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Regional Meeting on IMAP Implementation: Best Practices, Gaps and Common Challenges

Rome, Italy, 10-12 July 2018

Summary of outcomes of science-policy interface workshops of 2015-2017

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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 3 : The EcApMedII project's related Output 3

Reference Document: Outcomes of previous SPI Workshops

TABLE OF CONTENT

1. INTRODUCTION

1.1. Rationale of the SPI activity

1. The EcAp MED II Project (2015-2018) materialises the second phase of the implementation of the Ecosystem Approach (EcAp) in the Mediterranean.

2. One of the project's key activities, namely Output 3, focuses on strengthening the interface between science and policy in order to support the implementation of the IMAP Programme, and thereby, the EcAp Initiative. Indeed, it is paramount to bridge existing gaps between the scientific and policy-making spheres, while it is believed essential to provide continuous research and scientific support to the implementation of regulations focusing on achieving good environmental status (GES) of natural systems.

3. In this context, Plan Bleu/ RAC was mandated by UNEP/MAP to coordinate this activity, by organizing and facilitating five different workshops focusing on SPI development and strengthening across the Mediterranean region over a period of three years (2015-2018).

1.2. Objectives of the SPI activity

4. The overarching goal of SPI for the implementation of IMAP is to enhance the relationship between science and policy in order to improve the delivery of IMAP in terms of monitoring and assessment of the status of the Mediterranean Sea and coasts, as a basis for further and/or strengthened measures and informed policies for achieving GES.

5. To this purpose, a series of five different workshops were scheduled for the period 2015-2018 as a means to identify and further characterise the existing gaps on scientific knowledge and data related to monitoring procedures. Indeed, these gaps are to be addressed in order to put in place monitoring programmes –in particular, the regional Mediterranean IMAP Programme and its translation into national monitoring plans- as one of the seven steps of the EcAp Initiative towards achieving GES.

6. The expected outcomes of the SPI activity for IMAP are:

- Delivering the outputs of IMAP to decision makers in an appropriate way, allowing helping them take relevant action towards achieving GES;
- Decision makers will make effective use of the scientific information produced under IMAP in view of achieving GES through informed policy making.

1.3. Overview of milestones achieved

7. To date, three workshops out of five have been carried out: one first general launching workshop (Inception Workshop, December 2015), followed by two thematic SPI workshops focusing on specific issues: pollution (eutrophication and contaminants), on one side; and marine protected areas and marine biodiversity, on the other side (October and November 2016, respectively).

8. Taking into consideration that IMAP encompasses all areas covered by EcAp, involving thus three main thematic clusters (i.e. biodiversity and fisheries, pollution and marine litter, and hydrography and coasts), good coordination with the corresponding thematic UNEP/MAP components1, in charge of supporting IMAP's implementation at regional and national scales, is central to develop cooperation between environmental policy-makers and scientific experts and researchers. It was therefore agreed to envisage SPI workshops as joint sessions to thematic events organised by RACs.

[1] The regional activity centres (RACs) e.g. Plan Bleu, Priority Actions Programme, Specially Protected Areas, Sustainable Consumption and Production, REMPEC, INFO/RAC.

9. In this context, the two thematic workshops carried out in 2016 were held as specific sessions of a UNEP/MAP CORMON (Correspondence Group on Monitoring) on pollution issues (19-21 October 2016, Marseille, France); and of the "2016 Forum of Marine Protected Areas in the Mediterranean" (28 - 30 November, and 1 December 2016), respectively.

2. MAIN OUTCOMES OF CONDUCTED WORKSHOPS

2.1. LAUNCHING THE SPI ACTIVITY: THE INCEPTION WORKSHOP

10. The SPI activity was launched through an ambitious Inception Workshop organized by Plan Bleu, which took place in December 2015 in Sophia-Antipolis (France). It brought together key stakeholders2 to discuss on the development of effective science-policy interfaces (SPI) to support IMAP's implementation.

2.1.1. Objectives

11. As the first of a set of workshops scheduled in the framework of the SPI activity, the Inception Workshop was intended to foster a first exchange of information between scientists and policy-makers to highlight key policy challenges requiring scientific inputs in relation to monitoring, environmental assessment and provision of new measures.

12. Meeting objectives included identifying research needs regarding the implementation of IMAP, involving all ecosystem components as targeted by the EcAp Initiative; as well as imagining and detailing potential and feasible actions contributing to address the scientific gaps acknowledged.

13. In particular, the Inception Workshop, as launching event, provided a first opportunity to explore these objectives:

1. based on the analysis of the IMAP document, agree on a list of priority scientific gaps to be filled as a priority for a better implementation of IMAP, with maximum two priority scientific gaps identified by each Ecological Objective;
2. discuss and agree on key action points related to the identified gaps addressing how the scientific community could in a practical manner contribute effectively to the IMAP implementation and regional EcAp process;
3. provide recommendations on the objectives and methods for the following workshops;
4. identify key opportunities, i.e. relevant projects and research institutions around the Mediterranean, with the view of creating a network that can have an active role in the implementation of IMAP at various scales.

2.1.2. Major results

14. During the workshop, successful SPI experiences and practices developed in the Mediterranean region were presented. Discussions and exchanges among participants based on a first analysis of the IMAP document allowed identifying a number of knowledge needs to be addressed for the full implementation of IMAP, as well as a number of possible actions aimed to effectively bridge them.

15. Some of the recognised knowledge gaps were of cross-cutting nature and of general interest to the different scientific domains (see Table 1 below).

[2]MAP Focal Points designated by the Parties to the Barcelona Convention, representing policy-makers of the coastal and marine environmental policies; coordinators and participants to recent and on-going research projects willing to provide project results to serve environmental policies; regional scientific bodies advising policy-makers; experts in environmental science-policy interface, supporting developing sustained and efficient SPIs; UNEP/MAP component representatives, in charge of implementing decisions adopted by Conferences of the Parties to the Barcelona Convention.

Table 1. Cross-cutting knowledge gaps and actions

KNOWLEDGE NEEDS	FIELDS FOR ACTION
• **A recognized lack of knowledge** Scientists are not able to provide to policy-makers the necessary knowledge in all areas to support the goal of achieving GES. It is also recognized that additional efforts for identification, hierarchizing and synthesis of knowledge gaps are required. • **Heterogeneous spatial distribution of knowledge availability in the Mediterranean** Knowledge availability differs among CPs. Generally, a gap between Northern and Southern countries can be observed, which can impact the robustness of regional Mediterranean models and knowledge. • **Monitoring versus obtaining new knowledge** The difference between routine activity with the purpose of monitoring and scientific activities for obtaining new original knowledge is pointed out. Also, if new knowledge is considered GES relevant, a sustainable monitoring process should be developed. • **Scientific results to inform different processes.** 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.** Available knowledge regarding the functioning of Mediterranean marine and coastal ecosystems is today still lacking, yet it is also acknowledged that the mobilization around EcAp and the MSFD has so far succeeded in developing new knowledge.	• **Filling knowledge gaps with remote sensing**. It is recommended to make use of remote sensing results to monitor physical elements, especially to establish baseline data for coast and hydrography, where no field data is available. However, in some cases, more detailed data will require field work. • **Cost-benefit analysis** Workshop participants bring forward the interest of conducting cost-benefit analyses of monitoring. • **Scales** It is recommended that relevant scales and timelines for the integrated assessment are clearly defined. • **Aggregation rules**. Aggregation rules, allowing integrating the results of monitoring and addressing whether GES has been achieved or not, need to be clarified. • **Guidelines for risk-based approach.** IMAP 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 • **Mapping results** It is recommended that outputs of the integrated assessments be mapped under a GIS for a better understanding of environmental processes.

16. In addition, the workshop scheduled working group sessions dedicated to each EcAp thematic cluster, namely “Biodiversity and fisheries”, “Contamination and marine litter” and “Hydrography and coast” so as to identify topic-specific knowledge gaps and actions by sientific experts in the field (see the following tables, Table 2-

17. Table 4).

Table 2. Specific knowledge gaps and actions : Marine biodiversity

KNOWLEDGE NEEDS	FIELDS FOR ACTION
MARINE BIODIVERSITY	
• **List of species per ecosystem.** A list of species per ecosystem is still to be completed. In general, a description of the species' interactions under "GES" should be established.	• **Strengthening the marine station network.** The network of marine stations is to be reactivated and further developed in order to provide knowledge regarding: (i) taxonomy/list of and functional role of species (allowing to identify shifts or extinctions), (ii) gene banks for identification of species, (iii) ecosystems functioning, (iv) non-indigenous species, (v) monographs of each group of species, (vi) a shift from a habitat logic to en ecosystem logic. The development of the marine station network needs to be animated by a taxonomist. Capacity building and funding for equipment is required for non-European countries.
	• **Include pelagic and benthic realms into monitoring and assessment**. It is recommended to move to a more holistic approach of the marine environment and include pelagic and benthic realms (not only large-top food chain predators), along with linked threats and pressures into IMAP.
• **Baseline/ reference conditions for biodiversity**	• **Identify reference conditions on the basis of the existing MPAs network.** It is suggested that marine stations use well-managed MPAs to contribute to the definition of baseline conditions with regards to the different elements mentioned (above points (i) to (vi)).
• **Develop a cross-cutting perspective**	• **Develop links between** (i) physicochemical oceanology, (ii) ecosystems functioning knowledge and (iii) threats and pressures considering connectivity effects and processes (not areas but volumes), and overcoming political barriers.

Table 3. Specific knowledge gaps and actions : Pollution and marine litter

KNOWLEDGE NEEDS	FIELDS FOR ACTION
POLLUTION AND MARINE LITTER	
• **Definition of eutrophication and its ecological impact.** The observation of chlorophyll-a is not sufficient to characterize eutrophication phenomena. To assess the natural variability of the basin, long time series are required.	• Further **use of satellite data and validation with** the help of **field observations.** • **A standard common assessment methodology** with more than two indicators should be developed. • **Thresholds need to be defined** for different ecological areas. The scale of sampling needs to be targeted.
• **Concentration of nutrients in water column.** Need to further detail the assessment of the concentration of nutrients in the water column. Additional information about sources of nutrients such as aquifers and ground water may be useful.	• **Establish guidelines for hydrographic parameters**
• **Further development of monitoring and assessment of EO9 (Pollution)**	• **The relationship between inputs, concentration and effects to be further investigated.** • **Cross-enhance the contaminant reference list** with the MEDPOL list and **suggest additional priorities** for each area. • **Add observation of pathogens** not only **in bathing waters** but **also in shellfish**; this issue has been identified as of cross-cutting interest of need of further discussions. • **Discuss whether research data for the extension of monitoring strategies beyond coastal areas, in application of the risk based approach, is needed and suggests to discuss this further.** • **Further development of data management at the basin scale.**
• **Further development of monitoring and assessment of EO10 (Marine litter)**	• Develop a **common approach for the definition of baselines** at Regional Seas scale. • **Make use of modelling** to define where exactly monitoring should take place (accumulation areas, hotspots, sources). In the medium term, **a GIS platform** with all information stemming from models and the collected data should be envisaged. • **Develop and harmonize seafloor monitoring** including fish stock assessment programmes and remotely operated vehicles for remote areas.

Table 4. Specific knowledge gaps and actions : Coast and hydgrography

KNOWLEDGE NEEDS	FIELDS FOR ACTION
COAST AND HYDROGRAPHY	
• **Length of coastline influenced by man made structures**	• **For a baseline assessment, existing data should be used to generate an indicator at country level**; this data generally exists or can be retrieved from satellite data. E.g. Copernicus (the European Earth observation programme) has developed a specific initiative on coastal areas (setback area, 100m) with a good level of detail which can provide a useful source of data. • **Evaluate cultural attitudes of populations to coastal zones** and **values attributed to developments in the coastal zone.**
• **Location and extent of habitats impacted directly by hydrographic alterations**	• The **mapping of habitats made for other indicators** (e.g. biodiversity) **should be coordinated with the issues linked to this objective** for economies of scale and consistency. Mapping of existing man-made structures will provide a baseline for the assessment of future measures and their impacts. • **Future measures need to be assessed on the basis of (hydrological) modelling** (present indicator) and investigation on potential interruptions of connections between ecosystems (subsequent indicator) in order to minimize negative impacts. DELTARES, independent institute for applied research in the field of water, can provide guidelines for modelling and impact assessment; in France, approaches for estimation of losses caused by coastal structures are available.
• **Candidate indicator: Land use change.** This indicator has been tested in the Adriatic region (refer to PAP RAC website). It provides a good insight into spatial dynamics in order to detect hotspots for further investigation. Furthermore, the ClimVar & ICZM project has made an assessment for 11 countries based on data from Google Earth.	• **Implement monitoring with the help of satellite data** (e.g. COPERNICUS, CORINE Land Cover). The assessment should be done by country experts and associate socioeconomic and other cultural country characteristics. The online working group established for the definition of IMAP should assist in the process and further assistance is to be envisaged for interpretation of satellite data requiring specific knowledge. • In terms of communication, **the indicators need to be communicated as a tool assisting authorities in decision-making, aiming at coastal safety** (climate change, adaptation, tsunami, reducing land losses from erosion).

2.1.3. Conclusions

18. 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. Participants provided general and specific scientific recommendations, and addressed overall status and 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.

2.2. THEMATIC WORKSHOPS: POLLUTION (EUTROPHICATION AND CONTAMINANTS) AND MARINE PROTECTED AREAS (MPAS) AND BIODIVERSITY

2.2.1. Different topics, common objectives

19. Taking up the baton of the Inception Workshop, two thematic SPI workshops were subsequently carried out, targeting specific topics:

- Workshop on Science Policy Interface (SPI) strengthening for the implementation of the UNEP/MAP IMAP, back to back with the Meeting of the Ecosystem Approach Correspondence Group on Pollution Monitoring, Marseille, France, 20-21 October 2016;

- Workshop on Science Policy Interface (SPI) strengthening for the implementation of the UNEP/MAP IMAP, in the field of Marine Protected Areas and marine biodiversity, back to back with the 2016 Forum of Mediterranean MPAs, Tangier, Morocco, 28 November to 1st December 2016.

20. Despite the thematic difference, both workshops envisaged three main common specific objectives:

1. Reviewing and fine-tuning the scientific needs, identified during the Inception Workshop as preventing the effective implementation of IMAP, at regional and national levels, through:

i) Reviewing and completing the list of the science needs pre-identified during the Inception Workshop;
ii) Proposing concrete actions in order to translate general initiatives into specific activities at different geographical scales (regional, national, local, etc.).
iii) Reflect on the feasibility of the actions to be implemented to fill the gaps, and prioritise them according to the following criteria:
- The cross-cutting nature of activities (e.g. actions addressing many science needs, allowing optimising resources);
- The urgency to address the science needs, initially conducting actions addressing aspects related to the first stages of IMAP's implementation schedule;
- The existence of opportunities: a favourable context (ongoing scientific projects and/or initiatives, laboratory works, datasets, etc.) already existing and facilitating the implementation of the action.

2. Define the rationale and set proposals regarding pertinent geographical and temporal scales for periodic monitoring, reporting and assessing in the context of IMAP, in order to describe the status of Ecological Objectives;

3. Suggest actions to keep the SPI platform active in order to continue supporting IMAP's implementation.

2.2.2. Workshop on Science Policy Interface (SPI) strengthening for the implementation of the UNEP/MAP IMAP on Pollution (EO5 and 9): principal outcomes issued.

21. The second SPI workshop was to shed some light on the existing pollution (data) resources and knowledge (made available by MEDPOL) and the remaining gaps in relation to IMAP's implementation.

22. MEDPOL has been collecting and storing a wealth of valuable data regarding pollution components in its database over the last decades. Even if available information can be exploited to

characterize some of the indicators set up to characterise EcAp's EO5 and 9, data (and knowledge) gaps exist, making difficult the description of new aspects of marine and coastal ecosystems.

23. The expected outcomes of this workshop included:

i) identifying the science needs to be addressed in priority in order to support the full implementation of IMAP at regional and national levels;
ii) proposing concrete solutions out of general action lines;
iii) provide recommendations regarding pollution monitoring and assessing to be implemented in the framework of IMAP.

a. Specific results regarding Eutrophication

24. During the workshop, specific working group sessions allowed prioritising among urgent scienfic neds regarding the implementation of IMAP, in particular in relation to Eutrophication issues (EO5), as well as defining concrete action lines to address them (see Table 5).

Table 5. Specific knowledge gaps and actions : Eutrophication phenomena

PRIORITY	DESCRIPTION OF NEEDS	ACTIONS AND OPPORTUNITIES
• **Assessment of spatial and temporal natural variability regarding eutrophication processes at basin level** Eutrophication is not a generalized concern in the Mediterranean, yet a local phenomenon occurring in concrete coastal areas receiving high impacts of human activities and/or freshwater inputs.	Natural temporal (monthly, seasonal, etc.) and spatial variability of parameters related to eutrophication should be better considered for the development of national monitoring plans.	- River inflows should be monitored: whenever possible, data on river inflow for salinity and nutrients should be acquired. - Since salinity is a relevant indicator for eutrophication, it should be added to the common parameters to be monitored in national plans;
• **Definition of scales (temporal and spatial) and areas for the assessment of eutrophication for each Mediterranean country**	There is a need to make more types of spatial assessment. Grids to conduct nutrient monitoring are to be developed at local and national scales (exception of the North Adriatic).	- Coastal hotspot areas, where risks are important, are to be monitored regularly (in space) and frequently (in time). - Blooming frequency is to be considered, instead of their variability.
• **Assessment of main pressures (and related impacts) concerning eutrophication at national scale or lower if relevant**	More research is to be developed in countries' hotspots: - The scale of coastal areas and lagoons is important (areas highly human impacted, sensitive to eutrophication). - Monitoring tasks & resources should concentrate in these sensitive areas, while temporary measures are to be taken in other regions. - Pressures should be considered in countries' monitoring plans.	- Due to limited economic resources, monitoring efforts at the scale of the basin should be spaced out and concentrated in specific high risk areas; - Pressures should be considered when drawing up monitoring plans and be assessed; - Assess first the areas where nutrients have an impact; and once sensitive areas are identified, proceed with measurement;

• **Definition of eutrophication thresholds for different ecological areas at national or sub-national scales** Since eutrohication events occur locally, areas of risks or eutrophication hotspots are not regional, therefore thresholds differ across the basin according to local conditions	Consider differences between Mediterranean east and west areas (recording different Chl-a and nutrient levels), areas where eutrophication risks are shared (depending on close or open basins), causes (freshwater inputs, other) and examine whether thresholds might be shared or not.	- Establish thresholds for different Mediterranean areas/ sensitive areas; - Maximum and minimum values are to be included for Chlorophyll-a and nutrients;
• **Development of a (minima) common standard assessment methodology for all Mediterranean countries based on existing monitoring strategies for eutrophication**	A **common and comparable methodology** is to be developed among countries, including: - **Inter-calibration**: some national programmes in Med countries have been monitoring nutrients, but inter-calibration procedures need to be carried out to obtain comparable data; - Develop a **unique and revised common database**, (e.g. case of the Adriatic Sea); - Develop **thresholds for nutrients**, according to geographical areas/ conditions	

b. Specific results regarding Contaminants

25. In turn, prioritisation of urgent scientific needs was also conducted regarding Contaminants (EO 9); a number of actions were also proposed to address gaps (Table 6).

Table 6. Specific knowledge gaps and actions : Contaminants

PRIORITY	DESCRIPTION OF NEEDS	ACTIONS AND OPPORTUNITIES
Implement "IMAP's Common Indicator 18: Level of pollution effects of key contaminants where a cause and effect relationship has been established".	Conduct **research at two levels**: - the cycle of contaminants and biomagnification rate; - ecotoxicology and effects on organisms, specifying whether effects are caused at the organism, population of ecosystem level;	**Conduct a Workshop on** the issue of the known **cause-effect relationships for contaminants** Conduct a specific workshop on available data & knowledge on contaminant cause-effect relationships, open to Mediterranean scientists and decision-makers, and international experts, to provide indication on potential research lines for future research projects, e.g. metabonomics and biomarkers.
Research on the relationship between inputs and concentration, and between concentration and effects		
Selection of monitoring parameters according to EO9 indicators	Development of **a common standard assessment methodology** for all	**Conduct a Workshop to define a common standard assessment methodology**

(i.e. key pollutants, contaminant concentrations, pollution effects, etc.) and monitoring procedures based on existing experiences	Mediterranean countries to assess contamination	A workshop on available methods used in Mediterranean countries (or in other sea basins, whenever pertinent) useful to harmonise practices for pollution monitoring. It could help to answer CORMON requests on the issue of the scales at which to assess and report.
Definition of GES targets related to the different indicators for EO9	Establish **thresholds**	Characterise baseline and thresholds; - Develop expertise to prepare recommendations for BAC (background assessment concentrations); - Formulation of EAC (environmental assessment criteria) for selected biomarkers in Mediterranean species.
Develop common procedures for data collection, management and storage	A real priority in the Mediterranean, developing procedures for data collection, management and storage is a way to capitalise the existing, and progress towards assessing GES.	Further development of data management at the basin scale: - Collection of reliable data through standardised protocols; - Development and testing of data infrastructure(s) to store and access data, favouring the management and accessibility of new and existing data in a compatible manner.
Use of marine ecosystem modelling to assess pollution	Use existing tools to complement pollution assessment in the sea basin, particularly in regard of limited economic resources.	Consider the integration of available modelling tools to assess environmental status.
Develop coordination at the national and regional level	Including the policy expertise (not only scientific knowledge is needed). Demands efforts to increase capacity building in the area.	Set a mechanism for expertise and capacity building aiming at establishing operational national task forces to support IMAP regarding monitoring and assessment of contaminants occurrence and effects. Policy-makers should also be included in its coordination.

2.2.3. Workshop on Science Policy Interface (SPI) strengthening for the implementation of the UNEP/MAP IMAP, in the field of Marine Protected Areas and marine biodiversity (EO 1 to 6) : principal outcomes issued.

26. Despite some progresses, science and management in the Mediterranean are still largely disconnected. Much of the scientific outputs produced are inaccessible to MPA managers, often operating without a solid scientific underpinning. Alternatively, research projects conducted in MPAs may produce outputs of no help to practitioners, as not particularly focusing on management needs.

27. The workshop targeted the implementation of IMAP in the Mediterranean, in particular regarding monitoring of biodiversity as well as the effective management of MPAs as tools for its

conservation. Exchanges were based on a preliminary analysis of the IMAP science needs regarding marine biodiversity in the Mediterranean, prepared by Plan Bleu..

28. Similarly to the SPI session on pollution, the expected outcomes of this workshop also included:

i) identifying the science needs to be addressed in priority in order to support the full implementation of IMAP at regional and national levels;
ii) proposing concrete solutions out of general action lines;
iii) providing recommendations regarding pollution monitoring and assessing to be implemented in the framework of IMAP.

a. Specific results for Marine Biodiversity

29. Among pre-identified scientific gaps, workshop participants prioritised urgent needs regarding marine biodiversity (dealing in particular with habitats, indicator species, marine mammals and non-indigenous species) and imagined concrete solutions to address them (Table 7).

Table 7. Specific knowledge gaps and actions : Marine biodiversity

PRIORITY	ACTIONS AND OPPORTUNITIES
HABITATS	
Improve the knowledge of main Mediterranean habitats	• **Progressively extend the concept of habitat to the pelagic realm, as a further extension of IMAP;** o Build on CoCoNet project outputs and consider the fishery knowledge. • **Strengthen the habitat inventory (and species inventory) to produce reliable data with the support of scientific research programmes** o Develop chairs on management & conservation between scientific institutions and MPAs (exchanges of scientists and MPA managers, funding of thesis or co-supervised internships, etc.) on specific projects. o Promote the formation of taxonomists, since many marine habitats have as key species algae and invertebrates o Develop a regional organisation of scientific experts working on MPAs (e.g. extension of the MedPAN scientific council) o Foster capacity building for linking phenotypes and genotypes • **Map a significant part of selected representative habitats,** encompassing geological and biological features. • **Develop a GIS database or harmonise existing GIS databases** to store and make available results of habitat mapping, incl. data mining of past projects.
INDICATOR SPECIES	
Improve the knowledge regarding Mediterranean indicator species to quantify GES	• **Select common indicator species** to measure major environment disturbances, including CC (e.g. NIS and species sensitive to temperature increase), to be monitored at regional scale in order to address IMAP common indicators 1 to 5 o Use existing network of marine stations, universities, research institutes and MPAs with scientific capacities as **observational platforms of Mediterranean biodiversity**. o Capacity building and funding for equipment would be required for non-European countries. o When possible, produce monographs of Mediterranean biodiversity to foster taxonomy expertise

MARINE MAMMALS	
Improve collection of reliable information on diversity, density, distribution and important marine mammal habitats	• **Identify a minimum of two species** (e.g. coastal dolphins) **of two different functional groups** to be included in national monitoring programs based on the specificity of their marine environment and biodiversity o Use the survey of whales to observe other environmental features (jelly fishes, marine litter, fronts…) o Develop aerial surveys • **Based on existing large scale observations allowing identifying recurrent patterns**, develop national monitoring programmes (coherent, standardised operational methods using sea or aerial observations, physiology, epidemiology) for a regional perspective on the status of marine mammals. o Link to existing observational systems. • **Improve and sustain existing data bases and GIS** for marine mammal distribution o Link to regional geo-referenced databases like MedBiodivSDI and MAPAMED, and the regional cetacean stranding database MEDACES
NON-INDIGENOUS SPECIES (NIS)	
Increase knowledge on marine NIS distribution	• Link to MAMIAS, MedMIS and MedBiodivSDI.
Implement monitoring on NIS and IAS "Hot spots"	• **Implement Rapid Assessment Survey (RAS), at least yearly at national scale**, in Invasive (Alien) Species (IAS) hot spots areas**.** • **Improve knowledge on major vectors and filters of introduction processes** o During the IMAP initial phase, develop guidance for NIS citizen survey, as additional and cost-efficient method strengthening public awareness. Promote the risk based approach to get an overview of the NIS presence at large spatial scale from scattered data.
Measure occurence of IAS and their evolution	• **Define reference baselines,** implement assessments of IAS impacts, including impacts on ecosystem services o Use MPAs as reference sites, at least when far from IAS sources.
MARINE FOOD WEBS	
Improve knowledge on trophic networks as part of the ecosystem functioning	• **Extend applications of the Ecosystem-Based Quality Index (EBQI) applied to few significant Mediterranean ecosystems** (Posidonia beds, coralligenous, caves and other dark habitats). • **Provide an assessment of the pan-Mediterranean biogeographic variability,** transpose few (2-3) selected case studies of well-studied networks dealing to harvested species (molluscs, fishes, …) to 4 distinct biogeographic areas. • **Develop research projects :** o on orphan bentho-pelagic couplings - e.g. short food webs including microbial loops, role of suspension feeders (sponges, gorgons) in the ecosystem functioning. o on other networks of interactions (e.g. chemical ecology) explaining some behaviour leading to habitat selection, recruitment, etc.

b. Specific results for Marine Protected Areas

30. Similarly, workshop participants prioritised among previsouly identified scientific needs regarding MPAs (dealing specifically with connectivity and representativity, as well as with related socioeconomic aspects), proposing concrete solutions to address them (Table 8).

Table 8. Specific knowledge gaps and actions : Marine Protected Areas

PRIORITY	CONTEXT AND NEEDS	ACTIONS AND OPPORTUNITIES
REPRESENTATIVITY AND CONNECTIVITY		
Improve knowledge to better assess and increase the connectivity of the Mediterranean MPAs		**Better use the existing information**, namely: - Distribution of habitats to set up new MPAs (different projects have provided results, e.g. Oceana reports); - Ecologically or Biologically Significant Marine Areas (EBSAs) to assess connectivity within existing and new MPAs/ EBSAs; - Biological data; - Oceanographic data, regularly generated, are key data to understand oceanographic processes and connectivity between MPAs. Make profit of the existing MSP framework, allowing developing working groups and opportunities for spatial and conservation planning; Include actors: planners, decision makers, scientists, etc.
Analyse the gaps of the current MPA system in matter of representativity and connectivity at national level	In the Mediterranean, 46 different designations and/or preservation provisions for MPAs exist, targeting different aspects and providing different levels of protection	**Compile information on the MPA (baseline)**, a tool to confirm its adequate location and its (effective) "performance"; When not available, **establish baselines for all existing MPAs** (e.g. habitats, species, socioeconomic benefits, etc.); Prioritisation for new MPAs could be done in terms of urgency (as possible criteria), based on species needing higher protection levels; Use adaptive management to set and implement MPAs and adjust protection level.
Scientific contribution to the elaboration of measures aiming to increase representativity & connectivity of Mediterranean MPAs at national level;	There is today a system of MPAs, not a real network: to protect threatened and/or sensitive ecosystem components and develop a network of well-coordinated MPAs (i.e. representativity): - Need to combine data (existing & new), make it available and understandable;	**Conduct research** (e.g. PhD programmes, research projects, etc.) between countries, focusing on similar experiences successfully working (in the matter of MPAs) in different areas and developing comparative work. Use the platforms of established MPAs as a forum for interaction of stakeholders, regardless of their protection degree;

	- Scientists and technical experts need to deal with the "big data": collaboration is needed between academia from different countries; Need for implemented management: financing is needed to apply the results of projects on MPAs that have already proposed recommendations	Use existing scientific information to select new sites. Ensure participation of the private sector, together with decision-makers and managers, both at the local and national level, since there is no financial assistance if economic/social interest is not well-shown
SOCIOECONOMIC ASPECTS		
Improve the MAPAMED database and/or similar initiatives;	Database maintaining and update is needed, as data often incorrect; need of sound, validated and reliable data (for MAPAMED a validation method is in place). Need to encourage countries to provide (sound) information on their MPA and biodiversity data, to overcome the lack of coherence (related to connectivity) regarding the location of MPAs.	Set strong system(s) of data sharing and validation, especially with large amounts of data (e.g. validation committees). Check legal texts and contrast them with the information reported by countries on MPAs; Use the potential of MAPAMED to follow/ assess monitoring recorded by MPA managers: reflection is needed to develop a method; Include regional centres working on marine conservation (e.g. RAC/SPA), and national Focal Points from environmental ministries and/or national agencies (as reporting on data and well-placed to implement a mechanism to spread and validate scientific information).
Assessment of ecosystem services in MPAs	Ecosystem services should come together with socioeconomic benefits, knowing that the second are part of the first.	Use results of existing research on socioeconomic benefits provided by marine ecosystems to push/ support ongoing processes, adjusting to the different contexts of MPAs, and to concrete decision making.
Improve the sustainable funding of MPAs in the Mediterranean	Different financial measures exist, allowing developing a strong and healthy financial situation for MPAs; the capitalisation of the existing regarding financial tools to support and sustain MPAs is needed. Attention should be paid so that financing compensatory measures/ payment systems are not imposed on the general public.	Evaluate existing mechanisms to obtain sustainable funding for Mediterranean MPAs: - Set ecotaxes: paying permits for MPA users, going straight to MPA managers. - A "Trust Fund" dedicated to Mediterranean MPA funding is currently developing -the "association" status has been set up- and capital (public, private) will be searched (private actors need to be mapped). - Set "Compensatory payments for ecosystem services" mechanisms to fund MPA management; especially for activities exploiting marine resources in the Mediterranean (dredging, hydrocarbon exploitation, etc.), directly benefitting from resources and needing to contribute at the regional level to their

		conservation. In the Med case, it could fall onto the "Trust Fund for Med MPAs". - Setting "public-private partnerships" (from the perspective of a MPA network, not single MPAs), although it presents (legal) difficulties and depends on the legal framework of countries; it involves partnerships between public agencies and the companies that are using, exploiting, extracting natural resources in the Med. - E.g. Increasing activities such as the cruise sector might represent an opportunity to develop public-private partnerships.
Improve the assessment of socio economic benefits provided by MPAs		A socioeconomic assessment should be done for each MPA as soon as practicable, on the basis of existing information (since a variety of data and sources exist), and would make a compelling reason to develop the ecotax/ funding measures described above

2.3. TRANSVERSAL WORKSHOPS : THE RISK-BASED APPROACH (RBA) TO OPTIMIZE MARINE MONITORING AND THE DEFINITION OF SPATIAL AND TEMPORAL SCALES FOR MONITORING

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

31. The rationale of this workshop focused on strengthening the SPI in the field of the use of the Risk-based Approach (RBA) as a method aiming at both developing monitoring strategies to implement IMAP and dealing with the risks of not achieving Good Environmental Status (GES) in national waters.

32. The RBA is an overarching principle of IMAP and may represent a method for joined-up thinking across scientists, managers and decision makers. Previous SPI workshops recommended thus holding a specific workshop on this approach. The overall objective of this workshop was to share experiences between countries on this approach, to exchange on the importance and usefulness of the RBA for IMAP implementation, as well as to provide recommendations for its application.

33. The RBA is a convenient way to design and optimize marine and coastal environmental monitoring and assessment strategies, as well as to improve their cost effectiveness. Therefore, it is believed a useful tool providing significant support in the implementation of IMAP.

34. A series of presentations has been delivered to illustrate SPI good practices and examples of risk-based approach for marine litter, biodiversity and coast and hydrography. Based on the presentations regarding practical RBA applications, the meeting acknowledged that this approach is an efficient tool to develop monitoring and assessment schemes and enhance integration between Ecological Objectives.

Table 9. Advantages and needs to apply RBA

Management advantages	Economic advantage	Need
• The RBA, as an approach allowing balancing different languages and information coming from various sources (managers, decision- makers, scientists, other) that provides a base for a good communication. • The RBA is a method that enables identifying and prioritizing research needs for the implementation of monitoring, and provides a framework for the management of environmental risks according to different criteria (such as risk exposure, related effects and severity of impacts, determination of risk levels, etc.) allowing for prioritization. • For the definition of the object of monitoring, it is necessary to identify components and locations likely to be at most risk of impact from human activities. Therefore, the risk of impact needs to be assessed (i.e. in terms of intensity, frequency and geographical extent of pressures) for each component. As a result, a set of components and locations ranging from expected high impact to low or no impact (reference areas) are to be compiled, and prioritised according to the risk of not achieving the established targets. In order to prioritise, the spatial and temporal occurrence as well as the intensity of pressures are to be considered.	The RBA is an approach offering benefits both for policy makers and for scientists in order to prioritize and ensure cost effectiveness on common grounds.	The development of guidelines to implement RBA could be useful for whom decide to use such approach in line with specific needs of IMAP, in a simple, user-friendly and concrete form, to provide a common language both for scientists and for monitoring experts and decision-makers on how RBA can guide their implementation efforts related to IMAP in a cost-efficient manner.

2.3.2. Workshop on Science Policy Interface (SPI) strengthening and Ecosystem Approach Coordination Group Meeting on IMAP scales of monitoring and assessment. Principal outcomes issued.

35. The issue of the temporal and spatial scales for the implementation of IMAP: monitoring, reporting and assessing, has been object of specific discussions and exchanges in both workshops, as it is considered as a priority for the definition and development of a common methodology aimed to assess the status of marine and coastal resources of the Mediterranean at regional, sub-regional, national and local scales.

36. The following tables reflect some of the agreements achieved during specific sessions in working groups, for each topic addressed, namely eutrophication, contaminants, marine biodiversity and MPAs; as well as for each phase of the process, i.e. monitoring, reporting and assessing. An entire report dedicated to the workshop is available.

Table 10. Determining spatial and temporal scales: regarding Pollution cluster

<table>
<tr><th colspan="2">MONITORING</th><th colspan="2">REPORTING</th><th colspan="2">ASSESSMENT</th></tr>
<tr><td colspan="6">EUTROPHICATION</td></tr>
<tr><td>Spatial</td><td>Temporal</td><td>Spatial</td><td>Temporal</td><td>Spatial</td><td>Temporal</td></tr>
<tr><td>Eutrophication hotspots,
by means of satellite images.
Their resolution could be a problem.
Some countries combine Eutrophication selected sites with Marine Litter.
Small scales (Coastal eutrophication versus Larger Scales</td><td>Minimum periodicity monthly or bi-monthly</td><td>Coastal hotspot areas</td><td>Bi-annual</td><td></td><td>Annual</td></tr>
<tr><td colspan="2">Expert judgement can justify different monitoring periods, and consider eutrophication risks and trends.</td><td colspan="2">Seasonal frequency might be adopted for a few hotspots, if needed, based on expert advice</td><td colspan="2"></td></tr>
<tr><td colspan="6">Phytoplankton communities need to to be taken into account in a parallel program, feeding EO5 and their common indicators (CI13, CI14). Therefore, there is a need for future candidate indicators in a new IMAP cycle.</td></tr>
<tr><td colspan="6">CONTAMINANTS</td></tr>
<tr><td>Coastal and offshore areas</td><td>NA</td><td>NA</td><td>NA</td><td>NA</td><td>NA</td></tr>
<tr><td colspan="2">Use hydrodynamic modelling to support prevision of pollutant distribution.

Example: Turkey is planning to revise the scale every 5 years. They have a 3-years new programme (2017-2019) with 269 sites (including the Mediterranean Sea) focusing on “hotspots”.</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="6">MARINE LITTER</td></tr>
</table>

Beach litter monitoring	Seasonnal	NA	NA	NA	NA
Microliter monitoring is still an issue. Involve fishermen could help to provide data and solutions. Sometimes there is a low number of monitoring stations. There is a need to go from costal monitoring to offshore monitoring and to work at transboundary levels: the ecoregions.					

Table 11. Determining spatial and temporal scales: regarding MPAs and marine biodiversity cluster

MONITORING	REPORTING	ASSESSMENT
MARINE BIODVERSITY		
• For biodiversity components, it makes no sense to only reflect on an administrative basis: monitoring should be implemented depending on ecosystem functional units, i.e. depending on specific spatial and temporal characteristics as well as relationships between ecosystems. • Great parts of the EOs are already monitored at national level but there is a need to do more for some CIs. It is necessary to capitalize data from national monitoring programmes and other programmes with focusing on existing gaps. • There is a need to have mixed research teams (mixing disciplines) on specific issues at regional and sub regional levels. Then, there is a need for stakeholders' involvement and a need for coordination, at the national and sub regional levels. • There are difficulties to have data trends to understand processes and reminded the presence of disperse (and sometimes not localized) data which are not centralized in data sets.		
MARINE PROTECTED AREAS		

Use, whenever possible, defined spatial / functional units (e.g. EBSAs, EMAs…).	Every 2 years, according to expert judgement	At national level, and/or in coordination with neighboring countries	National assessments & reporting every **2-3 years**	National assessments to be coordinated with neighboring countries	National assessments every **2-3 years**
Use of MPAs as a measure for baseline (reference condition) Temporal and spatial scales should be indicator-specific					

Table 12. Determining spatial and temporal scales: regarding coast and hydrography cluster

MONITORING		REPORTING		ASSESSMENT	
COAST AND HYDROGRAPHY					
Spatial	Temporal	Spatial	Temporal	Spatial	Temporal
Data availability is a challenge for linking habitat maps related to EO1 Biodiversity to EO7 Hydrography. With regard to EO7 on hydrography, the spatial scale concerns the physical alterations of the environment and the impacts of new constructions only (decided in CORMON and incorporated into Indicator Guidance Fact sheets for EO7). For the Indicator on "Land use / cover change" is monitored in competent coastal units (municipality, wilaya, counties…) as defined in the ICZM protocol. The approach consists in looking the changes among five cover classes (artificial surfaces, agricultural, forests and semi-natural, wetlands, and water bodies) and to monitor how these classes change from one monitoring to another.	For CI 15: yearly up to 5 years after the construction, and bi-annually (every two years) following 10 years after the construction. For CI16: the monitoring should be done every 6 years. Environmental impact assessments (before and after building) are necessary. It has been suggested to link current monitoring with new environmental impact assessments.	NA	NA	NA	NA

General comments:

- Aerial photos and remote sensing are of key importance to do analysis.
- It has been stressed out that the main difficulties that Southern Mediterranean countries are facing regarding the implementation of the national monitoring are a need of capacity building and training on use of GIS (well-trained experts on basic layers needed for monitoring for the three indicators) and modelling (need for training the programmers at national levels to use software). They also need financial capacity to buy data.
- It has been recognized that science is needed to define spatial scale for building new installations/structures. So that science is also needed for the definition of the national monitoring scales.
- It has been noted that regarding the definition of spatial and temporal scales for coast and hydrography monitoring, it's crucial to consider natural variability of the coastline's position.

3. GENERAL RECOMMENDATIONS ISSUED FROM THE SPI WORKSHOPS

37. Participants to the different SPI workshops (the Inception worksop in 2015,the two thematic workshops in 2016 and the two transversal workshops in 2017) expressed a number of recommendations regarding key aspects to build up and keep active effective SPI platforms in the Mediterranean, which have been below structured and summarized.

Building-up SPI platforms	• Need to better structure SPI at different levels, starting from simple interfaces adapted to the context (local, national, or regional); • Need to create links between the scientific community (nature & social sciences) and policy makers/ public institutions in order to create a network of experts and projects regarding specific issues (e.g. pollution monitoring); • SPI should include evaluation processes to assess performance and allow improvement.
Communication	• Deliver clear and simple messages, allowing scientists to inform on science uncertainties and complexity as well as enabling policy-makers to express their needs and expectations; • Need for a communication procedure allowing integrating different stakeholders to a multilateral debate; • Scientific experts need to be trained to "translate" academic/ scientific results into advice on socioeconomic issues; • Involving "mass-media": the dialogue should also involve the media, and be fluent and effective.
Time limitation	• Scientific experts need time to conceive and implement scientific and technical protocols to collect and analyse data; their time periods differ from the timing dictated by politics; • On the contrary, science is often one step ahead policy-making, and needs to find an optimal way of periodically inform policy-makers on environmental evolution; • Scientists need to deal with the gradual increase of political demand for scientific advice.
Resource limitation	• To deal with limited (economic) resources, SPI processes could be integrated into research projects; • Existing scientific expertise should be capitalised; • Scientific gaps are not a matter of financial resources but a matter of availability of (monitoring) methods; there is a need for data and knowledge efficiency for monitoring. • To make capacity building more effective in a context of limted ressources, it has been suggested to promote South-South training and specific training and that as soon as the national IMAPs are adopted.
Suggestions to sustain SPI for EcAp implementation	• Develop new pertinent research projects, scheduling SPI in their program and adequately guiding scientific research to measure values/parameters/etc. that are important for policy making. • Include policymakers in projects from the beginning. Different research projects related to the MSFD and SPI (Perseus, Devotes, ...) have conducted

	pilot experiences, including policy makers from the beginning. New research projects should follow the same path, and link young professionals from the scientific and social disciplines. • Include social scientists in research projects to facilitate science/policy communication: scientific language should be "translated" to policy maker's language and include social aspects. • Strengthen technical expertise in SPI by integrating PhD students in the policy area and decision-making processes, either by common projects or through trainings carried out by the policy makers. • Develop SPIs at different levels of actions according to different scopes (topics), even at very local organisation levels (including common joint workshops, as an example). • Carry out pilot initiatives. Develop living examples involving both scientists and policy-makers in a small-scale pilot project, involving one or few countries. The idea being to develop good practices that can be further extended.