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**METHODOLOGY FOR FURTHER IMPLEMENTATION OF STEPS 4 AND 5 OF THE
ECOSYSTEM APPROACH ROADMAP IN THE MEDITERRANEAN SEA**

UNEP/MAP
Athens, 2011

I. Background

1. The Contracting Parties to the Barcelona Convention have articulated a systematic process for moving towards a more effective, ecosystem-based management. The Ecosystem Approach requires that Contracting Parties participate in a seven-step process:

- i) Definition of an ecological Vision for the Mediterranean;*
- ii) Setting of common Mediterranean strategic goals;*
- iii) Identification of important ecosystem properties and assessment of ecological status and pressures¹;*
- iv) Development of a set of ecological objectives corresponding to the Vision and strategic goals;*
- v) Derivation of operational objectives with indicators and target levels;*
- vi) Revision of existing monitoring programmes for ongoing assessment and regular updating of targets; and,*
- vii) Development and review of relevant action plans and programmes.*

2. During the 15th Meeting of the Contracting Parties (January 2008), the above roadmap was approved, as was the following Ecological Vision (Decision IG 17/6):

“A healthy Mediterranean with marine and coastal ecosystems that are productive and biologically diverse for the benefit of present and future generations”

3. Decision IG 17/6 also established the strategic goals aimed for with the Ecosystem Approach process:

- i. To protect, allow recovery and, where practicable, restore the structure and function of marine and coastal ecosystems thus also protecting biodiversity, in order to achieve and maintain good ecological status and allow for their sustainable use;
- ii. To reduce pollution in the marine and coastal environment so as to minimize impacts on and risks to human and/or ecosystem health and/or uses of the sea and the coasts; and,
- iii. To prevent, reduce and manage the vulnerability of the sea and the coasts to risks induced by human activities and natural events.

4. Assessments have been completed for the four subregions agreed to by the Contracting Parties, and an integrated assessment has been developed following the adoption of a specific Table of Contents that covers all relevant issues and themes. This integrated assessment, conceived with the purpose of determining priorities for implementing an ecosystem approach to management, has been useful not only in providing a broadbrush look at the overall status of the Mediterranean and varying conditions within its four subregions, but also in highlighting information availability and needs going into the future. The next step in the Ecosystem Approach process (referred as EA in shorthand) is to identify Ecological Objectives.

5. MAP has proposed a methodology that could be used to determine Ecological Objectives aimed at the progressive application of the EA in the Mediterranean region. It interprets each Descriptor under the EU MSFD and casts it as a Mediterranean-relevant Ecological Objective. In some cases Descriptors have been merged, amended, and added to reflect the priorities that have emerged in the EA Assessments as presented in document UNEP(DEPI)/MED WG.355/3.

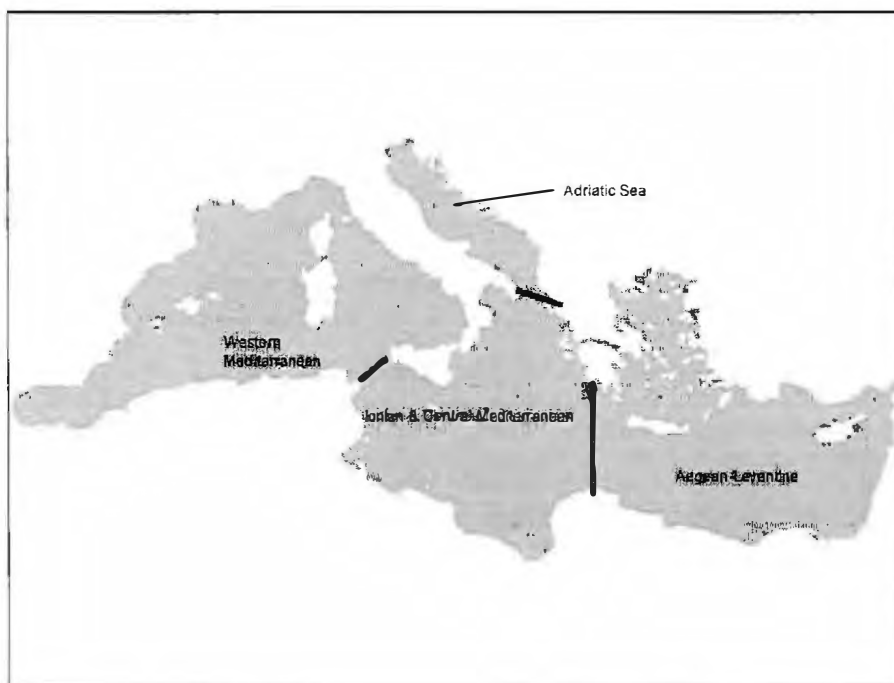
6. MAP has also given thought to the possible first-order and other operational objectives, and their corresponding indicators, for each of these proposed draft Ecological Objectives. The set of

¹ From this step onwards, it is necessary to consider the appropriate spatial and temporal scale of application of the approach

Ecological Objectives proposed aims at enhanced harmonization and integration amongst all the above-mentioned processes.

II. A possible process for prioritizing Ecological Objectives

7. When it comes to marine ecosystems, it is important to adopt some practical rule for bordering one ecosystem from another, even though it is likely that, given enough time, organisms in one water body can (and will) interact with organisms elsewhere (i.e. we have one global ocean). Ecosystems need to be defined so that relevant ecological processes are captured, while at the same time bounded in spatial scale so that the subdivisions make sense and are suitable for analysis. The Mediterranean region has already been subdivided, for assessment purposes, into four subregions i.e Western Mediterranean, Ionian Sea and Central Mediterranean, Adriatic and Eastern Mediterranean. This division aimed at a balance between grouping together ecologically related systems and defining units with adequate jurisdictional dimensions and boundaries.



8. When undertaking the sort of systematic assessment that institutes the EA process requires, other spatial scales may be used to identify what will be monitored (i.e. location for monitoring, in addition to periodicity of monitoring), by ecology, ecological impacts (pressures), or response. Certain drivers can be of international and global scale (e.g. IMO regulations, climate change) while others occur on a smaller scale (e.g. regional and national legislation, localised pollution, fisheries impact on a particular stock). For marine waters, investigation of pressures will include adjacent watersheds or even the whole drainage basin of the Mediterranean Sea. So far the classification and detailed mapping of habitats and ecosystems in the Mediterranean has so far not been undertaken at high resolution.

9. An option to overcome the need to further refine the scale used for the discussion of Ecological Objectives for the Mediterranean is to list the major types of ecologically significant, valuable, or vulnerable areas and cross check that the defined objectives are relevant for those taking in due consideration the ecosystem services they provide. The detailed identification of such areas has been performed by SPA/RAC in some areas, but for the purposes of EA such analysis would need to be expanded to all Mediterranean sea and its coastal zone including near shore

areas for which information distribution is irregular but good enough to identify the major types of ecologically significant, valuable, or vulnerable areas.

10. Guidelines and useful criteria to this end have been developed during an “Expert workshop on ecological criteria and biogeographic classification systems for marine areas in need of protection”, organised in the Azores in October 2007 under the auspices of CBD (Convention on Biological Diversity 2008). These criteria were later adopted during the 13th SBSTTA Meeting held in Rome in February 2008. Among other things, the Azores workshop produced scientific criteria for identifying ecologically or biologically significant marine areas (“EBSAs”), in open-ocean waters and deep-sea habitats, including examples of features that would meet such criteria.

11. The criteria for EBSAs identified by the workshop include:

- Uniqueness or rarity (to the best of the available knowledge)
- Special importance for life history stages of species
- Importance for threatened, endangered or declining species and/or habitats
- Vulnerability, fragility, sensitivity or slow recovery
- Biological productivity
- Biological diversity
- Naturalness

12. A non-exhaustive list of examples of features that would meet the above criteria for identifying ecologically or biologically significant marine areas (or species), provided in the CBD workshop report, include many features that are relevant to the Mediterranean including the ones mentioned in the detailed list of priority benthic habitats prepared by SPA/RAC.

Coastal features (static)

- Coastal wetlands
- Seagrass meadows
- Rocky shoreline
- Beaches
- Floodplains/deltas
- Islands /archipelagos

Benthic features (static)

- Seamount communities
- Cold water coral reefs
- Coral, sponge and bryozoan aggregations
- Hydrothermal vent ecosystems
- Cold seeps
- Canyons
- Trenches
- Banks

Pelagic habitats (dynamic)

- Upwelling areas
- Fronts
- Gyres

Vulnerable and/or highly migratory species critical habitats and corridors

- Whales and other cetaceans
- Seabirds
- Sea turtles
- Sharks

- Highly migratory fish /apex predators
- Discrete deep-sea fish populations

13. The preliminary assessment of the Mediterranean Basin undertaken by MAP has highlighted some key threats occurring at regional and subregional scales. Identifying priority ecological indicators in any given area must be based on understanding of threats, and will thus require a streamlined approach, as has been advocated by other regional seas. OSPAR has developed a methodology that focused on a prioritized list of pressures to provide cumulative pressure distribution/intensity information (preferably as GIS data layers) for future use in the assessment of GES under the EU MSFD. According to OSPAR prioritization of pressures need only be at a coarse level, perhaps into three or four categories (e.g. high, medium, low, minimal) to provide sufficient guidance about which pressures to concentrate on. For this, the pressure categories, including 1) climate change, 2) eutrophication, 3) hazardous substances, 4) radioactive substances, 5) offshore oil and gas development, 6) fishing, 7) emerging uses (wind farms, mariculture), and 8) loss of species and coastal and marine habitat, were scored according to their impact on eight ecosystem components, a) marine birds, b) cetaceans, c) seals, d) fish, e) rock and biogenic reef habitat, f) coastal sediment habitats, g) shelf sediment habitats and h) deep-sea habitats, across the five OSPAR regions. Their initial relative ranking is provided below (see Table 1).

14. The OSPAR assessment drew upon data and information on the distribution of the range of human activities presented in the Quality Status Report 2010 and its supporting thematic assessments. In some cases, information on impacts from these activities and the status of species and habitats for all OSPAR Regions is very limited. These gaps were filled by collective expert knowledge which was also limited for some Regions and pressures. The level of confidence was determined for each assessment of impact. Lack of consensus among experts was addressed, but could not always be resolved.

15. OSPAR's process for ranking or prioritizing pressures, in each of the five OSPAR subregions, may provide a good model for moving forward in specific locales of the Mediterranean. Because the OSPAR region is relatively homogeneous and smaller than the Mediterranean, such a model would have to be adapted for use in the EA process. Rankings like the ones below, but performed for the Mediterranean as a whole or for the four subregions would further the process of identifying priorities among the possible Ecological Objectives.

16. The integrated assessment and its corresponding subregional assessments has provided a clear picture of the priority threats to Mediterranean marine systems, and the delivery of ecosystem services from those systems. However the integrated assessment has also underscored limitations in data availability, compatibility and consistency, and a lack of systematic trend, statistical and geographic information for many of the priority issues that would be needed in order to prioritize amongst them.

17. A thorough understanding of pressures will also allow the elucidation of appropriate targets. In addition, feasibility considerations will influence choice of indicators. However, since the path towards ecosystem based management involves many small steps instead of a single leap, it is entirely possible/probable that the threats addressed by the Ecological Objectives, and the indicators used to measure progress towards them, will expand but become better focused over time. The progressive application of the EA with its iterative character will also provide information that will allow the ranking of the pressures and therefore allow a consistent prioritization of the Ecological Objectives in order to reduce the impacts on the ecosystems and the services they provide.

Table 1: Ranked list of pressures for the OSPAR regions, based on assessments of eight ecosystem components based on data, information and collective expert knowledge (output of 2009 Utrecht workshop)

		I	II	III	IV	V
Climate change	Climate change					
Hydrological pressures (local)	Temperature changes (local)					
	Salinity changes (local)					
	Changes in water flow, wave action & emergence regime (inshore/local)					
Pollution & other chemical pressures	Contamination by hazardous substances					
	Radionuclide contamination					
	De-oxygenation					
	Nitrogen & phosphorus enrichment					
	Organic enrichment					
Other physical pressures	Electromagnetic changes					
	Litter					
	Underwater noise					
	Barrier to species movement					
Habitat changes	Death or injury by collision					
	Siltation rate changes					
	Habitat damage					
Biological pressures	Habitat loss					
	Visual disturbance					
	Genetic modification					
	Introduction of microbial pathogens					
	Introduction of non-indigenous species & translocations					
	Removal of species (target & non-target)					

Total impact of pressures					

III. Climate Change and its treatment within the Ecosystem Approach Process

18. It is broadly recognized that the Ecosystem Approach to management of marine areas is an effective one for increasing the resilience of marine ecosystems to the myriad climate change-related pressures. Ecosystem-based adaptation strategies provide a cost-effective way to reduce vulnerability to climate change in the coastal zone through shoreline protection and have multiple benefits to people and local communities besides also reinforcing mitigation efforts by means of enhancing the capacity of certain coastal ecosystems to absorb CO₂.

19. At the same time, against the backdrop of other pressures, climate change will be expected to affect all aspects of the Mediterranean, and this added layer of pressures would also influence the progress being made towards the Ecosystem Approach. Table 3 lists the some of the potential effects of climate change on Mediterranean biodiversity and ecology, at the regional level, which should be considered in the setting of Ecological Objectives.

20. Due to the fact that the drivers of the physical and biological responses related climate change are external to Mediterranean system, the establishment of Ecological Objectives that can address climate change pressures themselves is not straightforward. Rather than develop a single Ecological Objective that deals with climate change (the backdrop against which all change is taking place in the Mediterranean and around the world), measurable climate change effects can and should be incorporated into the setting of Indicators.

21. Climate change considerations will also be crucial in the setting of targets. In order to consider climate change vulnerabilities, and the catalysis of degradation that climate change sometimes mediates, States could use modelling or GIS analysis to determine "hot-spots" of climate change vulnerability within their marine jurisdictions.

22. Table 2 reflects which of the ultimate biological responses related to the climate change drivers are already supposed to be monitored as part of the monitoring efforts related to the proposed indicators associated with the draft ecological and operational objectives. Technical experts could guide the development of indicators related to the agreed-upon Ecological Objectives that results in a comprehensive treatment of climate change within the EA process. At this stage the analysis has reviewed the suitability of the indicators to record the biological response but eventually indicators could also be adapted to ensure that they reflect the ecosystem physical response. The timeframe for the climate change related responses, being years to decades, highlights the need for regular monitoring of the climate change related indicators to track its impact.

Table 2: Climate change effects matrix. Tick marks in the last column reflect which of the ultimate biological responses are already supposed to be monitored as part of the monitoring efforts related to the proposed indicators associated with the draft ecological and operational objectives.

Driving force	Physical response	Biological response	
Sea Level Rise	Coastline erosion	Species and habitat range change	✓
	Lowland inundation	Species and habitat range change	✓
	Surface & ground water saline intrusions		
Temperature change	Increasing temperature- changes to ecology	Increased potential for eutrophication	✓
		Increased planktonic production	✓
	Increased water column stability	Reduced primary production, change of seasonal pattern	✓
	Changes in fronts	Consequences for marine mammals and benthic production	✓
	Change of biogeographic boundaries	Invasive species	✓
		Increased or decreased species ranges	✓
	Change of seasonal cycles /Mismatches in seasonal cycles	Trophic cascade effects	✓
		Consequences for breeding and recruitment success	✓
	Direct physiological effects of temperature	Changes in population dynamics of species	✓
Rainfall change	Increase of salinity	Invasive species	✓
		Species ranges change	✓
		Mismatches in seasonal cycles	✓
	Decrease of salinity	Invasive species	✓
		Species ranges change	✓
		Mismatches in seasonal cycles	✓
	Increased river discharge	Species ranges change	✓
		Mismatches in seasonal cycles	✓
		Increased coastal eutrophication	✓
		Hazardous chemical inputs	✓
	Decreased river discharge	Species ranges change	✓
	Interruption of spawning migrations	Invasive species	✓
	Change in seasonal timing of peak/ base flows	Disruption of migration events, anadromous, diadromous species	✓
	Change in seasonal timing of water column stratification	Reduced primary production, change of seasonal pattern	✓
Wind change	Change of regional currents (wind is main driving force of surface currents to 600m)	Invasive species	✓
		Species ranges change	✓
		Mismatches in seasonal cycles	✓
	Change of local currents (coastal, estuarine)	Disruption of local migrations and recruitment	✓
	Storminess and wave climate change	Impacts on coastal communities	✓
	Change in upwelling systems	Change in primary production regime	✓
		Change in benthic production	✓
	Coastal entrainment, gyral system	Decrease, increase in biomass	✓
Other atmospheric changes	CO2 increases – Ocean acidification	Impacts on CaCO3 organisms	
	Changes in transport of pollutants (Hg,PCBs)	Debilitation of higher trophic levels	✓

IV. Next Steps

23. After developing a consensus list of Ecological Objectives, there needs to be agreement on a first order for other indicators related to those Ecological Objectives. The reason for having a dual system of indicators is borne from the recognition that the Ecosystem Approach is one that is taken in steps, rather than developed all at once. By identifying first order indicators that are both feasible to track and pertinent to whether the Ecological Objective(s) is being met, countries can effectively and efficiently embark on the Ecosystem Approach process. At a later date, other indicators can be adopted to enhance the monitoring process and increase the robustness of the Ecosystem Approach.

24. Data and information guiding the EA process already exists, but current data management is not conducive to performing assessments, evaluating management, or tracking progress towards stated ecosystem-based management goals. In order to improve the situation, MAP should undertake or continue to build: 1) an inventory of monitoring; 2) an inventory of metadatabases; 3) a lasting platform for GIS; 4) a way to enhance the capacity of countries to source GIS –compatible data.

25. Technical experts working on the methodologies for determining GES in the EU have flagged the utility of GIS in linking pressures to possible management responses. It is stated that:

“...a prioritized list of pressures will help focus the work required to provide cumulative pressure distribution/intensity information (preferably as GIS data layers) for future use in the assessment of biodiversity Descriptors of GES.”

26. GIS will prove to be important as countries take the commonly developed Ecological Objectives and prioritize them within their own regions, establishing monitoring and research regimes that derive information on the conditions and trends in their coastal and marine ecosystems. The information system designed to support the EA process should also allow tracking progress towards the Ecological Objectives in order to reach the ecological vision, including programs of measures taken. Determination of where, and how often, data are collected using the priority indicators will be made possible by analysis of the specific ecosystems present, the human uses of and anthropogenic impacts on these ecosystems, and a systematic and objective process for determining priorities. GIS will also help elucidate target values for the indicators, in the context of multiple cumulative pressures, climate change effects, and socio-economic considerations.