental pressures and main impacts on the marine environment should be taken into careful consideration when selecting where and what to monitor based on a risk-based prioritisation (based on the best use of ongoing biodiversity monitoring programmes.

34. In general, the development of a monitoring programme for subsequent assessments should be based on a holistic understanding of the region or sub region to be assessed. Compiling relevant information in a Geographic Information System (GIS) is recommended to enable a spatial (and temporal) understanding of the relationship between human activities (which may be causing adverse pressures on the environment) and the characteristics of the environment, including its biodiversity.

35. Furthermore, in relation to biodiversity monitoring, it is recommended to focus on so called "representative sites" with the criteria for the selection as the following:

- Where pressures to and risks to/effects on biodiversity are most strongly associated, following a risk based approach (vulnerable habitats and species locations) (Table 1);
- Where most information/historic data are available;
- Where well established monitoring (in general, not only for biodiversity) is already undertaken;
- Sites of high biodiversity importance and conservation interest (according to national, regional or international regulations);
- Expert opinion.

36. Locations to be monitored should be prioritised to cover at least the following: Areas of influence from anthropogenic activities which are expected to cause impacts upon biological diversity, with priority on the areas at highest risk[6]:

[6] Where possible, use a transect from high to low pressure, so as to cross the "GES boundary"; – can help define the boundary between areas in GES and those not in GES.

i. high intensity activities;
ii. Multiple activities;
iii. Areas where impacts may be particularly severe or long term).

37. Areas considered representative of un-impacted (reference) conditions, i.e. not thought to be subject to, or impacted by, pressures:

i. Without pressure (as far as is possible within the assessment area);
ii. Representing the physiographic and hydrological conditions of the pressured areas identified in (a) (including the same community types or ecotypes).

38. Overlapping maps in a GIS will help give a holistic visualization of the assessment area, the anthropogenic pressures acting upon it and locations of current monitoring programmes. This will enable informed decision- making on how to prioritise the areas to be considered for monitoring.

39. The degree to which pressures occur in isolation or in combination and giving rise to cumulative impacts will affect the intensity of impacts as well as their spatial extent and temporal development. Spatial and temporal scales of change will also vary according to the specific background conditions of each region or sub region.

3.1.2. Monitoring in Marine and Coastal Specially Protected areas

40. Monitoring in marine and coastal protected areas or Specially Protected Areas under the SPA/BD Protocol should be a core activity undertaken during the initial phase (2016-2018 of the IMAP), in order to serve the following purposes:

- Based on the risk approach, some marine and coastal protected areas may be designated as such because of the risk to be under high pressures, requiring thus more intense monitoring;
- Other marine protected areas may be in remote areas only very slightly affected by pressures. Monitoring in these areas, even if real pristine conditions are much rare in the Mediterranean, could be useful for determining reference conditions and/or defining GES for several indicators;
- Monitoring of marine and coastal protected areas in different protection status could also inform on the effectiveness of protection measures.

<u>Indicative list of habitats and species under the EcAp Initiative and IMAP</u>

41. The COP 18 EcAp Decision includes the indicative list of habitats and species to be considered for monitoring and assessment, with the note that these lists should be further elaborated as part on work on integrated monitoring. These indicative lists were further refined at the CORMON Biodiversity and Fisheries Meeting (Ankara, 26-27 July, 2014) and by the online working group on biodiversity and non- indigenous species.

42. In relation to the indicative list of habitats, it was agreed that special consideration should be given inter alia to habitats that are considered as essential for important species functions such as spawning and feeding grounds.

43. In relation to the indicative list of species, it was agreed that in order to identify the most suitable biodiversity components to monitor it is recommended to follow a logical set of questions, namely:

- What are considered to be the main pressures on biodiversity in the region/sub-regions?
- Which main biodiversity components does each pressure most affect (start at level of birds, mammal, reptiles, fish, coastal, shelf and deep sea habitats, but subdivide if necessary, e.g. coastal birds/offshore birds)?

- Which individual species (or groups of species) or habitats types could be monitored to best represent the impacts of the pressure on each broader group?

Assessment of biodiversity common indicators in an integrated manner at the EO level

44. For the purposes of the assessment of the biodiversity EO1, it is important to analyse the description of the GES set for this EO.

45. The definition of the Convention on Biological Diversity (CBD) for 'biological diversity' is: "the variability among living organisms from all sources including, inter alia, [terrestrial,] marine [and other aquatic ecosystems] and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems".

46. The term 'maintained' is key to the quantification of GES for EO1 and thus for the elaboration of recommendations on criteria and methodological standards. The condition ('maintained') has three determining factors:

i. no further loss of the diversity within species, between species and of habitats/communities and ecosystems at ecologically relevant scales;
ii. any deteriorated attributes of biological diversity are restored to and maintained at or above target levels, where intrinsic conditions allow (cf. Art. 1.2 a) and
iii. the use of the marine environment is sustainable.

47. The term 'habitat' in relation to EO1 addresses both the abiotic characteristics and the associated biological community, treating both elements together in the sense of the term biotope, whereas 'quality', 'occurrence', 'distribution', 'extent' and 'abundance' form the basis of the criteria standards used to assess GES.

48. For assessment purposes it is important to note that EO1 has a broad scope, requiring assessment at several ecological levels: species, habitats (addressing both the abiotic characteristics and the associated biological community, treating both elements together) and ecosystems.

49. At the species level, GES shall be defined for the full range of functional and taxonomic groups occurring in the marine environment.

- Generally, it seems to be difficult to quantitatively define GES for biological diversity, considering the variety of the elements to be assessed which cannot be homogenously captured by a single quantitative description.
  A potential conceptual approach for a quantitative GES can be framed in such a way that the resilience of the ecosystem is suited to accommodate the quantified biodiversity, or in other words, it will be accounted in the determination of the GES boundaries as the "naturally" allowed deviation from the reference point.
- Where GES cannot be quantified, it could, as a first step, be qualitatively defined, notably according to the level of knowledge available for many species or habitats.
  For example, benthic habitat conditions can be defined qualitatively (based on species composition and proportions) and the presence of lack of GES could be expressed as a deviation (qualitative or semi-quantitative-range) around this qualitatively defined reference point.

50. Considering the dynamic nature of ecosystems and the naturally varying environmental conditions, GES can only be directly quantified for certain scales, species and habitats. To that end, lists of elements and common classification systems of elements can facilitate a coherent and comparable quantitative determination of GES, regionally.The CORMONs will thus continue to further explore and quantify as much as possible the GES on EO level, based on the above principles, during the initial phase of IMAP.

51. In relation to evaluating the status of habitat area extent through the indicator on area of habitat loss (in line with the operational objective that key coastal and marine habitats are not being lost) regional risk- based approach should seek to prioritise those habitats that need active, regular monitoring programmes to collect the necessary additional data to that derived from desk-based studies.

52. In addition, in relation to monitoring requirements, Risk-based Approach will identify additional monitoring effort required for certain habitat types and keep the monitoring effort cost-effective.

3.1.3. The preparatory phase for marine biodiversity monitoring, linked to the Risk-based Approach (Annex to the UNEP/MAP Biodiversity monitoring guidance, 2014).

53. Guidance on the application of each stage of preparatory tasks for monitoring of biodiversity under the EcAp based on a RBA.

Preparatory tasks

54. The preparatory tasks required in advance of beginning the main monitoring process include, but may not be limited to, the following:

Task 1: Collate human activity and environmental data

55. Developing a monitoring and assessment programme should be based on a holistic understanding of the region or sub-region to be assessed. Compiling relevant information in a Geographic Information System (GIS) is recommended to enable a spatial (and temporal) understanding of the relationship between human activities (which may be causing adverse pressures on the environment) and the characteristics of the environment, including its biodiversity.

56. The following information, which will be of direct use for many aspects of EcAp implementation, should be compiled:

a. The main ongoing or past human activities which potentially may affect or have affected biological diversity;
b. The distribution, intensity and frequency of pressures from human activities;
c. Noteworthy administrative and regulatory features;
d. Major physical/oceanographic/geological gradients (spatial and temporal) in the region or sub-region.
e. Biodiversity characteristics, including:
    i. The distribution of the habitat types on the seabed, and in the water column;
    ii. Distribution of the species ecotypes;
    iii. Habitats/communities and species of special interest (i.e. those listed for protection in regional and international agreements, Community legislation);
f. Existing data or ongoing monitoring programmes concerning biological diversity.

Figure A1 illustrates different information layers compiled in a GIS.

Task 2: Identify biodiversity components present in the region or subregion

57. Identify those biodiversity components that are present in the region/sub-region. Identify sub-species, populations and genetic variants, where relevant (i.e. where likely to need specific assessment). Species which are vagrants to the region/sub-region need not be included.

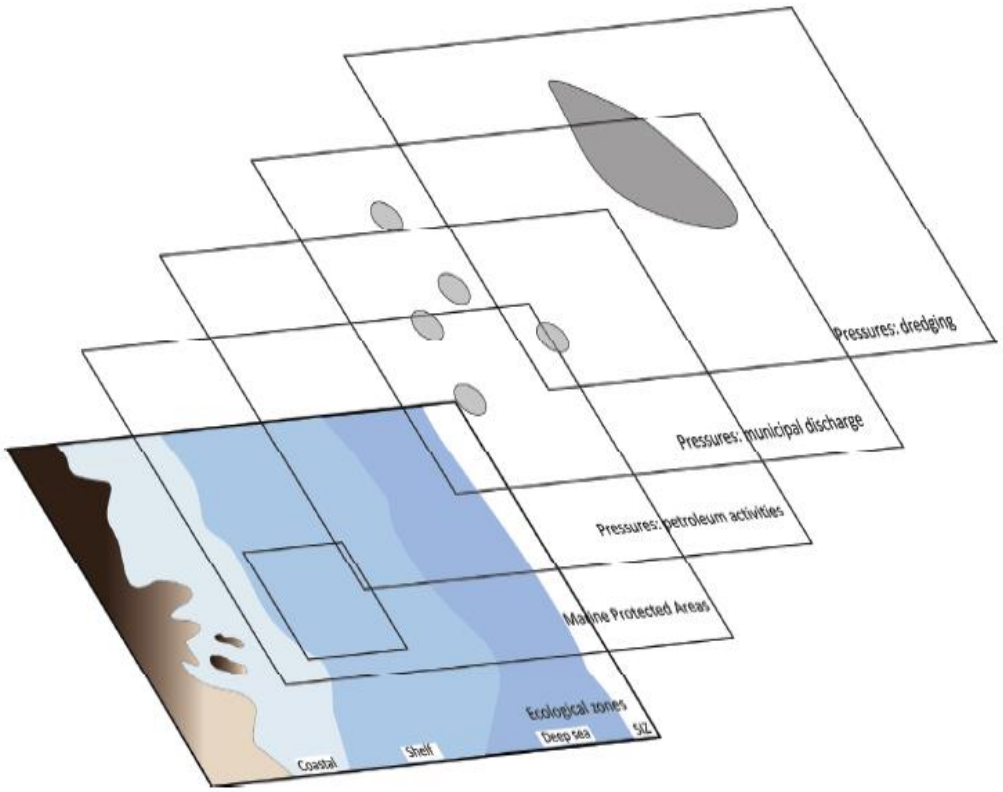

Figure 1: Illustration of different types of information layers compiled in a Geographical Information System (GIS).

Task 3: Define ecologically- relevant assessment areas

58. Define a set of ecologically relevant scales (assessment areas) for assessment of the biodiversity components present in the region or sub-region.

Task 4: Define reference state (condition)

59. Reference conditions define the un-impacted state of the biodiversity component, and are conditions as would be expected according to ”prevailing physiographic, geographic and climatic conditions”.

60. Reference conditions are specific to the species, ecotype or habitat/community type and to the ecological assessment area within a region/sub-region. Hence reference conditions need to be set to reflect these main variations in ecological character within each sub-region.

61. Reference conditions need only to be defined for the biodiversity components and the criteria which are to be monitored and assessed in each area, and can be established in different ways:

a. Using current data from locations in the assessment area (or equivalent biogeographic areas) which are not considered to be subject to pressures from human activities;
b. Using historical data, taking into account long- term changes in prevailing physiographic, hydrological and/or climatic conditions;
c. Using expert judgment, taking into account the characteristics of the biodiversity component which might be expected under prevailing physiographic, hydrological and/or climatic conditions, and the types of species which are sensitive to ongoing or past pressures from human activities and therefore may not be present now.
d. Some combination of the above options.

62. Under certain circumstances, it will not be possible to satisfactorily establish reference conditions; instead it may be more appropriate to use baseline conditions, established at a specific time in the past and which are considered to best meet the requirements of reference conditions (i.e. un-impacted by pressures from human activities).

3.2. The application of the Risk-based Approach to Eutrophication monitoring

63. Regarding the frequency of eutrophication monitoring and location of sampling sites, the IMAP monitoring guidance proposes for spatial distribution of monitoring stations to be risk-based and proportionate to the anticipated extent of eutrophication in the sub-region under consideration, as well as to its hydrographic characteristics aiming to determinate spatially homogeneous areas.

64. Consequently, each Contracting Party would be required to determine the optimum frequency per year and optimum locations for their monitoring stations. Each Contracting Party is responsible for the choice of the most representative sampling stations in order to detect a change over a selected period.

65. Salinity gradients can be a proxy for river discharge and salinity and nutrient concentrations are often strongly correlated. Salinity can thus be used to determine an optimal spatial distribution of sampling sites, in particular if a model is available to couple salinity and hydrodynamics to nutrient levels. Salinity and temperature are also important parameters supporting the interpretation of eutrophication indicators.

66. Therefore, annual and seasonal temperature regime and, where relevant, spatial and temporal distribution of salinity should be measured in both GES and non-GES regions.

67. The current national eutrophication monitoring programme implemented so far by the Contracting Parties in the framework of the UNEP/MAP MED POL programme should be used as a sound basis for monitoring under the EcAp complemented with the additional elements based on the above-mentioned considerations and each country/ sub region/ area specificity.

3.3. The application of the Risk-based Approach to Marine Litter monitoring

68. In relation to marine litter monitoring, the IMAP Guidance, in line with the TSG-ML (Technical Subgroup on Marine Litter of the Marine Strategy Framework Directive), suggests the usage of the Risk-based Approach.

69. All the protocols suggested by TSG-ML are aimed mainly at assessing environmental status and environmental targets. All protocols can supply quantitative data, and allow the assessment of trends. The beach litter protocol is also designed to identify sources by using a detailed list of identifiable items, while other protocols can do this to some extent through their lists of items, but also by modifying the sampling strategy (where and when to sample) to match the likely effects of specific measures.

70. In their analysis of the protocols, the issue of compatibility and coherence has been important. Most of the protocols proposed can be applied across the Regional Seas' scale. However, some of the protocols for litter in biota cannot be identical, for the simple reason that the proposed species do not all occur across the Regional Seas.

71. A complete analysis of risk should ideally include quantitative knowledge of harm. An analysis of harm will be a focus area for future work. In the event of insufficient quantitative data availability on harm, the Risk-based Approach is chosen to be addressed by an assessment of where the amounts of litter are likely to be highest or the type of litter which has the largest impact (e.g. microplastics). Already in the selections of protocols a degree of Risk-based Approach is used. For

example, it is proposed to measure litter on the sea surface rather than in the whole water column, because pilot studies indicate that litter quantities are higher on the sea surface. Similarly, the protocols for monitoring on the sea floor propose to assess where litter tends to accumulate (e.g. through pilot studies or oceanographic modelling), and then to direct monitoring towards such areas. While there may be problems to generalize the results from this kind of monitoring to other areas, such strategies are in line with a Risk-based Approach.

72. The IMAP Guidance also recommends that Contracting Parties, which currently have plans to monitor only in a subset of environmental compartments, to start with small pilot research or development projects in other compartments. This would provide baseline data to make an informed decision about future, full-scale monitoring programmes. Without information on trends and amounts, in all the marine compartments, a Risk-based Approach to litter monitoring and measures is not possible.

73. A considerable number of citizens, communities (NGOs, civil society initiatives) and environmental protection associations and institutes across the Mediterranean are already taking part in activities to tackle marine litter. The aim would be to enable them to participate in a Mediterranean regional attempt to address marine litter issues as envisaged through the MLRP and to empower citizen networks to help improve the evidence base needed to reach the EcAp main objectives.

74. In relation to site-selection for marine litter monitoring, the IMAP Monitoring Guidance recommends also to put in place the risk based approach, stating that priority should be given to monitoring programmes that measure environmental status and trends, in sites where the risk of harm is greatest. The criteria for the site selection should then be based on prediction of potential harm. Prediction of potential harm could be based on practical knowledge of which environmental values are most sensitive to harm. However, the current understanding of how different species or biotopes react to litter is insufficient, and should be further researched. Another approach to harm may be based on aspects that are particularly "valuable" to society for other reasons e.g. economically, socially or environmentally. A third approach is to assume that harm is more likely to occur in areas/environments where there is a lot of litter and select sites based on screening monitoring to identify them. While this option may be practical and make sense in terms of societal needs, it is important to remember that we do not know if statistical trends from such sites are representative of other sites (probably not), but represent a "worst case" scenario.

75. One way to make best use of limited resources is to take advantage of other studies and programmes where litter monitoring can be integrated (what is called "opportunities to reduce costs"). An example is to combine monitoring for litter on the sea floor with scientific trawling for fish stock biomass estimation (such as under the Mediterranean International Trawl Survey, MEDITS). In such a case, the selection of sites is designed for the original monitoring programme purpose, and representation of other areas are already defined. Where use of such a scheme is made, it is important to analyse the sampling strategy to assess if this is suitable for litter monitoring too.

76. For marine litter, a stratified, randomised sampling strategy where possible is advocated. Also, that the purposes of the monitoring programmes define the criteria for selecting sites. Simplification is necessary when resources are limited, and concentration of monitoring effort is the logical result.

3.4. Application of RBA for integration purposes- looking at interlinkages between Biodiversity and Coast and Hydrography

77. Following the discourse on RBA in IMAP, the "areas that are under higher pressures and the biota that are known to be more sensitive should be identified".So, regarding RBA to monitoring coasts and hydrography, it would be important to identify significant alterations of hydrographical conditions.

78. The significant alterations of hydrographical conditions are pressures (physical pressures) that act on biologic habitat. Different types of structures will have different levels of impacts, and also the size of the structures could be critical, since the indicator points out the longevity of structures (>10 yrs) and not size that needs to be taken into account. Some "prioritization" of above-mentioned structures could be carried out with respect to their potential impacts, i.e. to levels of pressure.

79. As for the sensitive biota, the focus should be on vulnerable types of habitats, marine protected areas, spawning, breeding and feeding areas, migration routes… However, it is important to note that the "final product", of the Common Indicator 15, is the intersection of the spatial map of the areas of hydrographical changes with spatial maps of habitats. So it relates more to the extent, while habitat condition will be assessed integrally together with other EO (namely EO1 Biodiversity).

80. In RBA approach to Coast monitoring, the key objective is not to classify artificialization by its intensity/level of impact but the areas which have more dense (less patchy) urbanized areas should be highlighted, as well as areas urbanized in vicinity of sensitive habitats.

3.5. The application of the risk-based approach for integration purposes- looking at interlinkages between Biodiversity and Marine Litter

81. This section deals with the interlinkages between micro and macro marine litter effects on biota. Most of the time, a pragmatic risk-based and synergistic approach is recommended. A risk-based approach to monitoring aimed to provide a framework for assessment of biodiversity which reduces the potentially enormous scope of what might be assessed down to a more manageable task. RBA seems most applicable to habitats and may be less easy to apply to higher predators (e.g. fish, mammals). Causal linkages between pressures done by marine litter to predators may be more weakly understood than on habitats.

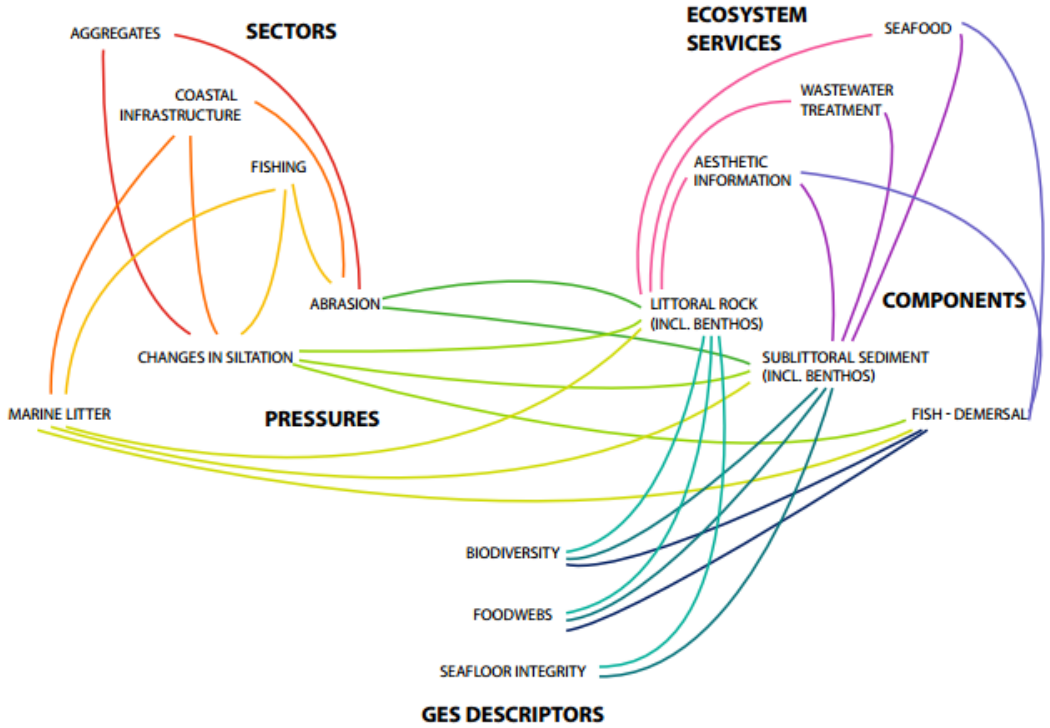

Figure 2: An illustration of the full linkage framework showing linkages between a subset of elements of the ecosystem. Source: Towards Delivering Ecosystem-Based Marine Management: The ODEMM Approach (EC-FP7 project)

3.6. Exemple of European research projects on marine monitoring

82. The ODDEM project (Options for Delivering Ecosystem-based Marine Management), covers Europe's four regional seas and focuses on supporting implementation of MSFD by developing tools and understanding required to weigh up options by Member States, Regional bodies and the EC. A tool on pressure assessment has been developed which identifies the sector/pressure combinations that currently present the greatest threat to marine habitats and their associated assemblages and its application to Europe's regional seas.

83. This tool will help identifying the key pressures, specifically from human activities, on marine ecosystem characteristics and will allow management action to be focused on the most damaging activities and identify the most vulnerable ecosystem characteristics and consequently, prioritise resources.

84. Although more directly related to measures, this prioritization could also be useful for the establishment of monitoring programmes under the light of the Risk-based Approach.

85. Examples of other European projects dealing with marine monitoring in the frame of the MSFD:

- PERSEUS: Policy oriented marine environmental research in the southern EU seas[7]
- COCONET : Towards COast to COast NETworks of marine protected areas (from the shore to the high and deep sea), coupled with sea-based wind energy potential[8]
- MESMA : an EU-FP7 project on monitoring and evaluation of spatially managed marine areas (2009-2013)[9].
- IRIS-SES: Integrated Regional monitoring Implementation Strategy in the South European Seas (IRIS -SES) is a pilot project on New Knowledge for an integrated management of human activities in the sea (PP/ENV D2/SEA 2012)[10]

86. Monitoring guidance under MSFD – Recommendation for implementation and reporting:

- WG GES to initiate the development of a framework for coordinated monitoring programmes which will deliver data to assess whether GES and associated environmental targets are being achieved, in close cooperation with WG DIKE.
- WG DIKE to assist the Commission, when necessary, in developing any formal Commission proposal on notification / reporting modalities.

[7] http://www.perseus-net.eu
[8] http://www.coconet-fp7.eu
[9] http://www.mesma.org
[10] http://iris-ses.eu/

4. TYPOLOGY OF PRESSURES ON THE NATURAL ENVIRONMENT RESULTING FROM ANTHROPOGENIC ACTIVITIES AND THEIR INTERLINKING IMPACTS

87. This table provides an example of generic linkages between pressures and impacts on the environemtal and an appreciation of the priorities.

Table 1 Typology of pressures on the natural environment resulting from anthropogenic activities and their interlinking impacts

Pressures		Type	Source of pressure Examples focus on marine				Destination of pressure				Impacts on marine environment			
			Air	Land	Water	Marine	Air	Land	Water	Sea	Physical	Hydrological	Chemical	Biological
Physical	Constructions on coast and at sea (concrete, metal, etc.)	Inputs			Barrages, dams	Offshore (e.g. renewable energy, tidal power) & coastal (e.g. pots, marinas) industry, coastal defences, barrages, dams					Seabed substrate, topography	Water movement changes (waves, currents, river flows), turbidity	Salinity changes	Loss of habitats for species (mobile) and communities (seabed); barriers to species
	Disturbance/damage of sea-floor	Change				Fishing, trampling on shores, beach cleaning and replenishment					Seabed habitat structure	Water clarity, turbidity		Community changes
	Mineral extraction (sand, gravel, rock etc.)	Extraction				Sand & gravel extraction, navigational dredging					Seabed habitat structure	Water clarity, turbidity		Community changes
	Water extraction	Extraction			Irrigation, domestic use, industrial use	Desalination						Turbidity, water volume	Salinity changes	
Energy	Heat	Inputs				Power station cooling						Sea temperature		Species distributional changes
	Noise	Inputs				Shipping, pilling, military								Displacement of species, behavioral changes
	Light	Inputs				Offshore platforms								Behavioral changes (birds); plant growth
	Electromagnetic waves	Inputs				Cables								Behavioral changes (e.g. fish)
Chemicals and other pollutants	Nutrients (N, P, organics)	Inputs		Agriculture, urban waste water	Aquaculture	Aquaculture						Water clarity	Deoxygenation, nutrient balance	Plankton blooms, macroalgal growth, species mortality
	Contaminants (hazardous	Inputs		Industr		Offshore industry (oil							Chemical	Sub-lethal effects

Pressures		Type	Source of pressure Examples focus on marine				Destination of pressure				Impacts on marine environment			
			Air	Land	Water	Marine	Air	Land	Water	Sea	Physical	Hydrological	Chemical	Biological
	substances, radionuclides)-diffuse/point sources			y, urban agriculture		& gas), aquaculture							balance	effects (incl.seafood)
	Contaminants (acute events, e.g. oil spills)	Inputs				Shipping, oil & gas industry								Death/injury to species, health of species
	CO_2 greenhouse gases	Inputs	Aviation emissions	Industry, transport, urban	Shipping emissions	Shipping emissions						Sea temperature, wave action, currents, sea level	pCO_2/ acidification	Species distribution, behavior and reproductive capacity changes
	Litter	Inputs		Industry, urban		Shipping, offshore operations					Smothering of habitat			Death/injury to species, health of species
Biological	Non-indigenous species	Inputs				Shipping ballast water, hulls, aquaculture								Community changes
	Translocation of (native) species	Change				Aquaculture								Genetic changes
	Introductions of genetically modified species	Inputs				Aquaculture								Genetic changes
	Microbial pathogens	Inputs		Urban waste water, sewage from agriculture		Aquaculture								Shellfish health, human health
	Removal of species (targeted, non-targeted)	Extraction		Hunting	Fishing	Fishing, hunting, harvesting, bioprospecting								Population changes, community changes
	Injury/death to species	Change	Hunting (wildfowl)	Transport		Shipping/wind farm collision, fishing (trawling)								Population changes
	Disturbance of species	Change				Ecotourism, shipping								Behavioral changes
Anthropogenic pressure = an input, alteration or extraction of physical, chemical or biological substances, properties of functions of the natural environment which results directly or indirectly from human activities								**Priority: highest**				**Priority: medium**		**Priority: lowest**

Source: D.Connor, European Commission. Annex III (Indicative lists of characteristics, pressures and impacts) of the Marine Strategy Framework Directive (http://eur-lex.europa.eu)

5. RELATIONSHIP BETWEEN IMAP COMMON INDICATORS AND APPLICABILITY OF RBA TO MEASURE INDICATORS

88. The analysis is done for the indicators concerned by the topic of the meeting of the EcAp CORMONs: on Marine Litter, Biodiversity and Coast and Hydrography.

Table 2 Short analysis of potential application of RBA for IMAP common and candidate indicators.

Note: Participant exchanges and discussions are expected enlighten the application of the RBA to the implementation of IMAP.

EO	IMAP Indicators	Indicator of Pressure	Indicator of State	How is RBA applicable to monitoring?	Observations / considerations
EO1	**Common Indicator 1:** Habitat distributional range to also consider habitat extent as a relevant attribute		X	**- Collate human activity and environmental data:** Evaluate existing pressures on biodiversity components and select the ones at risk of not meeting GES targets (distribution, intensity, frequency); Consider relationships between environmental pressures and main impacts on biological components **- Identify present biodiversity components** Evaluate main biodiversity components are most affected, in distribution, intensity, frequency (starting at macro-level, e.g. birds,	- Evaluation of pressures of human activities that are considered to be at risk of failing to meet targets set for GES (MSFD) - Need of a holistic understanding of the region to be assessed - A RBA is not useful when causal links between pressures and state is not clear (MSFD) - Not necessary to monitor all biological attributes and components throughout the whole region (MSFD)
EO1	**Common Indicator 2:** Condition of the habitat's typical species & communities		X		
EO1	**Common Indicator 3:** Species distributional range (related to marine mammals, seabirds, reptiles)		X		
EO1	**Common Indicator 4:** Population abundance of selected species (related to marine mammals, seabirds, marine reptiles)		X		
EO1	**Common indicator 5**: Population demographic characteristics (e.g. body size		X		

	or age class structure, sex ratio, fecundity rates, survival/ mortality rates related to marine mammals, seabirds, reptiles)			mammals, reptiles, fish, coastal and deepsea habitats, and subdivide when necessary) **- Map information** Compile relevant info under a GIS to enable spatial and temporal understanding between human pressures and biodiversity **- Set ecologically-relevant assessment areas** Set up areas at high risk and reference sites (low/no risk) • consider especially habitats essential for important species functions (e.g. feeding, spawning) Focus on "representative sites" **- Define the reference state** Define GES for the full range of functional and taxonomic groups in the marine environments • Quantitatively, when possible; or • Qualitatively **- Select monitoring parameters**	
EO2	**Common Indicator 6**: Trends in abundance, temporal occurrence, and spatial distribution of non-indigenous species, particularly invasive, non-indigenous species, notably in risk areas (in relation to the main vectors and pathways of spreading of such species)		X		- Representative sites based on criteria such as: • pressures & effects on biodiversity are strongly associated • most historic data/ information are available • monitoring already in place • of high biodiversity & conservation importance • expert opinion - It is difficult to quantitatively define GES for biological diversity: - Reference conditions are specific to species, ecotypes or habitats within a region
EO3	**Common Indicator 7**: Spawning stock Biomass		X		

EO3	**Common Indicator 8**: Total landings	X			
EO3	**Common Indicator 9**: Fishing Mortality		X		
EO3	**Common Indicator 10**: Fishing effort	X			
EO3	**Common Indicator 11**: Catch per unit of effort (CPUE) or Landing per unit of effort (LPUE) as a proxy	X			
EO1 & 3	**Common Indicator 12**: By-catch of vulnerable and non-target species	X			
EO7 & 1	**Common Indicator 15:** Location and extent of the habitats impacted directly by hydrographic alterations (EO7) to also feed the assessment of EO1 on habitat extent		X	- Identify **significant alterations of hydrographical conditions**: significant alterations are pressures (physical pressures) that act on biologic habitat. - As for the sensitive biota, the **focus** should be on **vulnerable types of habitats**, e.g. marine protected areas, spawning, breeding and feeding areas, migration routes… - The "**final product**": the intersection of the **spatial map of the areas of hydrographical changes with spatial maps of habitats**. So it relates more to the	Following the discourse on RBA in IMAP, the "areas that are under higher pressures and the biota that are known to be more sensitive should be identified". Different types of structures will have different levels of impacts, and also the size of the structures could be critical, since the indicator points out the longevity of structures (>10 yrs) and not the size that needs to be taken into account. Some "prioritization" of above-mentioned structures could be carried out with respect to their potential impacts, i.e. to levels of

				extent, while habitat condition will be assessed integrally together with other EO (namely EO1 Biodiversity).	pressure.
EO8	**Common Indicator 16:** Length of coastline subject to physical disturbance due to the influence of man-made structures	X		- Measure the length of coastline subjected to artificialisation. - Areas having more dense (less patchy) urbanized areas should be highlighted, as well as areas urbanized in vicinity of sensitive habitats.	The key objective is not to classify artificialisation by its intensity/level of impact, although densely urbanized areas are to be highlighted.
EO10	**Common Indicator 22:** Trends in the amount of litter washed ashore and/or deposited on coastlines	X		**- Collect data to identify:** • Characterization (size, type, possible impact) • Marine litter sources (e.g. rivers, densely coastal areas, offshore platforms, diffuse inputs) • Accumulation areas (hotspots) at regional level, e.g. closed bays, gyres, canyons, specific deep sea zones **- Select sampling sites based on different criteria, e.g.:** • potential harm/ impacts (environmental/ physiologic, or socioeconomic)	**- Key steps to locate hot spots** for Priority should be given to monitoring programmes measuring status and trends in sites of high risk of impacts/harm. Use practical knowledge of which environmental components are most sensitive to marine litter. Current understanding of how different species react to litter is insufficient, yet some proxies might be done (e.g. harm is more likely to occur in accumulation areas/
EO10	**Common Indicator 23:** Trends in the amount of litter in the water column including microplastics and on the seafloor	X			
EO10	**Candidate Indicator 24:** Trends in the amount of litter ingested by or entangling marine organisms focusing on selected mammals, marine birds, and marine turtles		X		

				• accumulation areas Set up areas at high risk and reference sites (low/no risk) Focus on "representative sites" **- Map information** **- Select monitoring strategy:** • For marine litter, stratified & randomised sampling is advised • Select sampling sites according to criteria when limited resources available • Select monitoring parameters **- Identify "co-monitoring" opportunities:** • Evaluate pertinence of combining with other monitoring programmes, e.g. scientific trawling for fisheries, other, by analysing sampling strategy	hotspots). Proxies are not illustrative of all sites, but represent "worst case scenarios" and the application of the Precautionary principle. Distribution and quantities (especially for microplastics) to develop GIS and mapping systems?
EO8	**Candidate Indicator 25**: Land use change		X		

6. THE MAIN SCIENTIFIC GAPS WHICH HAMPER AN EFFECTIVE IMPLEMENTATION OF MONITORING PROGRAMMES FOR THE FULL IMPLEMENTATION OF MONITORING STRATEGIES

89. This section allows focusing on needs for further research and interaction between science and policy in order to fill the science gap for marine policies implementation. In order to make best use of the RBA, during the development of the IMAP at the national level, some science-policy questions would need to be addressed, both in relation to the overall development of national Integrated Monitoring and Assessment Programmes as well as regarding specificities of marine litter, biodiversity and fisheries, and coastal and hydrography monitoring.

Note: Participant exchanges and discussions are expected to contribute to address some of these gaps, in order to best apply RBA to the implementation of IMAP.

Priority Issues/ questions / gaps for the implementation of the RBA by themes

6.1. EO 1, 2, 3, 4, 6 marine biodiversity and fisheries

Table 3 Priority Issues/Questions related to Marine Biodiversity and Fisheries (EO 1; 2; 3; 4; 6) and for Common Indicators 1 to 12

Indicator	Type of gap	Specific question/ issue	Description and observations
EO 1, 2, 3, 4, 6 - MARINE BIODIVERSITY AND FISHERIES			
CI 1-12	**Monitoring & Guidance Methods**	Cost-benefit analysis of the monitoring?	- For sensitive biota, where to put the focus to prioritise? Vulnerable types of habitats, e.g. MPAs, spawning, breeding & feeding areas, migration routes, other. Other criteria, also to prioritise among them? A practical and cost-effective approach could as a first step to focus on MPAs (including SPAMIs and possibly FRAs)? - In relation to NIS monitoring, is there a need for a different approach than in relation to biodiversity common indicators? - Seek cost-effective monitoring methods for commercial fish stocks - Seek opportunities for joint/ integrated monitoring for selected biodiversity and coastal Indicators - Seek opportunities to create joint/ integrated monitoring for seafloor litter and fish stock assessment surveys (existing, envisaged…)

	Data	**Lack of data**	- Data scarcity
	Sources/Pressures/Impacts/ Knowledge		- Lack or imperfect knowledge on the variable state of the ecosystems/ habitats/ species, and the desired state.
	Models & Tools		*To be completed*

6.2. EO 7 Hydrography and EO 8 Coastal ecosystems and landscapes

Table 4 Priority Issues/Questions related to Hydrography and coasts (EO 7, 8) and for Common Indicators 15, 16 and 25

Indicator	**Type of gap**	**Specific question/ issue**	**Description and observations**
EO 7 - HYDROGRAPHY			
CI 15	**Monitoring & Guidance Methods**	- Frequency of monitoring: to be established case by case? o Larger-scale installations may cause more serious impacts, and could potentially be monitored more frequently - The issue of infrastructure size: o All manmade infrastructures lasting for over 10 years are to be considered, but this can refer also to relatively small installations o Consider size, besides longevity, of manmade structures to estimate potential impacts and levels of pressure. - Coherence of geographical scales, important between different countries for the same indicator, but for different indicators the scale will differ; - Need to reflect on how to measure specifically the extent of habitats impacted by manmade structures (mapping the areas of hydrographical changes together with spatial maps of habitats) since habitat condition is to be assessed integrally under other EOs (namely EO1/EO6 Biodiversity and Seafloor condition).	
	Data	- Data scarcity and lack of knowledge regarding the complexity of ecosystem processes	

	Sources/Pressures/ Impacts/ Knowledge	- Interactions/ links between land-use and marine ecosystem-habitats quality/health/integrity; - How to deal with decision-making under uncertainty? o Data scarcity, heterogeneity of methods, lack of knowledge, complexity of ecosystem processes… Decision-makers need to be prepared to deal with these issues (highlight the precautionary principle).
	Models & Tools	- The issue of expert capacity: - Hydrological models can be complex and require certain level of knowledge and experience. These models usually need many data (bathymetry, offshore hydrodynamics data, fields data) and can be expensive in time and cost
	Socio-Environment Economics / Policy	- An importance of integration between different sectoral bodies on a national level should be highlighted, since one particular type of policy can affect different EOs, and also one specific EO can be affected by several different policies; - Focus on needs driven by relevant policies, not only international but national ones, i.e. what policies want and/or need and what science can provide.
EO 8 - COASTAL ECOSYSTEMS AND LANDSCAPES		
CI 16	**Monitoring & Guidance Methods**	- In relation to coastal monitoring, noting that the key objective is not to classify artificialization by its intensity/level of impact, how can we still highlight more dense (less patchy) urbanized areas, as well as areas urbanized in vicinity of sensitive habitats?
	Data	- There are extensive spatial databases within programmes such as Copernicus, but do they cover non-EU, e.g. North African countries?
	Sources/ Pressures/ Impacts/ Knowledge	- Interactions/ links between land-use and marine ecosystem-habitats quality/health/integrity; - How to deal with decision-making under uncertainty? There are sometimes issues on data scarcity, heterogeneity of methods, lack of knowledge, complexity of ecosystem processes… Decision-makers need to be prepared to deal with these issues (highlight the precautionary principle). -
	Models & Tools	- We should aim for an official institutional body to provide a GIS polyline ("official" coastline), then such coastline can be used to "project" the identified manmade structures in order to classify parts of the coastline as being subjected to physical disturbance due to the influence of manmade structures. Geographic scale of maps and cartography used to identify manmade structures could be different but

		not too much form the ones used for the official coastline. - It needs to be established what exactly the indicator comprises. For example, there should be inventory of impervious surfaces within 100m buffer from the coastline, but how much "urbanized" these sections need to be to fall under this indicator. - Coherence of geographical scales (this is important between different countries for the same indicator, but for different indicators the scale will differ)
	Socio-Environment Economics Policy	- An importance of integration between different sectoral bodies on a national level should be highlighted, since one particular type of policy can affect different EOs, and also one specific EO can be affected by several different policies - Focus on needs driven by relevant policies, not only international but national ones, i.e. what policies want and/or need and what science can provide.
CI 25 Land use change	**Policy**	- In relation to candidate indicator 25 (land use change), how could we ensure that in line with RBA, the areas where most valuable habitats were lost due to the land use change (changes from natural areas to urbanized areas, for example) could be focused on (as well as areas where the change was occurring at levels significantly higher than in other areas)?
	Knowledge	- The interpretation of the land use change processes and especially drivers behind them is up to responsible local institutions (GES definition?)

6.3. EO 10 - Marine Litter

Table 5 Priority Issues/ Questions related to Marine litter (EO 10) and for Common Indicators 22-24

Indicator	Type of gap	Specific question/ issue	Description and observations
EO 10 - MARINE LITTER			
CI 22, 23 and 24	**Monitoring & Guidance Methods**	What are the main elements to optimize monitoring strategies?	- Number of replicates in time and space (especially for monitoring microplastics); - Harmonization of sampling protocols; - Comparability of available data (size classes, types, weight, sampling procedures, analytical methods, reference values). - Maximize results/ outputs from low cost monitoring (e.g. regular beach monitoring)

		Are there any opportunities for joint/integrated monitoring of Marine Litter with other Pollution and Biodiversity Indicators?	- Create linkages among indicators: e.g. seafloor litter can be jointly assess with fish stock assessment surveys; - Reduce costs and increase efficiency.
	Data	Do we have consistent baseline data/information to assess the problem in basin scale?	- Refine baseline data, threshold values and targets. - More valuable and comparable data could be obtained by standardizing our approaches;
	Sources/ Pressures/ Impacts/ Knowledge	What's the fate of plastics in the marine environment?	- Better understanding of degradation rates for different types of litter (plastics, degradable materials, bio plastics, etc.) and where relevant potential knowledge on risk and linkages with marine litters is needed.
		Can we precisely determine the effect/harm of marine litter on marine organisms?	- Pilot scale monitoring is needed for determine litter harm in terms of baselines and/or adapting the strategy to local areas; - Better understanding of entanglement (lethal or sub-lethal) under different environmental conditions and of how litter is ingested by marine organisms; - For ingestion of litter by sea turtles, the precise definition of target (GES) and the identification of parameters/ biological constraints and possible bias sources to be considered when defining GES.
		To what extent rafting of marine litter is an important factor for transportation/translocation of species?	- What is the probability of translocation of species due to floating litter? - Nature of constraints for the colonization of floating plastics. - Identification of species which mainly settle on marine litter and if alien species are included among them; - Research, assessment and development of databases of species and/or rafted on marine litter.
	Models & Tools	Are there any accumulation areas in the Mediterranean	- Accumulation rates vary widely in the Mediterranean Sea and are subject to factors such as adjacent urban activities, shore and coastal uses, winds, currents, and

		Sea? Can we detect them?	accumulation areas.
		Which are the main transportation paths in the Mediterranean?	- Evaluation of links between hydrodynamic factors. This will give a better understanding of transport dynamics and accumulation zones; - Further development and improvement of modelling tools must be considered for the evaluation and identification of both the sources and fate of litter in the marine environment.
	Socio-Environment Economics	Which are the main socio-economic experiences and best practices for ML?	- Problems encountered in the application of economic instruments; - Evaluation of direct costs and loss of income to tourism and fisheries; - Evaluation of cost due to clogging of rivers, coastal power plant cooling systems, wastewater purification, and effectiveness of market based instruments; - Development of common methodologies to evaluate the costs of removal; - Development of common methodologies to collect social and economic data; - Assessment of socially acceptable levels of marine litter to the public and industry; - Development of social and economic impact indicators; - Education of the public/civil society; - Monitoring the impact of reduction and prevention measures (evaluation/ effectiveness).

7. COMMON/TRANSVERSAL QUESTIONS AND NEEDS TO BE DISCUSSED DURING THE WORKSHOP

90. In addition to the above-mentionned main scientific gaps which hamper an effective implementation of monitoring programmes for the full implementation of monitoring strategies, here are some transversal issues to be considered during the workshop.

91. Which scientific improvments are needed the most for RBA practical implementation in relation to IMAP (monitoring, evaluations and management)?

92. In line with IMAP, under practical implementation of RBA, "areas that are under higher pressures and the biota that are known to be more sensitive should be identified"- what scientific tools are available for this to be done in an integrated manner?

93. As suggested during the previous SPI workshops, it seems crucial to develop sustainable Scinece-Policy Interfaces especially in pursuing the work done with "the informal online working groups on monitoring". So, according to you, how make them sustainable e?

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Annex 1
List of EcAp Ecological Objectives and Common Indicators

Annex 1: List of EcAp Ecological Objectives and Common Indicators

Ecological Objective	IMAP Indicators
EO 1 Biodiversity	
Biological diversity is maintained or enhanced. The quality and occurrence of coastal and marine habitats and the distribution and abundance of coastal and marine species are in line with prevailing physiographic, hydrographic, geographic and climatic conditions.	Common Indicator 1: Habitat distributional range (EO1) to also consider habitat extent as a relevant attribute
	Common Indicator 2: Condition of the habitat's typical species and communities (EO1)
	Common Indicator 3: Species distributional range (EO1 related to marine mammals, seabirds, marine reptiles)
	Common Indicator 4: Population abundance of selected species (EO1, related to marine mammals, seabirds, marine reptiles)
	Common indicator 5: Population demographic characteristics (EO1, e.g. body size or age class structure, sex ratio, fecundity rates, survival/mortality rates related to marine mammals, seabirds, marine reptiles)
EO 2 Non-indigenous species	
Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystem	Common Indicator 6: Trends in abundance, temporal occurrence, and spatial distribution of non-indigenous species, particularly invasive, non-indigenous species, notably in risk areas (EO2, in relation to the main vectors and pathways of spreading of such species)
EO 3 Harvest of commercially exploited fish and shellfish	
Populations of selected commercially exploited fish and shellfish are within biologically safe limits, exhibiting a population age and size distribution that is indicative of a healthy stock (To be further developed in partnership with GFCM)	Common Indicator 7: Spawning stock Biomass (EO3);
	Common Indicator 8: Total landings (EO3);
	Common Indicator 9: Fishing Mortality (EO3);
	Common Indicator 10: Fishing effort (EO3);
	Common Indicator 11: Catch per unit of effort (CPUE) or Landing per unit of effort (LPUE) as a proxy (EO3)
	Common Indicator 12: Bycatch of vulnerable and non-target species (EO1 and EO3)
EO 4 Marine food webs	
Alterations to components of marine food webs caused by resource extraction or human-induced	To be further developed

environmental changes do not have long-term adverse effects on food web dynamics and related viability	
EO 5 Eutrophication	
Human-induced eutrophication is prevented, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algal blooms and oxygen deficiency in bottom waters.	Common Indicator 13: Concentration of key nutrients in water column (EO5);
	Common Indicator 14: Chlorophyll-a concentration in water column (EO5)
EO 6 Sea-floor integrity	
Sea-floor integrity is maintained, especially in priority benthic habitats	To be further developed
EO7 Hydrography	
Alteration of hydrographic conditions does not adversely affect coastal and marine ecosystems.	Common Indicator 15: Location and extent of the habitats impacted directly by hydrographic alterations (EO7) to also feed the assessment of EO1 on habitat extent
EO 8 Coastal ecosystems and landscapes	
The natural dynamics of coastal areas are maintained and coastal ecosystems and landscapes are preserved	Common Indicator 16: Length of coastline subject to physical disturbance due to the influence of man-made structures (EO8);
	Candidate Indicator 25: Land use change (EO8)
EO 9 Pollution	
Contaminants cause no significant impact on coastal and marine ecosystems and human health	Common Indicator 17: Concentration of key harmful contaminants measured in the relevant matrix (EO9, related to biota, sediment, seawater)
	Common Indicator 18: Level of pollution effects of key contaminants where a cause and effect relationship has been established (EO9)
	Common Indicator 19: Occurrence, origin (where possible), extent of acute pollution events (e.g. slicks from oil, oil products and hazardous substances), and their impact on biota affected by this pollution (EO9);
	Common Indicator 20: Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels in commonly consumed seafood (EO9);
	Common Indicator 21: Percentage of intestinal enterococci concentration measurements within established standards

	(EO9)
EO 10 Marine litter	
Marine and coastal litter do not adversely affect coastal and marine environment	Common Indicator 22: Trends in the amount of litter washed ashore and/or deposited on coastlines (EO10);
	Common Indicator 23: Trends in the amount of litter in the water column including microplastics and on the seafloor (EO10);
	Candidate Indicator 24: Trends in the amount of litter ingested by or entangling marine organisms focusing on selected mammals, marine birds, and marine turtles (EO10)
EO 11 Energy including underwater noise	
Noise from human activities cause no significant impact on marine and coastal ecosystems	Candidate Indicator 26: Proportion of days and geographical distribution where loud, low, and mid-frequency impulsive sounds exceed levels that are likely to entail significant impact on marine animal
	Candidate Indicator 27: Levels of continuous low frequency sounds with the use of models as appropriate

Annex 2
Brief on the Integrated Monitoring and Assessment Programme (IMAP)

Annex 2: Brief on the Integrated Monitoring and Assessment Programme (IMAP)

Monitoring and assessment, based on scientific knowledge, of the sea and coast is the indispensable basis for the management of human activities, in view of promoting sustainable use of the seas and coasts and conserving marine ecosystems and their sustainable development. The Decision IG.22/7 Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria (UNEP/MAP, 2015a), adopted during the COP 19, describes the strategy, themes, and products that the Barcelona Convention Contracting Parties are aiming to deliver, through collaborative efforts inside the UNEP/MAP Barcelona Convention, over the second cycle of the implementation of the Ecosystem Approach Process (EcAp process), i.e. over 2016-2021, in order to assess the status of the Mediterranean sea and coast, as a basis for further and/or strengthened measures.

Background

IMAP builds on the monitoring and assessment related provisions of the Barcelona Convention and its Protocols, previous Decisions of the Contracting Parties related to monitoring and assessment, and to the EcAp process, including on Decision IG. 21/3 and the expert level discussions mobilized based on this Decision, such as the ones taking place in the Correspondence Groups on Good Environmental Status (COR GEST) and Monitoring (CORMON), the On line Working Groups (Eutrophication, Contaminants, Marine litter, Biodiversity and Non-invasive species and Coast and hydrography) as well as the EcAp Coordination Group. In addition, the development of IMAP took due account of the Contracting Parties‟ existing monitoring and assessment programmes, practices of other Regional Sea Conventions and other Regional bodies, such as GFCM[11] and ACCOBAMS[12].

Timeline

IMAP is aiming to deliver its objectives over 2016-2021. It is introduced first however in an initial phase (in line with Decision IG. 21/3, in between 2016-2019), during which the existing national monitoring and assessment programmes will be integrated, according to the IMAP structure and principles and based on the agreed common indicators. This implies in practice that the existing national monitoring and assessment programmes will be reviewed and revised as appropriate so that national implementation of IMAP can be fulfilled in a sufficient manner. The main outputs during the initial phase of IMAP will include the update of GES definitions, further refinement of assessment criteria and development of national level integrated monitoring and assessment programmes. Furthermore, the Quality Status Report in 2017 and the State of Environment and Development Report in 2019 will build on the structure, objectives and data collected under IMAP. The validity of IMAP should be reviewed once at the end of every EcAp six year cycle, and in addition it should be updated and revised as necessary on a biennial basis, based on lessons learnt of the implementation of IMAP and on new scientific and policy developments.

The SPI for IMAP definition phase

As any UNEP/MAP programme, IMAP has been built using available scientific basis. As presented above, IMAP elaboration has been supported by expert advice issued from the Correspondence Groups, themselves complemented by those of the On-line working groups, under the supervision of the EcAp coordination groups. These multidisciplinary groups were composed of technical and scientific experts designated by the Parties to the Barcelona Convention. Their works were facilitated by the dedicated MAP components, supported by contracted experts.

[11] General Fisheries Commission for the Mediterranean (GFCM)
[12] Accord sur la Conservation des Cétacés de la Mer Noire, de la Méditerranée et de la zone Atlantique adjacente (ACCOBAMS)

Moreover scientific expertise issued from ongoing research projects were also mobilized for specific question regarding biodiversity. A workshop was co-organized by UNEP/MAP and the EU PERSEUS[13] project to follow up the recommendations of February 2014, asking the Secretariat to consult international experts for developing IMAP, especially in relation to biodiversity. This workshop was held on the 28-30April 2014 in Anavissos HCMR[14] premises, Greece, with contribution of several on-going research and pilot EU projects, namely PERSEUS, CoCoNet[15], DEVOTES[16] and IRIS SES[17] and was attended by scientific working in the field of biodiversity.

The workshop has resulted in some general and some specific biodiversity and NIS common indicators related scientific recommendations and addressed both overall status or aspects of biodiversity in the Mediterranean, monitoring needs, challenges, methodologies, cost efficiency and feasibility in light of recent scientific developments. As such it provided a key contribution to the development of IMAP.

[13] http://www.perseus-net.eu/
[14] Hellenic Centre for Marine Research, coordinator of the PERSEUS and IRIS SES projects
[15] http://www.coconet-fp7.eu/
[16] http://www.devotes-project.eu/
[17] http://iris-ses.eu/

Annex 3
Other existing definitions on Risk Based Approach for monitoring

Annex 3: Other existing definitions on Risk Based Approach for monitoring

Reference to RBA in the report: **"Scientific Support To The European Commission On The Marine Strategy Framework Directive".** *(March 2010).*

"When the ecologically meaningful scale for variability in environmental conditions and impacts of pressures is relatively small, the best approach for selecting a set of indicators and monitoring schemes builds on the available knowledge on what ecosystem features are particularly vulnerable to and where pressures are confined. In such cases, the first step in prioritisation would be to map the spatial distribution of pressures, particularly the ones most likely to cause the largest impacts on the ecosystem, and the vulnerability of various properties of marine systems. The areas and indicators which should be priorities for monitoring are determined by prior assessment of:

i. the distribution of the intensity or severity of the pressures across the region at large;
ii. the spatial extent of the pressures relative to the ecosystem properties possibly being impacted;
iii. the sensitivity/vulnerability or resilience of the ecosystem properties to the pressures;
iv. the ability of the ecosystem properties to recover from impacts, and the rate of such recovery;
v. the extent to which ecosystem functions may be altered by the impacts; and
vi. where relevant, the timing and duration of the impact relative to the spatial and temporal extent of particular ecosystem functions (e.g. shelter, feeding, etc).

The variation in scale of both environmental conditions and impacts of pressures means that assessments of GES should begin with sub-areas of both greatest vulnerability and highest pressures. If the environmental status in these areas is good, then it can be assumed that the status over the larger area is 'good'. On the contrary, if the environmental status in the sub-areas is not ‚good', then monitoring and assessments would be conducted stepwise at additional sites along the gradients of pressure or vulnerability. The size of the appropriate steps along the gradient will depend on the nature of the gradient and the way the environmental conditions are being degraded. It may vary significantly with different cases. This Risk-based Approach will be particularly effective for Descriptors that are spatially patchy and where pressures are applied at specific locations.

This pragmatic prioritisation of monitoring strategies enables general statements to be made about environmental status at large scales while keeping monitoring requirements manageable. It is referred to as a Risk-based Approach in several of the Task Group. The approach also facilitates the identification of actions needed to improve the environmental status, and represents a suitable methodological scheme for marine spatial planning."