

1. Introduction

This Working Document aims to:

- present the main elements for the definition of GES and the setting of GES targets in the Mediterranean Region for the Ecological Objectives 5 (eutrophication), 9 (contaminants), 10 (marine litter) and 11 (noise) based on common approaches as appropriate
- present possible examples on the definition of GES and setting of targets for the EOs, 5, 9, 10 and 11.

This Working Document is based on the UNEP/MAP documents developed in the framework of the gradual application of the ECAP, and specifically documents: “Methodologies for setting targets relating to Ecological Objectives to further the Ecosystem Approach in the Mediterranean Sea” (UNEP(DEPI)/MED WG.369/3, 2012), Decision 20/4 on “Implementing the Ecosystem Approach Roadmap” of COP 17 (Paris, February 2012) and the Report of the 1st Meeting of Ecosystem Approach Coordination Group (UNEP(DEPI)/MED WG.369/6, 2012).

In the preparation of this report, special emphasis was given to one of the recommendations that the meeting agreed, which states that the targets should address pressure, state or impacts related to the ecological objectives, operational objectives and indicators. More information is generally available on pressures than on state and impacts for a specific issue. The establishment of all relevant targets, mostly emanating from human activities will allow the design of coherent management measures using the precautionary approach and serve well the ecosystem approach.

Previous Reports and Documents prepared by UNEP/MAP in the framework of the gradual application on the ECAP in the Mediterranean were also used, as well as the work carried out in the framework of MED POL Programme on the organisation and implementation of the regional marine pollution monitoring programme and reporting pollutant releases during the MED POL Phases III (1996-2005) and IV (2006-2013).

This Working Document took also into consideration the important work done in the framework of the EU MSFD on the definition of GES and the setting of targets, as well as the relevant documents issued in the framework of OSPAR and HELCOM Commissions. In this respect, due consideration was given to the following documents: “Draft common understanding of (initial) assessment, determination of Good Environmental Status (GES) and establishment of environmental targets (Articles 8, 9 and 10 MSFD) (MSFD GES Working Group, 2011); OSPAR Commission MSFD Advice Manual(s) and Background document(s) on GES – Eutrophication (2012), Contaminants (2012), Marine Litter (2012), Underwater Noise (2011); and HELCOM CORESET Expert Workshop on Biodiversity Indicators 4/2011.

An additional central piece of information for the determination of GES and the setting of targets in the Mediterranean region is the relative documents for the definition of national GES and the setting of targets, which are under preparation by the Mediterranean EU Member States, and will be notified to the Commission by 15 October 2012.

The Secretariat has prepared an inventory of existing Quality Criteria and Targets approved in the framework of MAP by the Contracting Parties with regards to pollution

(UNEP(DEPI)/MED WG.372/Inf.3). For indicative purposes this document contains information on GES and Targets adopted in the framework of HELCOM.

2. Definitions

For the purpose of this document:

Good Environmental Status herein after referred to as GES can be defined as the desired status of the marine environment and its components. The determination of GES is based on the 11 specific Ecological Objectives, (criteria/descriptors in the case of EU MSFD) and relevant indicators. GES may represent reference conditions in relation to which thresholds are set, using different methodologies.

GES Thresholds are used to define the boundary between an acceptable and unacceptable environmental status (GES or non-GES)....

GES Reference conditions. For assessment purposes, it is necessary to define a reference state/condition (baseline) against which current and future state is compared. Reference conditions describe the state of the marine environment (or a component) in which there is considered to be no, or very minor, disturbance from the pressures of human activities. Reference conditions may not necessarily reflect “background” or “historical” conditions and it is up to the regulator to decide whether GES will represent pristine or slightly impacted but still “good” status, allowing for a specified level of disturbance from the pressure(s) and hence to define the boundary between an acceptable state (GES) and an unacceptable state (non-GES)

GES Background or historical values represent the concentration pollutant that would be expected in “pristine” or remote sites, based on contemporary or historical data

Scale means the spatial and temporal order of ecosystem components, their assessment and good environmental status. Regional scale refers to the Mediterranean. Sub-regional scale refers to the 4 sub-regions established for the purpose of the Integrated Assessment or lower scale, as appropriate.

The GES Targets are defined in the framework of EU MSFD as “a qualitative or quantitative statement on the desired condition of the different components of, and pressures and impacts on, marine waters in respect of each region or sub-region” (EC MSCG 2011). GES targets should establish desired conditions, be measurable with associated indicators allowing for monitoring and assessment and be operational relating to concrete implementation of measures to support their achievement and move towards GES.

Three kinds of targets can be set:

- a) State targets establishing desired conditions of GES
- b) Pressure targets to measure achievement in pollution reduction
- c) Operational targets are pressure related targets on the basis of which programmes and measures on specific sectors and contaminants are to be established to achieve pressure and state targets.

In the present document, state and pressure targets will be discussed. Operational targets, as well as relevant measures, will be subject to the next phase of ECAP implementation.

3. Data availability

Pollution monitoring in the Mediterranean region is being implemented in the framework of MED POL in a coordinated manner since 1980 (MED POL Phase II) to implement the relevant provisions of the Barcelona Convention and the LBS Protocol. During the MED POL Phases III (1996-2005) and IV (2006-2013), national monitoring programmes were harmonized, a data quality control system was applied and national monitoring data were submitted to the MED POL database. The MED POL monitoring programme includes state and trend monitoring of hazardous substances and eutrophication parameters, as well as a pilot programme on biological effects monitoring. Additionally, MED POL has implemented a periodical inventory of pollution sources and loads from land based activities, in the framework of the LBS Protocol and the Strategic Action Programme (SAP) to Address Pollution from Land-based Activities (adopted in 1997 and launched in 2000). Also, compliance monitoring was coordinated, in order to assess the effectiveness of action plans, programmes and measures for pollution control implemented by the Governments (compliance monitoring – microbiological pollution). Data submitted by the countries in the framework of MED POL activities were uploaded on two databases: i) a marine pollution database, where all data reported yearly by the countries' national monitoring programmes were uploaded, following data quality control, and ii) a pollution sources database, where countries reported pollutants loads from industrial and municipal sources on a 5 years period (Data reported on 2003 and 2008). The marine pollution database holds today 34,000 records of pollutants and general parameters in seawater, sediments and marine biota reported yearly by the countries since 1998 from their national monitoring programmes, from more than 700 stations (Annex I). The database covers mainly contaminants (heavy metals, chlorinated pesticides, PCBs and PAHs) and eutrophication parameters (nutrients and chlorophyll-a). The pollution sources database holds 12,500 records reported by the countries. Each record indicates the emission of a substance for a given activity sector and sub-sector, in an administrative region and country. The database covers about 100 different substances or groups of substances and parameters according to national legislation and country development specificities. However a restricted number of substances are common to almost all national pollutant releases.

The capacity of Mediterranean countries to generate pollution related data and to use Marine Pollution Indicators (MPIs) for major chemical and biological parameters in the assessment of the status of the marine environment, was evaluated in 2007 (UNEP(DEPI)/MED WG.321/Inf.7, MED POL 2007). Mediterranean countries which participated in the survey indicated that chemical indicators (nutrients and contaminants) are better monitored in the region, while ecological indicators and biomarkers (biological effects of contaminants) are less measured. With regard to chemical indicators and biomarkers, methodologies appear to be uniform and standardised following established analytical MED POL procedures under national and international QA/QC protocols and proficiency tests.

4. Proposed approaches for GES determination and GES targets with regard to Ecological Objective 5 on Eutrophication

Decision 20/4 of COP 17 (Paris, February 2012) provides for assessing eutrophication by combining the information on nutrients levels (Indicators 5.1.1. and 5.1.2), on direct effects (Indicators 5.2.1., 5.2.2. and 5.2.3.) and indirect effects (Indicator 5.3.1.) of nutrients enrichment (Table 1).

Table 1 EOs, OOs and indicators for Eutrophication

<i>Ecological Objective</i>	<i>Operational Objectives</i>	<i>Indicators</i>
<i>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.</i>	5.1 Human introduction of nutrients in the marine environment is not conducive to eutrophication	5.1.1 Concentration of key nutrients in the water column 5.1.2 Nutrient ratios (silica, nitrogen and phosphorus), where appropriate
	5.2 Direct effects of nutrient over-enrichment are prevented	5.2.1 Chlorophyll-a concentration in the water column
		5.2.2 Water transparency where relevant
		5.2.3 Number and location of major events of nuisance/toxic algal blooms caused by human activities
	5.3 Indirect effects of nutrient over-enrichment are prevented	5.3.1 Dissolved oxygen near the bottom, i.e. changes due to increased organic matter decomposition, and size of the area concerned

*Monitoring to be carried out where appropriate

In the framework of the LBS Protocol, the MED POL monitoring programme (Phase III and IV), includes the collection of the following eutrophication-related data (Table 2). In addition pilot monitoring programmes were implemented in different Mediterranean locations to build capacity in the formulating and implementing integrated eutrophication monitoring programmes.

Table 2 Parameters to be monitored in the framework of MED POL monitoring programme

Temperature (°C)	Dissolved oxygen (mg/L, %*)
pH	Chlorophyll "a" (µg/L*)
Transparency	Total Nitrogen (N µmol/L)#
Salinity (psu)	Nitrate (NO ₃ -N µmol/L, µg/L*)
Orthophosphate (PO ₄ -P µmol/L, µg/L*)	Ammonium (NH ₄ -N µmol/L, µg/L*)
Total phosphorus (P µmol/L, µg/L#)	Nitrite (NO ₂ -N µmol/L, µg/L*)
Silicate (SiO ₂ µmol/L)	Phytoplankton (total abundance, abundance of major groups, bloom dominance)

not mandatory, only recommended

* units supporting TRIX index

Most of the Mediterranean countries have the capacity to measure hydrological, chemical and biological parameters related to eutrophication in marine water, (Table 3). However several countries, still do not report eutrophication related data to the MED POL database, resulting in substantial geographical and temporal gaps.

Table 3 Number of countries with a capacity to measure eutrophication related parameters UNEP(DEPI)/MED WG. 316/Inf.11/2007),

Marine Pollution Indicator		ECAP indicator	Number of counties developing MPI			
			level of developmet			
			Well developed	Partially developed	Poorly developed	No data available
Nutrients	Total N , P	5.1.1	12	3	4	0
	NO ₂ ,NO ₃ ,NH ₄	5.1.1	12	2	3	2
	P -PO ₄	5.1.1	12	2	2	3
	Si -SiO ₄	5.1.1	8	2	0	9
	Chl -a	5.2.1	10	4	1	4
	BOD/COD		9	2	5	3
Hydrological	DO	5.3.1	11	4	2	2
	T & S		14	2	3	0
	pH		12	4	3	0
	Transparency	5.2.2	11	5	3	0
	TRIX		8	0	0	11

Determination of GES

Three approaches may be used for GES determination

a. GES is achieved where the biological community is in equilibrium and conserves all necessary functions in the absence of negative perturbations related to eutrophication and/or when there is no impact to ecosystem services due to an excessive enrichment of nutrients in the water.

In order to assess quantitatively the achievement of GES in relation to eutrophication, a measurable assessment threshold may be set, including the definition of the reference conditions. GES assessment thresholds and reference conditions (background) may not be identical for all areas, especially where the marine environment is already disturbed by human presence since many years. In these cases a decision has to be made whether to set the threshold value for GES achievement independently to the setting of the reference conditions. The approach is based on the recognition that area-specific environmental conditions must define threshold values. A threshold value could include provisions to allow for statistical fluctuations (example: No nutrients and chl-a values exceeding the 90th percentile are present in a frequency more than statistically expected for the entire time series). GES could be defined on a sub-regional level, or on a subdivision of the sub-region (such as Northern Adriatic), due to local specificities in relation to the trophic level and the morphology of the area.

b. A second approach to determine GES for eutrophication is to use trends for nutrients contents, and direct indirect effects of eutrophication. For using the trend approach, a reference value representing the actual situation is needed, for comparison. In the case of nutrients and chl-a, such reference levels exist due to data availability in most areas. Therefore, GES could be defined as no-increasing trends in nutrient and/or chlorophyll-a concentrations over a defined period of time in the past (ex. 6 years), which are not explained by hydrological variability. For indirect effects, GES could ask for no change in macrophyte communities attributable to increase the concentration of nutrients, and no decreasing trend in oxygen saturation beyond what would be statistically expected.

c. GES thresholds and trends could be used in a combined way, according to data availability and agreement on GES threshold levels. In the framework of MED POL there is experience with regard to using quantitative thresholds. It is proposed that for the Mediterranean region, quantitative thresholds between “good” (GES) and “moderate” (non GES) conditions for the coastal waters could be based as appropriate on the work already done in the framework of the MED GIG Project of the EU Water Framework Directive, a project closely followed by MED POL programme. In this context, sub-regional thresholds were proposed only for chlorophyll-a values, in three types of marine water based on seawater density (Sigma_t annual mean values): Type I: Sigma_t < 25. Type IIA: 27 > Sigma_t > 25. Type III(W&E): Sigma_t > 27. The whole NW Adriatic Sea area, which is affected by Po River inputs belongs to Type I, while the coastal stretches of Adriatic and Tyrrhenian Seas belong to Type IIA. However, due to trophodynamic differences between these regions, MED GIG identifies two different categories of Type IIA: the Adriatic and the Tyrrhenian. Type III marine water is Western and Eastern Mediterranean.

**Table 4 Boundaries between Good and Moderate status (tentative)
(MED GIG, 2011 and COM Decision 2008/915/EC)**

Water Type	Chl-a annual geometric means (µg/L)	Chl-a 90th percentile (µg/L)
Type I (North Adriatic)	6.2	17.3
Type IIA (Adriatic)	1.57	3.81
Type IIA (Tyrrhenian)	0.9	2.19
Type III-W (Western Mediterranean)		1.80
Type III-W Islands (Western Med, Corsica, Sardinia, Balears)		1.20
Type III-E (Eastern Med)		0.4

The boundaries proposed for EU WFD may be considered as a base for the determination of corresponding threshold values for GES in the framework of ECAP. With regard to nutrient concentration, there are not yet available any thresholds commonly agreed at sub regional or regional levels. Therefore the GES may be determined at first hand on trend basis until common thresholds are negotiated and agreed.

Setting of GES targets

State targets are the achievement of measurable specific desired conditions in the water in relation to the concentrations of nutrient, chlorophyll-a, or dissolved oxygen, which are considered to represent “good” environmental quality / achievement of GES. Alternatively, a state target could be a statistically defined decreasing trend of the concentrations of the defined parameters. State targets have to include and a time table for their achievement and need the establishment of an adequate monitoring programme to follow the progress made. Pressure targets are related to quantifiable reduction of nutrients and organic matter discharge from urban and industrial effluents, agriculture runoff, and atmospheric emissions. For example, the Strategic Action Plan (SAP) of MAP which was endorsed in the framework of the LBS Protocol aims at 50% reduction of nutrients inputs from urban and industrial sources to the marine environment and the Baltic Action Plan of HELCOM sets specific maximum permissible nitrogen load to be discharged annually by individual countries to the

Baltic Sea. Pressure targets are linked to state targets and a combination of both is required to achieve and to demonstrate progress towards GES.

However, due to the fact that the marine ecosystem does not respond linearly to pressures, a reduction of the pressure may not necessarily lead to a prompt improvement of the state of the marine environment. A reduction of nutrients inputs is diminishing the pressure from only one of the stressors present in the area; therefore the ecosystem may not recover, as fast as expected. Additionally, a perturbed ecosystem may need more time to recover than expected, because some of its functions have been damaged. It is important to understand these parameters in order not to expect very soon meaningful results on the fulfilment of state targets.

Scale of assessment

The geographic scale for eutrophication assessment depends on the hydrological and morphological conditions of an area, particular the fresh water inputs from rivers, the salinity, the general circulation, upwelling and stratification. In principle, a risk based approach is more appropriate, using a screening procedure to decide the areas to be assessed and monitored more frequently. The problematic areas could then be divided into smaller areas for assessment purposes and could be monitored more frequently than remote and non-affected marine waters. The division already made in the framework of the WFD MEDGIG Project (Northern Adriatic, Southern Adriatic, Tyrrhenian, Alboran, Western Med. and Eastern Med.), could be used as a base for the definition of GES at sub-regional level. For these areas, more data exist for coastal and hot-spot locations, where GES could be defined based on thresholds values. The analysis of available data will also reveal the geographical gaps in the coverage of the sub-regions, providing leads to the optimization of the stations location, when preparing the MAP integrated monitoring programme. For a wider sub-regional and regional scale, it is possible to assess the actual condition for chl-a concentrations using satellite images. These values could then be used as reference conditions for any subsequent GES assessment based on trends.

An overview on the possible GES and Targets for the Ecological Objective on Eutrophication is presented in Table 5.

Table 5 Overview of possible GES and Targets for EO5 (Eutrophication)

Indicators	Suggestion for GES description	Approach for setting the GES boundary	Thresholds for GES setting scale	Possible option for targets	Possible target setting scale
5.1.1 Concentration of key nutrients in the water column	Concentrations of nutrients in the euphotic layer are in line with prevailing physiographic, geographic and climate conditions	Reference nutrients concentrations according to the local hydrological, chemical and morphological characteristics of the un-impacted marine region	To be set on a sub-regional scale	<p>State</p> <ul style="list-style-type: none"> Decreasing trend of nutrients concentrations in water column of human impacted areas, statistically defined <p>Pressure</p> <ul style="list-style-type: none"> Reduction of BOD emissions from land based sources Reduction of nutrients emissions from land based sources 	Sub-regional
		no-increasing trends in nutrient concentrations over a defined period of time, which are not explained by hydrological variability			
5.1.2 Nutrient ratios (silica, nitrogen and phosphorus), where appropriate	Natural ratios of nutrients				Sub-regional
5.2.1 Chlorophyll-a concentration in the water column	Natural levels of algal biomass in line with prevailing physiographic, geographic and climate conditions	Reference Chl-a concentrations according to the local hydrological, chemical and morphological characteristics of the un-impacted marine region	Sub regional Thresholds as presented in Table 4 for different sub-regions of the Mediterranean	<p>State</p> <p>Chl-a concentrations in high-risk areas below thresholds</p>	Regional, sub-regional
		no-increasing trends in chlorophyll-a concentrations over a defined period of time in the past, which are not explained by hydrological variability		Decreasing trend in chl-a concentrations in high risk areas affected by human activities	

Indicators	Suggestion for GES description	Approach for setting the GES boundary	Thresholds for GES setting scale	Possible option for targets	Possible target setting scale
5.2.2 Water transparency where relevant	Clear water in line with prevailing physiographic, geographic and climate conditions	Reference water transparency according to the local hydrological, and morphological characteristics of the un-impacted marine region	To be set on a sub-regional depending on the conditions	State Secchi disk depth above threshold in risk areas	Sub-regional
		No decreasing trend in water transparency beyond what would be statistically expected		Increasing trend of transparency in areas impacted by human activities	
5.2.3 Number and location of major events of nuisance/toxic algal blooms caused by human activities	No HABs	No increasing trend in the frequency of the occurrence of HABs		State Decreasing trend in the frequency of the occurrence of HABs	Sub-regional
5.3.1 Dissolved oxygen near the bottom, i.e. changes due to increased organic matter decomposition, and size of the area concerned	Bottom water fully oxygenated in line with prevailing physiographic, geographic and climate conditions	Reference dissolved oxygen concentrations near the bottom according to the local hydrological, and morphological characteristics of the un-impacted marine region	To be set on a sub-regional scale depending on the conditions	State Dissolved oxygen concentrations in high-risk areas above local threshold	Sub-regional
		No decreasing trend in oxygen saturation beyond what would be statistically expected		Increasing trend in dissolved oxygen concentrations in areas impacted by human activities	

5. Proposed approaches for GES determination and GES targets with regard to Ecological Objective 9 on Contaminants

Decision 20/4 of COP 17 (Paris, 2012) provides for assessing contaminants by combining information on their concentration in different matrices (Indicator 9.1.1, 9.4.1 and 9.4.2), their effects (Indicator 9.2.1), occurrence of acute pollution events (indicator 9.3.1), microbial pollution (indicator 9.5.1) and occurrence of HABs (indicator 95.2) (Table 6).

Table 6 EOs, OOs and indicators for Pollution

Ecological Objective	Operational Objectives	Indicators
Contaminants cause no significant impact on coastal and marine ecosystems and human health	9.1 Concentration of priority¹ contaminants is kept within acceptable limits and does not increase	<i>9.1.1 Concentration of key harmful contaminants in biota, sediment or water</i>
	9.2 Effects of released contaminants are minimized	<i>9.2.1. Level of pollution effects of key contaminants where a cause and effect relationship has been established</i>
	9.3 Acute pollution events are prevented and their impacts are minimized	<i>9.3.1 Occurrence, origin (where possible), extent of significant acute pollution events (e.g. slicks from oil, oil products and hazardous substances) and their impact on biota affected by this pollution</i>
	9.4 Levels of known harmful contaminants in major types of seafood do not exceed established standards	<i>9.4.1. Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels in commonly consumed seafood²</i>
		<i>9.4.2. Frequency that regulatory levels of contaminants are exceeded</i>
	9.5. Water quality in bathing waters and other recreational areas does not undermine human health	<i>9.5.1 Percentage of intestinal enterococci concentration measurements within established standards</i>
<i>9.5.2. Occurrence of Harmful Algal Blooms within bathing and recreational areas</i>		

Data availability and gaps

In the framework of the LBS Protocol, the MED POL monitoring programme (Phase III and IV), includes the determination of contaminants that are in environmental matrices (biota and sediment). The full list of contaminants to be monitored and assessed as far as possible, which is presented in the Annex I of the LBS Protocol, includes a great spectrum of hazardous substances, such as persistent organic compounds (POPs), organotin

¹ Priority contaminants as listed under the Barcelona Convention and LBS Protocol

² Traceability of the origin of seafood sampled should be ensured

compounds, PAHs, heavy metals, lub oil, radioactive substances, biocides and pathogenic microorganisms. However, under the MED POL monitoring programme, only a limited number of key contaminants are actually monitored by the countries. These include Mercury, Cadmium, Lead, organochlorinated hydrocarbons (such as DDT and PCBs) and PAHs, determined in biota and/or sediment. Also countries provide information on the level of pathogens in bathing water and shellfish growing waters, in comparison to the relevant national regulations. The biota species used for monitoring contaminants are usually restricted to mussels (*Mytilus galloprovincialis*) and/or a species of fish (red mullet - *Mullus barbatus*). On the effects of contaminants, methodologies have already been developed for biological effects monitoring in the framework of MED POL and relative capacity has been built in Mediterranean countries. Most countries could use a general test for effects of pollution on organisms (lysosome membrane stability), but tests linking a specific contaminant to a specific effect have not been widely implemented in the region.

Most of the Mediterranean countries have the capacity to measure contaminants concentrations in marine samples (Table 7). However some countries, still do not report regularly contaminants data to the MED POL database, resulting in substantial geographical and temporal gaps.

Table 7 Number of countries with a capacity to measure concentrations contaminants UNEP(DEPI)/MED WG. 316/Inf.11/2007)

Marine Pollution Indicator	ECAP indicator	Number of counties developing MPI				
		Well developed	Partially developed	Poorly developed	No data available	
Heavy metals	Effluent		7	2	6	4
	Sediment	9.1.1	7	2	6	4
	Biota	9.1.1 and 9.4.1	12	1	3	3
Organochlorines	Effluent		3	3	4	9
	Sediment	9.1.1	3	1	2	13
	Biota	9.1.1 and 9.4.1	9	0	3	7
Petroleum hydrocarbons	Effluent		2	1	4	12
	Sediment	9.1.1	4	2	3	10
	Biota	9.1.1 and 9.4.1	3	1	1	14
Bacterial levels	Bathing water	9.5.1	12	1	3	3
	Shellfish growing area		1	1	0	17

The results of the 2007 survey on Marine pollution indicators revealed that the capacity of countries to apply biological effects tests was less widespread, since only 3-4 countries had well developed methods for these tests. However, MED POL capacity building programme during the last 5 years succeeded to create a network of laboratories in 11 Mediterranean countries, which have the capacity to perform at least one biological effects test (Lysosome membrane stability

Acute pollution events (oil spills) (ECAP indicator 9.3.1) are followed and recorded in the framework of the Prevention and Emergency Protocol, 2002 by REMPEC, which is also reviewing the maritime traffic in the Mediterranean providing information on routine operations. In relation to HABs, there is no regular monitoring system to record their occurrence.

Determination of GES

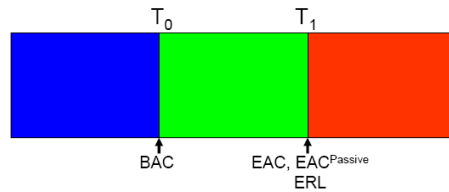
Concentrations of contaminants

1. GES is reached when the levels of concentrations of contaminants are below a determined threshold defined for the area and when they are not giving rise to pollution effects. Therefore, in order to be able to monitor the achievement of GES it is necessary to establish threshold values for key contaminants to distinguish between acceptable (little or no risk) and un-acceptable (unacceptable risk) environmental conditions. In the Mediterranean region, threshold values for major hazardous contaminants, namely trace metals, chlorinated compounds (pesticides and PCBs) and PAHs, are lacking and have to be defined. Alternatively, temporal trend in the concentrations of pollutants could be useful to assess if the state of the marine environment is improving or not, without considering its initial quality.

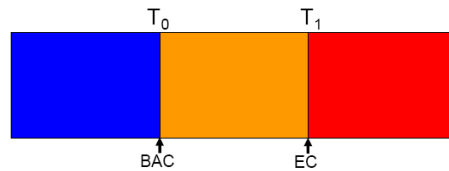
A conceptual approach to define contaminants threshold values is applied in the OSPAR region using Environmental Assessment Criteria for any given substance (OSPAR, 2009. Background Document on CEMP Assessment Criteria for QSR 2010). These criteria are based on the policy for achieving concentrations in the environment near background values for naturally occurring substances and close to zero for man-made synthetic substances, and are also based on dose-response relationships. This approach involves the adoption of a “traffic light” system in which the green/red transition level represents contaminant concentration below which, no chronic effects are expected to occur in marine biota species, including the most sensitive. Thus, the transition between green to red implies a transition from a marine state which is acceptable and there is little or no risk, to a state of unacceptable risk. These thresholds may be related to the Environmental Quality Standards (EQSs) applied to concentrations of contaminants in water under the EU Water Framework Directive (WFD).

Following the OSPAR approach there are two concentration “thresholds” to be defined: T_0 and T_1 . T_0 is defined in sediments and biota, as the concentration of a contaminant at a “pristine” or “remote” site, where no deterioration of the environment can be expected. For a man-made compound this concentration should be taken as zero. In turn, T_1 is the concentration above which significant adverse effects to the environment or to human health are most likely to occur. Between T_0 and T_1 , the levels do not pose significant risk to the environment or to human health. The definition of these thresholds requires specific statistical analysis of the existing databases and additional information. For instance, the definition of T_1 for each pollutant concerned requires ecotoxicological information for the key species to be used for such a purpose. The outcome of these definitions can be described by the transition in a “traffic light scheme” between green and red as shown in Figure 1. This is wise from a presentational perspective, as it can give the reader a clear and immediate picture of where environmental conditions are acceptable or not and prompt appropriate environmental management options.

A. Proposed transition points for PAHs and CBs in sediment and biota and metals in sediment



B. Proposed transition points for metals in biota



T = Transition point

Figure 1. Illustration of the proposed traffic light system and the relevant transition point criteria for: A. PAHs and CBs in sediment and biota and metals in sediments, and B. metals in biota. The green/red boundary corresponds to the achievement of a statutory target (in WFD terms) or a policy objective (in OSPAR terms). The red/amber boundary defines the EC dietary limits for fish and is used because there are no EAC recommended values for metals in biota

A green assessment for a particular contaminant means that environmental concentrations meet relevant statutory limits or policy objectives, and are satisfactory in that they present little or no risk. The same is valid for the amber assessment for metals in biota, although the risk for pollution effects is uncertain. A red assessment means that the relevant limit or objective had not been met. The statistical aspects of the comparisons are on a precautionary basis.

The OSPAR methodology on EACs, has been tested by MED POL, using the Mediterranean MED POL data base on contaminants (UNEP(DEPI)/MED WG. 365/Inf.8, 1 November 2011). It was found that the methodology could be used, provided additional data were provided in order to better define Background concentrations of contaminants in sediment and biota. Also, a thorough study of available ecotoxicological data is needed in order to propose EACs for specific substances. The approach taken by OSPAR for metals in biota (using the EU dietary limit for seafood as the threshold between GES and non-GES conditions) could be applied in the Mediterranean region. Until EACs are defined for the major substances of concern, a two-fold approach could be used to define GES: i) a threshold value for GES could be set using concentrations from relatively unpolluted areas on a sub-regional level and ii) a decreasing trend should be observed from reference values representing the actual level of contaminants concentrations. Thus, GES could be defined for toxic metals (Hg, Cd, Pb), organochlorinated compounds and PAHs, for which monitoring data exists because of running monitoring programmes.

Effects

The measurement of effects presents more difficulties. Although there are many methods to measure pollution effects on organisms, there are not many contaminant-specific techniques that allow to measure responses within marine organisms to the exposure of specific contaminants. The most widely used specific technique is the measurement of TBT effects (imposex) on gastropods, where a cause and effect relationship has been established. Therefore, for the time being, it will not be possible to define GES in relation to effects, using

a quantitative approach, for other contaminants. There is a possibility to use available information for TBT thresholds for GES from other regions in order to propose similar effects thresholds for the Mediterranean. And there is a need to develop and test more contaminant-specific techniques for quantifying GES, which is an issue to be addressed in the phase of the ECAP implementation

Pollution events

Discharges of oil are regulated under the IMO and in the Mediterranean under the Protocol of the Barcelona Convention concerning cooperation in preventing pollution from ships, the Offshore Protocol (Protection of the Mediterranean Sea against pollution resulting from exploration and exploitation of the continental shelf and the seabed and its subsoil) and the LBS Protocol. GES could be considered as the absence of acute pollution events, while operational discharges could be covered by the GES for contaminants, since petroleum hydrocarbons are included in the list of substances to be monitored (PAHs, alkylated PAHs). The monitoring of the occurrence of acute events should be reinforced.

Microbiological pollution

National legislation and regional agreements define the level of pathogenic microorganisms in bathing and shellfish growing waters, which is considered safe for bathing or for seafood production. The values agreed for the Mediterranean region in COP 17 (2012) (Decision IG.20/9 Criteria and Standards for bathing waters quality in the framework of the implementation of Article 7 of the LBS Protocol) are presented in Table 8 and could be used to define GES for the indicator on pathogens in seawater.

Table 8 Water Quality criteria for pathogens in bathing water

Category	A	B	C	D
Limit values	<100*	101-200*	185**	>185**(1)
Water quality	Excellent quality	Good quality	Sufficient	Poor quality/ Immediate Action

* 95th percentile intestinal enterococci/100 mL (applying the formula 95th Percentile = antilog ($\mu + 1,65 \sigma$))

** 90th percentile intestinal enterococci/100 mL (90th Percentile=antilog ($\mu + 1,282 \sigma$), μ =calculated arithmetic mean of the log10 values; σ = calculated standard deviation of the log10 values.

By definition bathing waters data are close to the shore, but the threshold is valid on a regional level. Therefore, the category A or B values could be defined as GES threshold for microorganisms in bathing waters in the Mediterranean.

Setting of GES targets

State targets are the achievement of concentrations of contaminants below the relative EAC value in biota and sediment. Alternatively, a state target could be a statistically defined decreasing trend of the concentrations of the contaminant from an actual value. Based on the available data, state targets could be set for contaminants, for which enough monitoring

data are available on a regional and sub-regional level. These include the three toxic metals usually monitored (Hg, Cd and Pb), some organochlorine compounds (such as DDT and PCBs) and PAHs. For synthetic organics, GES could be set on a regional or sub-regional base, but for naturally occurring contaminants (metals and PAHs) a more detailed subdivision may be needed according to the local specificities. Also, targets could include the decreasing of contaminants concentrations in a specific matrix.

Pressure targets are related to quantifiable reduction of specific contaminants discharged from human sources (urban and industrial effluents). Such targets for contaminants, oil and pathogens already exist in national legislation, as well as in regional legislation (EU) and in the legal and regulatory framework of the Mediterranean Action Plan/Barcelona Convention and specifically the LBS Protocol, including the reduction of the releases of heavy metals, specific synthetic organic compounds and oil from urban and industrial sources according to SAP MED.

Scale of assessment

The geographic scale for setting GES and targets for contaminants and their effects depends on the specific conditions of an area that may influence the background concentration of contaminants, including local mineralogy, inputs from rivers, hydrodynamic conditions, sediment texture, etc. A risk based approach should be used in order to follow a screening procedure to decide the areas to be assessed and monitored more frequently. The areas where greater pollution pressure occurs could be divided into smaller areas for assessment purposes and could be monitored more frequently than remote and non-affected marine waters. The GES for totally human fabricated contaminants like organochlorines, could be done on a regional scale, because the background concentration for these contaminants is zero. However, local specificities in the production and use of these compounds (pesticides and industrial compounds) have created a difference between the sub-regions that has to be considered. Also, although coastal level of pollutants are mainly influenced by local processes (river runoff, coastal hot spots), open-sea biota and sediments are mainly influenced by regional or even super-regional pathways (atmospheric transport and deposition of pollutants emitted from remote areas). The latest is also true for PAHs. It could be appropriate to consider setting a regional GES threshold for open sea and a different one for coastal zones. For natural occurring contaminants (metals) in addition to the previous remarks, local mineralogy plays an important role in the definition of the GES threshold, since metal deposits are present in different Mediterranean locations. As a consequence the assessment for metals may need to be done on a subdivision of the sub-region according to the local characteristics.

For contaminants effects and occurrence of oil spills, the GES could be set on sub-regional or even regional level, provided appropriate information is available. Also, for pathogenic microorganisms in bathing water, the GES could be set on sub-regional or even local level due to the nature of microorganism's contamination (impact is restricted to relatively short distance from the pollution source due to the short survival time of microorganisms in seawater).

Table 9 Overview of possible GES and Targets for EO9 (Contaminants)

Indicators	Suggestion for GES description	Approach for setting the GES boundary	Thresholds for GES	Possible option for targets	Scale of assessment
9.1.1 Concentration of key harmful contaminants in biota, sediment or water	Concentrations of contaminants are below a determined threshold defined for the area and when they are not giving rise to pollution effects	Threshold values for contaminants according to Environmental Assessment Criteria (EACs) or Comparison with reference concentrations from relevant unpolluted areas	EACs to be set following ecotoxicological tests at regional scale for synthetic compounds (Organochlorines, POPs) and at sub-regional scale for metals depending on the mineralogy. WHO dietary limits could be used to set regional thresholds for metals in biota.	State <ul style="list-style-type: none"> Concentrations of specific contaminants below EACs or below reference concentrations Decreasing trend in contaminants concentrations in sediment and biota from human impacted areas, statistically defined Pressure <ul style="list-style-type: none"> Reduction of contaminants emissions from land based sources 	Regional and sub-regional
		Decreasing trend in the concentrations of contaminants			
9.2.1. Level of pollution effects of key contaminants where a cause and effect relationship has been established	Concentrations of contaminants are not giving rise to pollution effects	Thresholds for contaminant-specific effects	Threshold could be set for TBT effects (imposex) on gastropods	State Contaminants effects below threshold	Regional,
9.3.1 Occurrence, origin (where possible), extent of significant acute pollution events (e.g.	Non-occurrence of acute pollution events	Number of acute pollution events and volume of oil released	Zero acute pollution events involving oil and other contaminants	State <ul style="list-style-type: none"> Decreasing trends in the concentrations of oil in the 	Regional, sub-regional

Indicators	Suggestion for GES description	Approach for setting the GES boundary	Thresholds for GES	Possible option for targets	Scale of assessment
<p><i>slicks from oil, oil products and hazardous substances) and their impact on biota affected by this pollution</i></p>		<p>Decreasing trend in the occurrence of significant pollution events and in oil quantity released during operation</p>		<p>water column and the occurrence of tar balls on the beach</p> <p>Pressure</p> <ul style="list-style-type: none"> • No occurrence of acute pollution events • Decreasing trend in the occurrences of acute pollution events • Decreasing trend in the operational releases of oil and other contaminants from human activities 	
<p><i>9.4.1. Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels in commonly consumed seafood</i></p>	<p>Concentrations of contaminants are within the regulatory limits for consumption by humans</p>	<p>Regulatory levels of contaminants in commonly consumed seafood</p>	<p>Existing regulatory levels for seafood consumption at international (WHO), regional (EU) level</p>	<p>State Concentrations of contaminants are within the regulatory limits set by legislation</p>	<p>Regional,</p>

Indicators	Suggestion for GES description	Approach for setting the GES boundary	Thresholds for GES	Possible option for targets	Scale of assessment
9.4.2. <i>Frequency that regulatory levels of contaminants are exceeded</i>	No regulatory levels of contaminants in seafood are exceeded	Frequency that regulatory levels of contaminants in seafood samples are exceeded		State Decreasing trend in the frequency of cases of seafood samples above regulatory limits for contaminants	Regional,
9.5.1 <i>Percentage of intestinal enterococci concentration measurements within established standards</i>	Concentrations of intestinal enterococci are within established standards	Percentage of intestinal enterococci concentration measurements within established standards	WHO, EU and UNEP/MAP standards	Increasing trend in the percentage of intestinal enterococci concentrations within established standards	Regional
9.5.2. <i>Occurrence of Harmful Algal Blooms within bathing and recreational areas</i>	No occurrence of HABs	Decreasing trend in the frequency of the occurrence of HABs		State Decreasing trend in the frequency of the occurrence of HABs	Regional, sub-regional

6. Proposed approaches for GES determination and GES targets with regard to Ecological Objective 10 on Marine litter

Decision 20/4 of COP 17 (Paris, 2012) requires assessment of the impact of marine litter on the coast (Indicator 10.1.1), the water column and seafloor (indicator 10.1.2), as well as the impact on marine life (indicator 10.2.1 (Table 10).

Table 10 EOs, OOs and indicators for Marine litter

Ecological Objective	Operational Objectives	Indicators
Marine and coastal litter do not adversely affect coastal and marine environment	10.1 The impacts related to properties and quantities of marine litter in the marine and coastal environment are minimized	<i>10.1.1 Trends in the amount of litter washed ashore and/or deposited on coastlines, including analysis of its composition, spatial distribution and, where possible, source</i>
		<i>10.1.2 Trends in amounts of litter in the water column, including microplastics, and on the seafloor</i>
	10.2 Impacts of litter on marine life are controlled to the maximum extent practicable	<i>10.2.1 Trends in the amount of litter ingested by or entangling marine organisms, especially mammals, marine birds and turtles</i>

Common measures on marine litter were adopted by the Parties in 1993. Marine litter monitoring is not part of the MED POL monitoring programme, therefore there is no available data from the Mediterranean countries. However, beach cleaning (and litter recording) campaigns are implemented in many countries on specific sites. Although this information is useful, it does not replace a well-coordinated monitoring programme on national base. The marine litter monitoring will be included in the integrated MAP monitoring programme that is under preparation.

Determination of GES – thresholds

GES determination is relatively difficult because of the multitude of parameters that are involved in the generation, transport, fate and impact of marine litter. GES could be defined as follows: the occurrence of marine litter and their decomposition products do not have negative impacts on human health, marine life and ecosystem services, and do not create risk on navigation. It has to be recognized that due the increasing production of synthetic materials, and the global circulation cycles, an important part of these materials ends up as “marine litter”. Therefore, it may not be realistic to set as GES the “zero marine litter” and a threshold that constitutes an acceptable level of marine litter in the different substrates (beach, water column, sea floor) and an acceptable level of impacts on marine life has to be set to define GES. However, for the time being, there are not enough information and reference values for marine litter, due to the lack of regular monitoring programmes in most countries in the region. Also, although a decreasing trend in the occurrence of marine litter in different substrates (beach, water column and sea floor) could be used as GES, the lack of

data for the actual situation which would represent a reference point for future assessments constitutes an obstacle.

Setting of GES targets

Setting state targets for marine litter cannot be done in a completely quantitative way because it is difficult to define a meaningful background level for litter in our contemporary world, due to the universal presence of marine litter and the multitude of sources (primary or secondary). Therefore a decreasing trend in the amount of litter items on the beach, the water column of the seafloor, could be set as a target for achieving GES.

On the other hand, setting targets for impact of marine litter on marine life is more difficult, because, although the impact on individuals is well documented (stomach content of plastic in seabirds, entanglement of cetaceans and turtles), the effect on population level is not yet well understood. One way to approach this issue according to OSPAR is to set specific quantitative thresholds for the plastics found in the stomach content of a sea bird (the northern fulmar *Fulmarus glacialis* in the case of OSPAR). The use of a sentinel organism for the impact of marine litter on marine biota in the Mediterranean could provide useful data for this indicator and has to be considered.

In case trends are used as targets, if initial information exists on the amount of marine litter in a substrate, the decreasing trend could be expressed as the percentage reduction of the number of items in comparison to an initial value. If no previous records exist on the level of marine litter, the first task is to measure the existing status in order to use it as a baseline for comparison with future data. To allow for inter-comparisons, specific monitoring and assessment methodologies have to be agreed on a sub-regional and regional level for the different substrates, in order to have comparable results.

Scale of assessment

Marine litter is a global problem because it may be transported easily and the definition of its source is usually very difficult. Local assessment scale may be appropriate for litter deposited on the beach, since it is estimated that approximately 50% of it has local sources, although caution is required because the other half is been transported from other areas. Therefore assessment of marine litter deposited on the coast is relatively easier to be undertaken during the first cycle of the ECAP application. On the other hand, litter in the water column (including microliter) and litter deposited on the sea floor may have been transported from remote areas, therefore a sub-regional or even regional assessment scale might be needed. As an example litter distribution in the water column is mainly influenced by external factors (sea currents, wind patterns, shipping density and fishing intensity) and a local assessment scale would be meaningless. The scale of the assessment has to take into consideration the characteristics of the marine litter, as well as the external factors that may play a role in a specific area.

Table 11 Overview of possible GES and Targets for EO10 (Marine litter)

Indicators	Suggestion for GES description	Approach for setting the GES boundary	Thresholds for GES	Possible option for targets	Scale of assessment
<i>10.1.1 Trends in the amount of litter washed ashore and/or deposited on coastlines, including analysis of its composition, spatial distribution and, where possible, source</i>	Number of marine litter on the coastline do not have negative impacts on human health, marine life and ecosystem services	Decreasing trend in the number of marine litter deposited on coast in comparison to a reference value set, based on available information	Reference value for the number of marine litter items on the coast	State Decreasing trend in the number of marine litter items deposited on the coast	Sub-regional
<i>10.1.2 Trends in amounts of litter in the water column, including microplastics, and on the seafloor</i>	Number of marine litter items in the water column and the seafloor do not have negative impacts on human health, marine life, ecosystem services and do not create risk to navigation	Decreasing trend in the number of marine litter in the water column and the seafloor in comparison to a reference value set, based on available information	Reference value for the number of marine litter items in the water column and the seafloor	State Decreasing trend in the number of marine litter items in the water column and the seafloor	Regional, sub-regional
<i>10.2.1 Trends in the amount of litter ingested by or entangling marine organisms, especially mammals, marine birds and turtles</i>		Could be set as a decreasing trend in the number of marine litter in the stomach of a sentinel organism or as cases of entanglement of marine biota by plastics (including fishing nets). A reference value has to be set based on available information	No methodology yet agreed for the monitoring of impact of marine litter on marine biota	To be defined after the setting of the methodology. Probably as decreasing trend in the cases of entanglement or/and a decreasing trend in the stomach content of the sentinel species.	To be defined once the methodology is set

7. Proposed approaches for GES determination and GES targets with regard to Ecological Objective 11 on Noise

Decision 20/4 of COP 17 (Paris, 2012) requires assessment of the impact of noise on marine and coastal ecosystems. The Indicator 11.1.1 address the impact of loud, low and mid-frequency impulsive sounds on marine animals and the indicator 11.1.2 address the trends continuous low frequency sounds (Table 10).

Table 10 EOs, OOs and indicators for Noise

Ecological Objective	Operational Objectives	Indicators
Noise from human activities cause no significant impact on marine and coastal ecosystems	11.1 Energy inputs into the marine environment, especially noise from human activities is minimized	<i>11.1.1 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 animals</i>
		<i>11.1.2 Trends in continuous low frequency sounds with the use of models as appropriate</i>

Human produced noise in the marine environment has not been included in the MED POL monitoring programme, therefore relevant data are not available. At national level, although research has been conducted by research institutions on the impact of sounds on marine species, there is no regular monitoring programme to generate relative data. As a consequence, more targeted research is needed in order to understand better the process and a regular monitoring programme has to be established to collect noise data in the marine environment.

Definition of GES – thresholds

Presently there is not enough knowledge and data on the impact of noise on marine animals, which could allow for a quantitative definition of the GES in relation to this Ecological Objective. A qualitative GES could be that the human produced sounds should not disturb the communication of cetaceans, nor disturb the function of the ecosystem. More information is required for a more specific definition of GES, including the determination of the activities that may generate noise, as well as the areas that are considered as more sensitive because of higher concentration of noise sources or/and because of the presence of large population of marine mammals sensible to noise.

Setting of GES targets

It is very difficult to set state targets when there is not enough understanding of the impact of noise on the marine ecosystem, nor on the baseline for noise. Therefore, as an interim step, pressure targets could be set, including the reduction of noise generating activities in marine zones where population of cetaceans are more abundant.

Scales of assessment

Due to the lack of more specific information on noise and its impact on the marine ecosystem, it is premature to propose scales for assessment. This is one of the questions that have to be answered by the relative research, which needs to be conducted.

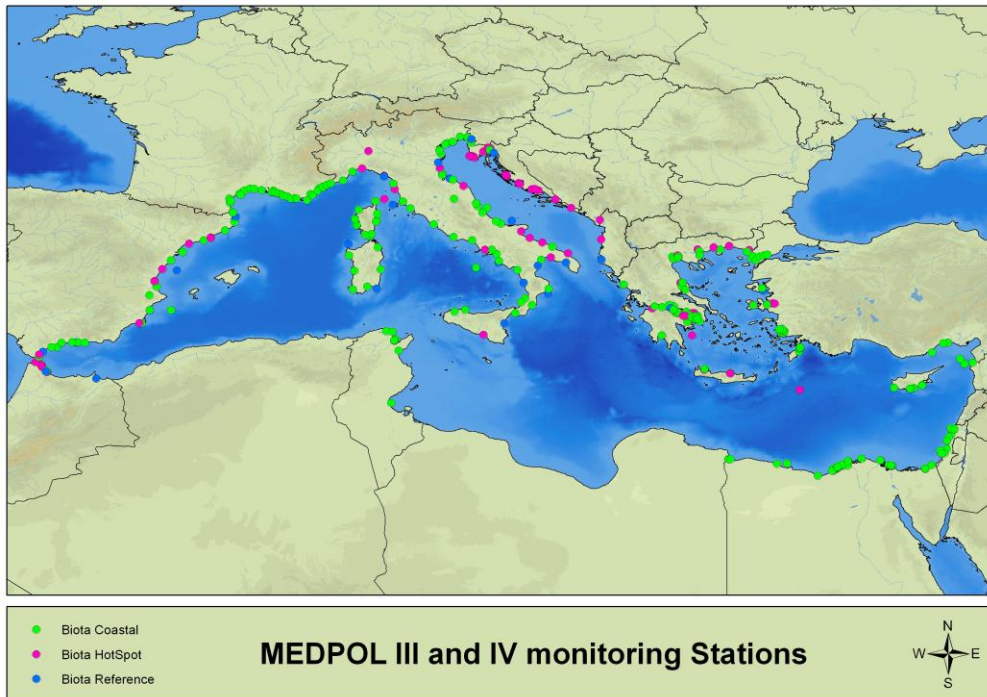
For the time being the understanding of the impact of noise on the marine ecosystem is relatively limited and there is no information on the baseline for noise. Therefore the noise related indicators cannot be used for the time being, until more information is made available. It is proposed to continue developing these indicators at a later stage and not to use them the first cycle of the application of the ECAP.

8. Concluding remarks

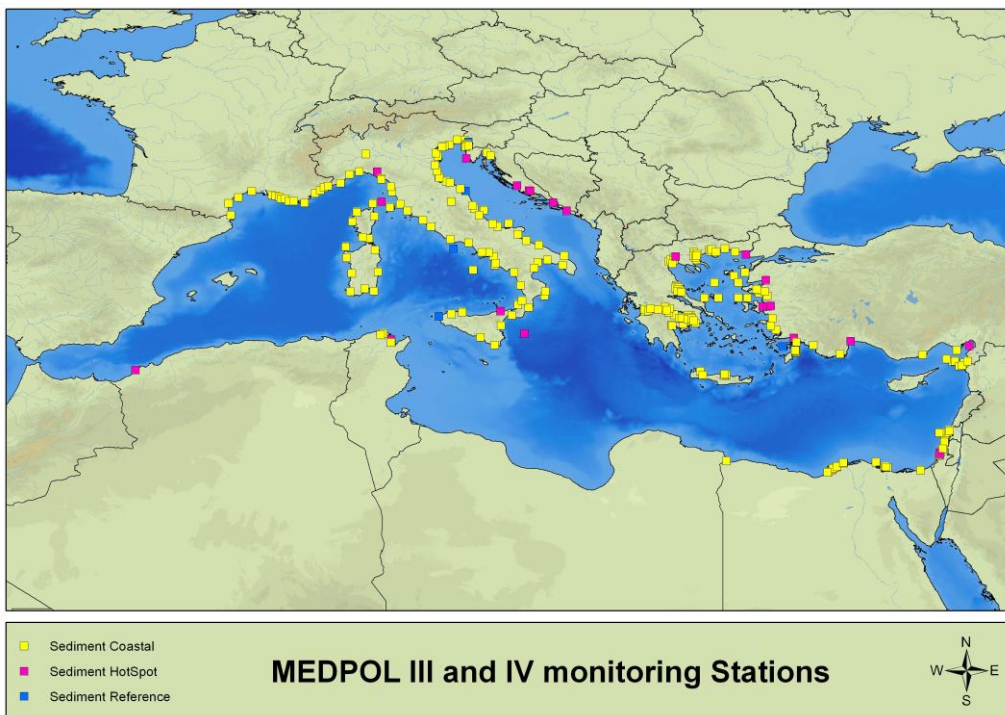
During the first cycle of the implementation of the ECAP by the Mediterranean countries, it may not be possible to set targets for all 56 indicators of the Ecological Objectives, due to knowledge and data gaps. Therefore, a pragmatic approach may be taken by prioritizing the setting of indicators depending on their maturity for the region. Also, indicators could be combined, as far as possible, in order to provide information on progress towards GES achievement, for as many Ecological Objectives as possible. The aim is to reduce the necessary work and cost to generate data for the indicators, while combining available information to get the optimum result.

Annex I

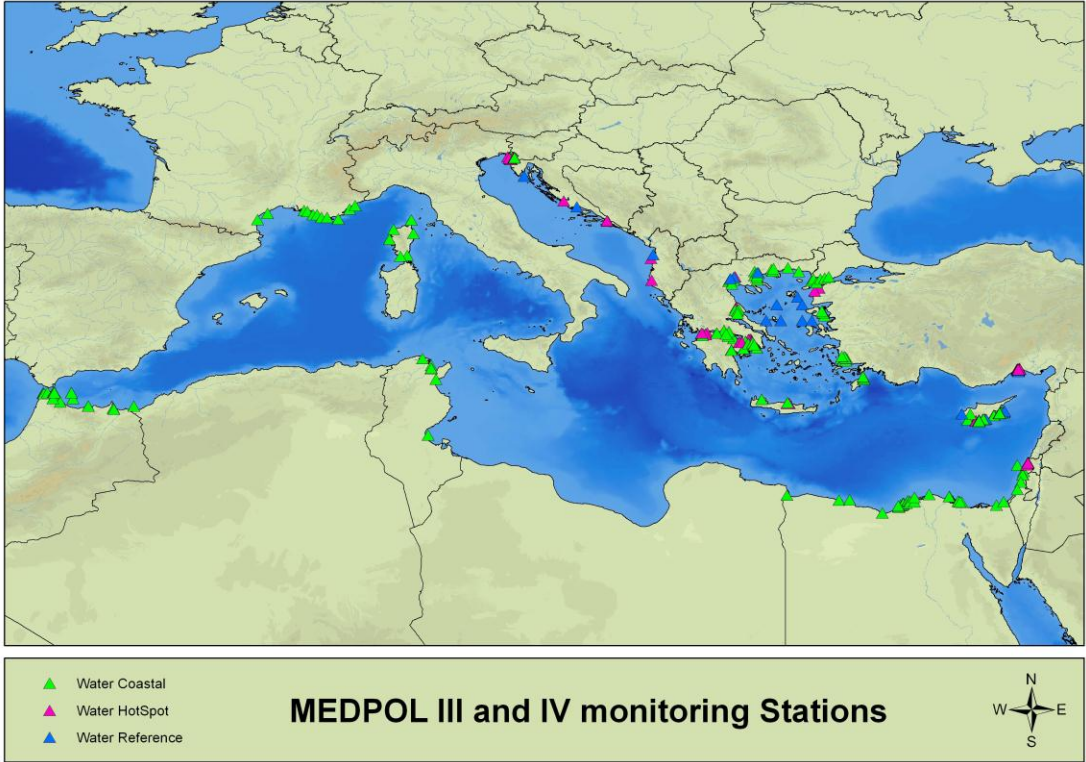
Sampling station of the MED POL monitoring Programme (Phase III and IV, 1998-2012)



Biota sampling stations



Sediment monitoring stations



Water monitoring stations