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MEDITERRANEAN ACTION PLAN

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Secretariat's Gap Analysis on ongoing Monitoring Activities

Secretariat's gap analysis on ongoing monitoring activities of the Barcelona Convention/UNEP MAP relevant for a future Integrated Monitoring Programme in the Mediterranean in the framework of implementing the ecosystem approach roadmap

I. INTRODUCTION

The implementation of the ecosystem approach roadmap in the Barcelona Convention/MAP requires the establishment of a regional monitoring programme that addresses the ECAP ecological objectives and respective criteria, indicators and what constitutes Good Environmental Status.

The future regional Monitoring Programme will build on the existing Programme and the guidance already provided by Contracting Parties such as Decision 17/7 adopted in Almeria (Spain) in 2008 which had already established that pollution monitoring needed to be better integrated into the scope of the Strategic Action Programme (SAP MED) and of any other pollution control measure adopted by the Contracting Parties in application of the LBS Protocol.

The purpose of this document is to analyze the existing marine environment monitoring programmes in the Mediterranean, indicators and data availability at the regional and subregional level, looking at available data streams and drawing attention to gaps in relation to the ECAP agreed indicators.

Based on the above analyses recommendations for the implementation of the major elements of the integrated monitoring programme are proposed and a possible realistic roadmap, taking due consideration of the MAP components requirements.

The scope of the integrated monitoring activities of the Barcelona Convention/MAP for EcAp purposes should respond to the following needs:

- 1) Monitoring, assessment and pollution control activities, as well as data quality assurance, data collection and handling, reporting and data management policies and procedures, to be functionally harmonized with those adopted by regional, international and global bodies and organizations, such as the European Union and other UN Agencies and programmes;
- 2) Existing Barcelona Convention/MAP pollution assessment and reporting schedules to be synchronized, and the assessment and reporting procedures harmonized, with the schedules and procedures which will be adopted for the evolving global assessment of the state of the marine environment;
- 3) Monitoring and assessment of the environmental effects and ecological implications of fisheries management, including aquaculture, on ecosystems (as advocated by the ecosystem approach roadmap to the management of human activities and practiced by other Europe-based regional seas programmes) as well as of sea water desalination activities;
- 4) Monitoring and assessment of environmental effects associated with energy production and maritime transport, in cooperation with other competent international and regional bodies;
- 5) Assessment of the health risk associated with the quality of bathing and shellfish growing waters, tourist establishment and facilities.

Additionally, a monitoring system of endangered and threatened species has to be established, as well as adequate monitoring and survey of the effectiveness of marine and coastal protected areas.

Therefore, based on the decisions and developments in the ecosystem approach roadmap an integrated holistic monitoring programme will be prepared, including marine pollution and biodiversity, in line with the objectives and steps agreed upon for the application of the ecosystem approach. The philosophy underlying the holistic approach is that all monitoring activities are integrated in a single, well-defined aim – that of achieving a particular level of environmental quality in a specified ecosystem. This means that common practices have to be adopted across all types of monitoring activities and data management.

II. An overview of monitoring activities in the Mediterranean

In the framework of UNEP/MAP-Barcelona Convention MEDPOL programme, the Contracting Parties have implemented in a coordinated manner since 1982 a regional marine pollution monitoring programme in the Mediterranean coastal waters, according to Article 12 of the Barcelona Convention and Article 8 of the Land-Based Sources Protocol. Table 1.1. shows the monitoring obligations adopted by the Contracting parties under the Barcelona Convention. In 1996, a marine monitoring and reporting strategy was approved and a marine monitoring database was created. As a result, the monitoring programme was better coordinated, including an agreement on common integrated monitoring methodologies, a Quality Assurance/Quality Control system to improve data quality and a common reporting system.

The marine monitoring database is the basis to the preparation of thematic assessment reports on marine pollution.

The MED POL marine databases hold data on:

- Seawater: General oceanographic parameters (temperature, salinity, dissolved oxygen),
- Nutrients (NO₃-N, NO₂-N, NH₄-N, PO₄-P, SiO₄), Chlorophyll-a
- Marine sediments: Total mercury, total cadmium (mandatory), Chromium, Copper, Lead, Zinc, Halogenated hydrocarbons, PAHs
- Marine organisms: Total mercury, total cadmium (mandatory), halogenated hydrocarbons, PAHs, Arsenic, Chromium, Copper, Lead, Zinc.

Furthermore, a land-based pollution sources database has been created in 2005, which is hosting national data on pollutants industrial and municipal discharges collected by national surveys.

1) Pollution monitoring

The major components of the marine pollution monitoring programme are:

a) State and Trend monitoring

State monitoring aims to provide the necessary data in order to prepare periodical assessments of the state of the environment in pollution hot spots and coastal areas. Trend

monitoring aims to detect site-specific temporal trends of selected contaminants at hot spots and coastal/reference areas.

b) Monitoring of inputs

This type of monitoring deals with the quantification of inputs expressed as loads from point sources based on the National Baseline Budgets of Pollutant Emissions and Releases (NBBs).

c) Compliance monitoring

This type of monitoring is addressed to coastal recreational water quality activities that are mainly linked to bathing waters and shellfish growing waters.

d) Biological effects monitoring

Monitoring with biomarkers assess exposure to, and impacts of, chemical contaminants at the organism level at very early stages.

e) Monitoring of eutrophication

Pilot studies are implemented in specific eutrophication-threatened marine coastal areas.

2) Monitoring shipping accidents and oil pollution

Under the Prevention and Emergency Protocol (2002), there is no obligation to monitor maritime traffic. However under an EU financed project, REMPEC has developed a GIS on maritime traffic flows and related risks in the Mediterranean. http://www.rempec.org/tools.asp?theIDS=2_160&theName=Tools&daChk=1.

Moreover, REMPEC is currently participating in the implementation of the MEDESS-4MS Project which *inter alia* will be collecting a set of important data to assess the vulnerability of the Mediterranean to an oil spill. <http://www.medess4ms.eu/>

3) Monitoring biological diversity

With regard to biodiversity the countries do not implement yet a regionally coordinated biodiversity monitoring programme. However, biodiversity monitoring is included in the SPA/BD Protocol (Articles 3, 7 and 20) as an obligation for the Contracting Parties.

a) Elements of biodiversity monitoring to be performed under MAP

The Contracting Parties of the Barcelona Convention are required under the SPA and Biodiversity Protocol to establish inventories and monitoring activities on the components of biological diversity. To date this activity appears to be restricted basically to the national monitoring programmes of a number of the EU Mediterranean countries. Certain efforts at the project level have also been made by non-EU countries mainly for SPAs where the parties have been strongly advised to enlarge the spatial coverage of such studies however, budgetary constraints limit the work. The MAP Strategic Action Programme for Biodiversity (SAP-BIO) lists the gaps of information and data at the national and regional level and the consequent lack of actions (management and recovery plans) that should be taken aiming to provide a common and an operational framework for the Mediterranean.

Inventorying, mapping and monitoring requirements for the Mediterranean coastal and marine biodiversity under the SAP BIO include specific targets, priority actions with specific identified objectives.

Table 1.1. Monitoring activities/requirements under the Barcelona Convention

	Policy requirement	Area Concerned	Monitoring Requirement (Objectives)	Implementing bodies and status of implementation
Water Quality	<p>1.<u>LBS Protocol (P1) and SAP-MED</u></p> <p>2.<u>Protocol for preventing pollution from/at ships/cases of emergency (P2)</u></p>	<p>- MED Sea area as defined in the Barcelona Convention (from Gibraltar to Dardanelles, marine waters)</p> <p>- Hydrologic basin of the MED sea area</p> <p>- waters on the landward side up to the fresh-water limit</p> <p>- brackish and coastal saline waters including marshes, coastal lagoons and ground waters communicating with the MED sea.</p>	<p><i>Art. 12</i> of Barcelona Convention <i>Art. 8</i> of (P1), <i>Art.5</i> of (P2)</p> <p>Art 8 of P1 states that Parties shall launch a monitoring programme</p> <ul style="list-style-type: none"> - to assess the levels of pollution along their coasts - to evaluate the effectiveness of action plans, programmes and measures <p>Art 5 states that Parties shall develop and apply monitoring activities to prevent/detect/combate pollution of the sea by oil, hazardous and noxious substances</p>	<p>Competent national authorities designated by the Contracting Parties.</p> <p>P1 :</p> <ul style="list-style-type: none"> - MAP/MED POL is responsible for establishing a pollution monitoring system⁽¹⁾ (with common procedures and standards) at the regional level (1975-today) -17/21 countries have monitoring programmes; 11/17 are MED POL/ National Monitoring Programmes- Annual reporting and submission of raw data <p>P2: Parties are responsible for achieving reporting obligations on incidents, oil spills etc. and transmit the required information to <u>REMPEC/RAC</u>.</p>
Biodiversity	<u>Protocol for Specially Prtoected Areas and Biological Diversity and SAP-BIO</u>	<p>- MED Sea area as defined in the Barcelona Convention (from Gibraltar to Dardanelles)</p> <ul style="list-style-type: none"> - Seabed and its subsoils - Waters, seabed/subsoils on the landward side up to the fresh-water limit - Terrestrial coastal areas including wetlands 	<p><i>Arts. 3, 1, 20</i> Parties shall</p> <ul style="list-style-type: none"> - identify/compile inventories of the components of biological diversity - identify/plan/undertake scientific/technical research/ monitoring programmes necessary for identification/protection of protected areas and species and assessing the effectiveness of management and recovery plans 	<p>Competent national authorities designated by the CPs</p> <p>Reporting on SPAMI and species lists to <u>SPA/RAC</u>.</p>
Fisheries ⁽¹⁾				

(1) Within the existing MAP framework policy/management/monitoring on fisheries is not provided for. Other international policies apply in the region.

III. Data availability in relation to the indicators of the respective 11 ECAP Ecological Objectives

It has already been established that the existing MEDPOL monitoring database constitutes a relevant source of information for assessing the state of pollution of the Mediterranean Sea by contaminants. The efforts made during the MEDPOL Phase III and Phase IV have been successful in building up and improving this essential instrument of environmental policy. Although at the moment it is hosting monitoring data of only 14 Mediterranean countries, and the portion of data for each component and country is uneven, it constitutes the most comprehensive record of monitoring data for the whole basin.

However, even under the current existing context the need to establish monitoring programmes in many countries has been clearly identified, particularly from the southern riparian coasts, to fill the geographical data gaps and ensure the continuation of existing temporal trend data. It should be taken into account that for evidencing and assessing significant temporal variations a sufficiently large time span of data is required (>10yr for sediments and >5 yr for biota).

These programmes must be able to generate comparable and accurate data, taking into account the intrinsic variability of the environmental matrices considered. For example, the adoption of normalization procedures which could account for the differences in sediment characteristics (organic carbon or AI contents) as well as the implementation of quality assurance/quality control procedures is considered essential.

A useful outcome of the database can be the establishment of background concentrations for the target compounds in Mediterranean biota and sediments, which is necessary in order to have reference values for comparison with field data.

Moreover, with the improvement and development of analytical techniques, the identification and quantification of emerging substances of potential concern for the marine environment because of their persistence, toxicity and bioaccumulation properties, is continuously increasing. They are believed to be ubiquitous but information on their occurrence in the Mediterranean is limited and should be improved.

Finally the conceptual approach of the MEDPOL Programme, updated with the recent knowledge and experience generated by the scientific community needs to incorporate relevant assessment tools for hazardous substances in marine sediments and biota. Specifically, there is a need to establish and formally adopt environmental assessment criteria (EAC) for the hazardous substances included in the MEDPOL database: trace metals, chlorinated pesticides and PCBs.

As concerns the recent evaluation of MED POL trend monitoring data, though substantially improved over the years, some areas for improvement have been identified, mainly dealing with the lack of maintaining the declared sampling strategy. The weakest part of the programme still resides in data transfer and manipulation. To overcome these problems, involved countries have been encouraged to write a detailed programme manual where all issues for a successful programme realisation would be addressed. The manual, for future monitoring reference also, would need to include objectives and detailed methodological approach to successfully maintain the programme over time (positioning, sampling, methods, and data elaboration, exchange and presentation).

IV. Capacity of the current MEDPOL/UNEP MAP monitoring programme to generate data for ECAP and data gaps:

1. Ecological Objective 1 BIODIVERSITY

The Contracting Parties to the Barcelona Convention are required under the SPA and Biodiversity Protocol to establish inventories and monitoring activities on the components of biological diversity. Despite the increasingly important effort made by Mediterranean countries, there are still critical gaps in the information and data for many key components of Mediterranean marine biodiversity. Indeed, in many Mediterranean countries, marine species and habitats remain little studied and knowledge on species abundance and distribution, as well as conservation status is uneven. Gaps in knowledge hinder the establishment of baselines for most of the Mediterranean Biodiversity components.

The ECAP Coordination Group during its first meeting (Athens, May 2012) noting that in comparison with contaminants monitoring, the data derived from monitoring of biodiversity is scarce, recommended that a combination of quantitative and qualitative targets addresses specific endangered or threatened species and priority habitats of the Mediterranean. For this purpose it was recommended that the species listed in Annex II and III of the SPA/BD be used as the basis for the selection of a list of indicator species. For habitats, the Coordination Group recommended that targets be developed in relation to priority benthic habitats. The approach adopted proposes that the biodiversity assessments for the determination of GES and targets be made for three species functional groups (marine mammals, birds and reptiles) selected from Annex II to the SPA/BD Protocol and a list of habitats reflecting representativeness across broad categories of habitat types.

This approach accordingly defines the scope of biodiversity monitoring to be performed by Mediterranean Member States, notwithstanding that monitoring should primarily represent the wider state of biological diversity, adopting also a risk-based approach where monitoring and assessment is focused, wherever possible, on key pressures that are, or may be, affecting the state of biological diversity.

i. Coastal and marine habitats

The latest work of the MAP Correspondence group on GES and targets Biodiversity and Fisheries has selected for the purpose of GES determination in coastal and marine habitats the indicators 1.4.1 Potential / observed distributional range of selected coastal and marine habitats listed under the SPA Protocol, 1.4.2 Distributional pattern of selected coastal and marine habitats listed under the SPA Protocol and 1.4.3 Condition of the habitat-defining species and communities.

Accordingly common monitoring guidance for the above indicators would need to be prepared for adoption by the Member States during 2014-2015, to allow for inter-comparisons. This guidance could take due consideration of EU guidelines developed for the implementation of Article 17 of the Habitats Directive (European Commission, 2006). The latter also provides guidance on how to estimate the favorable reference range of a habitat.

The MAP Correspondence group has drafted an indicative list of habitats to be considered for monitoring biodiversity to support the assessment of GES. These have been selected from the Reference List adopted by the Contracting Parties of Marine Habitat Types for the Selection of Sites to be included in the National Inventories of Natural Sites of Conservation Interest.

The Correspondence group has recommended that a definitive list of the habitats to be considered is to be drawn up/adopted during the preparatory phase of the ECAP integrated monitoring programme.

ii. Coastal and Marine Species

The latest meeting of the MAP Correspondence group has drafted an indicative list of species to be considered for monitoring biodiversity to support the assessment of GES, with recommending further work on its specifics in the future monitoring group.

Due to the limited availability of data on cetacean population size and distribution, the Scientific Committee of ACCOBAMS recommended that a synoptic survey be carried out in the Mediterranean Sea.

2. Ecological Objective 2 NON INDIGENOUS SPECIES

A large number of reports and scientific papers on the occurrence of non- indigenous species in the Mediterranean have been prepared in the last ten years. Some compilation efforts were undertaken to elaborate inventories. The most important of these compilations for the Mediterranean Sea are the CIESM Atlas of Exotic Species in the Mediterranean and the Database on Marine Mediterranean Invasive Species developed by the Specially Protected Areas Regional Activity Centre (RAC/SPA).

Still, there is currently no Mediterranean coordinated monitoring programme of non – indigenous species in the framework of the Mediterranean Action Plan. The SPA Action Plan on Species Introductions and Invasive Species in the Mediterranean Sea requires that Parties prepare programmes for data collection and monitoring, particularly of the presence of non-indigenous marine species, on their population trends, including for those used in aquaculture, the impact of non-indigenous species on the indigenous biodiversity and the origin of ballast water discharged into their territorial waters, applying the monitoring protocols of relevant international organizations.

3. Ecological Objective 3 COMMERCIALY EXPLOITED FISH AND SHELLFISH

There is no Mediterranean monitoring programme of commercially exploited fish and shellfish in the framework of the Mediterranean Action Plan.

Considering that most of the Mediterranean fisheries are multi-specific with a limited number of fisheries targeting only one species, the determination of GES for EO3 within a context of an Ecosystem Approach should be based on the assessment of the adopted indicators for a set of species belonging to different trophic levels. Considering the above criteria, the following species have been proposed by the MAP Correspondence Group on GES and targets for commercially exploited fisheries to be considered:

		Pelagic/ Demersal	Province
<i>Thunnus thynnus</i>	High trophic level fish predator	Pelagic	Neritic/Oceanic
<i>Xiphias gladius</i>	High trophic level fish predator	Pelagic	Neritic/Oceanic
<i>Engraulis encrasicolus</i>	Planktivorous fish	Pelagic	Neritic
<i>Sardina pilchardus</i>	Planktivorous fish	Pelagic	Neritic
<i>Merluccius merluccius</i>	Predator (encountered between 70 and 370 m)	Demersal	Neritic
<i>Mullus barbatus</i>	Predator (medium trophic level) (Sand and soft bottoms at depths less than 100 m)	Demersal	Neritic
<i>Mullus surmuletus</i>	Predator (medium trophic level) (Frequents broken and rough grounds but found also on sand and soft bottoms at depths ranging from 5 to 400 m)	Demersal	Neritic/
<i>Parapenaeus longirostris</i>	Crustacean	Demersal	Oceanic
<i>Scylliorhinus canicula</i>	Predator	Demersal	Neritic/Oceanic
<i>Nephrops norvegicus</i>	Crustacean	Demersal	Neritic/Oceanic

4. Ecological Objective 4 MARINE FOOD WEBS

There is no Mediterranean monitoring programme addressing marine food webs in the framework of the Mediterranean Action Plan. This ecological objective is considered to be closely related to the ecological objective 03 concerning commercially exploited fish and shellfish, and relevant indicators and respective monitoring requirements are expected to be developed in parallel.

Due consideration would need to be taken of the fact that modeling energy flows in food webs requires a significant amount of accurate and comprehensive data.

5. Ecological Objective 5 EUTROPHICATION

Table 5.1. Data generated for the purpose of the MED POL Phase IV eutrophication monitoring programme

Indicators	Data collected (MED POL Phase IV)	Additional Data needed
5.1.1 Concentration of key nutrients in the water column	NO ₃ , NO ₂ , NH ₄ , PO ₄ (or Total N, Total P), SiO ₄ (occasionally)*	None (improve geographical coverage)

5.1.2 Nutrient ratios (silica, nitrogen and phosphorus), where appropriate	Possible if ALL nutrient data are Collected	None
5.2.1 Chlorophyll-a concentration in the water column	CHI-a	None (improve geographical coverage)
5.2.2 Water transparency where relevant	None	Secchi disc
5.2.3 Number and location of major events of nuisance/toxic algal blooms caused by human activities	None	Record of location and frequency of toxic algal blooms
5.3.1 Dissolved oxygen near the bottom, i.e. changes due to increased organic matter decomposition, and size of the area concerned	None	DO measurements in bottom waters at selected locations

*Not all countries provide data for all nutrients

From table 5.1 it can be established that the MED POL monitoring programme (MED POL Phase IV) is already generating data for most of the indicators of EO5 eutrophication. Eutrophication-related data collected in the framework of the LBS Protocol, the MED POL monitoring programme (Phase III and IV) are summarized in Chapter 1. Pilot monitoring programmes have been implemented in different Mediterranean locations to build capacity in formulating and implementing integrated eutrophication monitoring programmes.

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

In order to become fully operational for ECAP monitoring, the MED POL Programme would need to extend geographical coverage beyond the coastal zone, providing the according guidance for performing the respective monitoring. 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 monitoring based on trends.

A fully operational ECAP eutrophication monitoring programme would require the development/submission for adoption, of a common methodology to address the indicator on water transparency and the indicator on dissolved oxygen concentration in water bottoms. As regards the indicator on number and location of major events of nuisance/toxic algal blooms caused by human activities it is well accepted that links between HABs and nutrient enrichment have been much debated. HABs should be treated as part of the undesirable consequences of eutrophication only if their frequency, amplitude, or toxic content increases in correspondence with increased nutrient input.

MED POL has already made some preparatory work to provide initial background information on methodologies for the establishment of threshold values for eutrophication (UNEP(DEPI)/MED WG.365/Inf.7). This work would need to be further discussed during national expert meetings organized by MAP MED POL during 2014-2015.

6. Ecological Objective 6 SEAFLOOR INTEGRITY

There is no Mediterranean monitoring programme addressing seafloor integrity in the framework of the Mediterranean Action Plan. This ecological objective is considered to share common features with the ecological objective 01 for Biodiversity. Hence from the list of habitats to be considered under the ecological objective for biodiversity, habitats vulnerable to bottom impacting activities could be considered for the purpose of developing monitoring guidelines for the ecological objective 06 for seafloor integrity.

7. Ecological Objective 7 ALTERATION OF HYDROGRAPHICAL CONDITIONS

There is no Mediterranean monitoring programme in the framework of the Mediterranean Action Plan specifically addressing the effect of permanent alterations in hydrographic conditions on marine ecosystems.

In general, plans, programmes and projects likely to have significant effects on the environment are expected to be subject to environmental assessment prior to their approval or authorization. Under the Barcelona Convention, Member States have adopted a Protocol for the Protection of the Mediterranean Sea against Pollution Resulting from Exploration and Exploitation of the Continental Shelf and the Seabed and its Subsoil.

8. Ecological Objective 8 COASTAL ECOSYSTEMS AND LANDSCAPES

While there is currently no Mediterranean monitoring programme in the framework of the Mediterranean Action Plan specifically tailored to address EO8 on the state of coastal ecosystems and landscapes Article 16 of the Integrated Coastal Zone Management Protocol (ICZM¹), on "Monitoring and Observation Mechanisms and Networks" requires the Contracting Parties to use and strengthen existing appropriate mechanisms for monitoring and observation, or create new ones if necessary on both resources and activities as well as legislation, institutions and planning to participate in a Mediterranean coastal zone network in order to promote exchange of scientific experience, data and good practices and to collect appropriate data in national inventories.

By definition coastal ecosystems and landscapes form an integral component of biodiversity, in this case situated on the interface between the marine environment and the hinterland. Conventional marine monitoring programmes for biodiversity would be succeeded by elements for the determination of whether GES is being achieved/ maintained or not that can be more suitably applied. More specifically these tools would be applied in relation to the respective indicators of this ecological objective that are 8.1.1. Areal extent of coastal erosion and coastline instability; 8.1.2 Changes in sediment dynamics along the coastline; 8.1.3 Areal extent of sandy areas subject to physical disturbance²; 8.1.4 Length of coastline subject to physical disturbance due to the influence of manmade structures; 8.2.1 Change of land-use³; 8.2.2 Change of landscape types; 8.2.3 Share of non-fragmented coastal habitats.

¹ <http://www.pap-thecoastcentre.org/razno/PROTOCOL%20ENG%20IN%20FINAL%20FORMAT.pdf>

² Physical disturbance includes beach cleaning by mechanical means, sand mining, beach sand nourishment

³ Land-use classes according to the classification by Eurostat-OCDE, 1998:
<http://unstats.un.org/unsd/environment/q2004land.pdf>

Section 1.4. of the Action Plan for the implementation of the ICZM Protocol for the Mediterranean⁴ (2012-2019) on the “Reporting on Protocol Implementation and Monitoring the State of the Mediterranean Coast”, states that assessing the state of the Mediterranean coasts and measuring the effectiveness of the ICZM Protocol implementation will require the development of indicators to monitor change, important areas and hot spots. In this context it is stated that the indicators developed under the implementation of the Ecosystem Approach in the Mediterranean are relevant for the implementation of the ICZM Protocol and represent a primer in UNEP/MAP in terms of launching a process of periodic monitoring of the status of coastal areas. Under this Action Plan, priority will be given to gather information and establish monitoring systems for indicators agreed under the successive iterations of the Ecosystems Approach with a view to establish trends, thresholds and targets.

9. Ecological Objective 9 CONTAMINANTS

Table 9.1. Data generated for the purpose of the MED POL Phase IV contaminants monitoring programme

Indicators	Data collected (MED POL Phase IV)	Additional Data needed
9.1.1 Concentration of key harmful contaminants in biota, sediment or water	Hg, Cd, Hg, PCBs, halogenated pesticides, PAHs, in sediment and biota*	Contaminants may be added following countries specificities Aluminum (Al) and Organic Carbon (OC) measurements in sediments for normalization purposes
9.2.1. Level of pollution effects of key contaminants where a cause and effect relationship has been established	Lysosome membrane stability for general effect (pilot). No cause and effect relationship established for specific contaminants	Development of biomarkers (such as lipofuscin accumulation, neutral lipid accumulation, micronuclei frequencies, oxidative stress, metallothionein content, acetyl cholinesterase activity, peroxisome proliferation, lysosome to cytoplasm ratio, and stress on stress) Imposex (for TBT)
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	None (REMPEC is following shipping accidents involving oil slicks)	REMPEC to develop oil slick tracking system Method to evaluate impact on biota

⁴<http://www.pap-thecoastcentre.org/razno/Decision%20-%20ICZM%20Action%20Plan.pdf>

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	None	To be developed
9.4.2. Frequency that regulatory levels of contaminants are exceeded	None	To be developed
9.5.1 Percentage of intestinal enterococci concentration measurements within established standards	Intestinal enterococci concentration measured	None
9.5.2. Occurrence of Harmful Algal Blooms within bathing and recreational areas	None	To be developed

*Not all countries provide data for all required contaminants

From Table 9.1 it can be established that the MED POL monitoring programme (MED POL Phase IV) is already generating data for core indicators of EO9 contaminants. Most of the Mediterranean countries have the capacity to measure contaminants concentrations in marine samples.

Even though some countries still have challenges to produce reports, during the last 5 years the MED POL capacity building programme has succeeded in creating a network of laboratories in 11 Mediterranean countries, which have the capacity to perform at least one biological effects test (Lysosome membrane stability).

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 standardized following established analytical MED POL procedures under national and international QA/QC protocols and proficiency tests.

Acute pollution events (oil spills) are followed and recorded in the framework of the Prevention and Emergency Protocol, 2002 by the MAP Regional Marine Pollution Emergency Centre (REMPEC), which is also reviewing the maritime traffic in the Mediterranean providing information on routine operations. REMPEC has data on shipping accidents that caused oil or HNS pollution in the Mediterranean or were likely to cause it. ([http://www.rempec.org/tools.asp?theIDS=2_71&theName=Tools&daChk=1.](http://www.rempec.org/tools.asp?theIDS=2_71&theName=Tools&daChk=1))

Moreover, in the field of scientific assistance for oil spill drift forecast, during the last few years, REMPEC developed a strong relationship with the Mediterranean Operational Oceanographic Network (MOON) with regard to operational use of forecasting and backtracking system for oil spills based on meteo oceanographic observations and models. REMPEC and MOON have also signed a co-operation agreement to formalize their working relationship and define the type of common activities to be implemented.

The UNEP/MAP adopted criteria in 2011 would be expected to apply for monitoring related to the concentrations of intestinal enterococci. As there is no regular monitoring system in relation to HABs, this activity would need to be coordinated with the respective activities envisaged under eutrophication monitoring and appropriate guidance should be provided by the Secretariat in the coming biennium.

Background information on the methodology to be followed for the definition of environmental assessment criteria for hazardous substances and the first estimates of background concentrations for trace metals in sediments and biota, and PAHs in sediments have been provided by MED POL in the information document (UNEP(DEPI)MED WG.365/Inf.8).

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 thresholds in relation to effects, using a quantitative approach, for other contaminants. There is a possibility to use available information for TBT thresholds 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.

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 could be used for the indicator on pathogens in seawater.

10. Ecological Objective 10 LITTER

Marine litter monitoring is not part of the MED POL monitoring programme, therefore there is no organized data submission from the Mediterranean Member States. However, beach cleaning (and litter recording) campaigns are implemented in many Member States on specific sites. Although this information is useful, it does not replace a well-coordinated monitoring programme.

Trend monitoring would appear to be a realistic approach for marine litter monitoring, and in the absence of previous consistent records on the levels of marine litter, the first task would be to monitor the existing status in order to use it as a baseline for comparison with future data. To allow for inter-comparisons, specific monitoring methodologies would need to be established /agreed upon in the biennium 2014-2015 on a sub-regional and regional level for the different substrates defined in Decision 20/4 of COP 17 namely litter washed or deposited ashore (Indicator 10.1.1), litter in the water column and seafloor (indicator 10.1.2), and litter in marine life (indicator 10.2.1). The preparation of such a methodology is envisaged within the framework of the implementation of a Regional Plan for Marine Litter.

Accordingly MEDPOL, in consultation with regional and international organizations will prepare guidelines for marine litter monitoring in the Mediterranean and an expert group is to be established in 2014 for this purpose.

11. Ecological Objective 11 NOISE

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.

Note: The Mediterranean countries, which are also EU member states, have an obligation to monitor the above ecological objectives in line with the Marine Strategy Framework Directive. Monitoring guidelines are currently being developed:

<https://circabc.europa.eu/w/browse/1dfbd5c7-5177-4828-9d60-ca1340879afc>

V. Commonalities and possible synergies between indicators of different ecological objectives

	Themes	Subtheme	Ecological objectives
I	Nutrients enrichment and contaminants		5, 8 & 9
I A		Nutrients enrichment	5
I B		Contaminants	8 & 9
II	Disturbance		10 & 11
III	Biodiversity		1, 2, 3, 4, 6, 7
III A		Species	1(partly), 2, 3 & 4
III B		Habitats	1 (partly), 6 & 7

Quality of the data collected is a key requirement for the assessment and description of water status and for the assessment of anthropogenic influences and required measures in relation to all Ecological Objectives.

QA/QC should provide confidence in the whole analytical process, from sampling to reporting, for all monitoring parameters, from monitoring at national and regional scale. Monitoring should provide data, which are representative of the location and time of sampling.

In general, a Data Quality and Assurance system in the Mediterranean Region has been run by the IAEA Marine Environment Laboratory for state and trends monitoring of contaminants, WHO for compliance monitoring, DISAV for biological effects monitoring (pilot) and by the

Italian consortium (ARPA-ER, CRM, ICRAM) and IAEA/MEL for eutrophication monitoring (pilot).

VI. Recommendations of the Secretariat regarding the future Integrated Monitoring Programme (and Assessment) Programme based on its gap analysis

Adequacy (overarching principle 1)

The Integrated Monitoring Programme should be able to provide all the data needed to assess whether GES has been achieved or maintained, the distance from and progress towards GES, and progress towards achieving environmental targets and should provide the data to calculate/estimate the relevant criteria and indicators adopted in the ECAP process.

Coordination and coherence (overarching principle 2)

The Integrated Monitoring Programme should, as much as possible follow agreed monitoring approaches. Ideally, member states would monitor a common regional set of elements, following agreed frequencies, comparable spatial resolution and agreed sampling methods in a coordinated manner. Joint specifications and use of other observation data in the region, such as satellite imagery, also could contribute to coordination. Ultimately, coherent monitoring programmes will facilitate the application of coherent mitigation measures so that measures taken by one Member State would facilitate and not prevent the achievement of GES in other Member States.

Data architecture and interoperability (overarching principle 3)

A coherent integrated monitoring programme would ideally result in the collection of data for a regional set of common parameters. In order to achieve common datasets and interoperability of data, data sources will need to ensure that they are capable to deliver data using the same interface format. To achieve common data sets and to avoid duplication of work, existing databases and data flows at international or regional level should be taken into account, which already provide a pool of regionally interoperable data.

The concept of adaptive monitoring programme (overarching principle 4)

New or previously unknown pressures, evolution of socioeconomic activities worsening pressures may emerge in a marine and coastal areas and/or existing pressures may decrease or be eliminated. The frequency, intensity and the whole of monitoring programmes may need adjustment to better respond to a changing situation. The ECAP implementation follows 6 years cycles but more frequent adjustment of monitoring programmes may be needed.

Consideration of the differences in scientific understanding for each Ecological Objective (overarching principle 5)

It is widely acknowledged that for some ecological objectives the level of scientific knowledge is more developed than for others. E.g. contaminants and eutrophication are already addressed, to some extent, by the existing regulations and some specifications exist on what GES is for these ecological objectives. For some ecological objectives such as noise and coastal ecosystems and landscapes much less knowledge exists and they have not been previously addressed or they have been addressed in a different context. The limited

knowledge for some ecological objectives should trigger specific monitoring efforts, starting from investigative monitoring that will be built on the state of the art scientific developments.

The use of risk-based approach and where appropriate the precautionary principle (overarching principle 6)

Resources are never infinite and are usually very limited. In order to achieve the successful implementation of the EcAp Roadmap in a cost-efficient manner, areas that are under higher pressures and the biota that are known to be more sensitive should be identified, should be monitored more frequently. Furthermore, increased monitoring effort may be needed in areas that are close to the boundary of GES in order to increase confidence in assessment and, consequently, in the decision to take measures.

The precautionary principle requires that measures should be taken even in areas where there is uncertainty if the status is good or less than good. This uncertainty may be due to limited understanding of what GES is for certain areas. The implications of the precautionary principle in monitoring are that these areas of uncertain status may require research.

ANNEX I

Indicative list of characteristics, pressures and impacts to be addressed in the ECAP integrated monitoring programme

Table1. Characteristics

Physical and chemical features

- Topography and bathymetry of the seabed,
- annual and seasonal temperature regime, current velocity, upwelling, wave exposure, mixing characteristics, turbidity, residence time,
- spatial and temporal distribution of salinity,
- spatial and temporal distribution of nutrients (DIN, TN, DIP, TP, TOC) and oxygen,
- pH, pCO₂ profiles or equivalent information used to measure marine acidification.
- Topography of coastal ecosystems and landscapes

Habitat types

- The predominant seabed and water column habitat type(s) with a description of the characteristic physical and chemical features, such as depth, water temperature regime, currents and other water movements, salinity, structure and substrata composition of the seabed,
- identification and mapping of special habitat types, especially those recognised or identified under regional convention protocols, directives and agreements or international conventions as being of special scientific or biodiversity interest,
- habitats in areas which by virtue of their characteristics, location or strategic importance merit a particular reference. This may include areas subject to intense or specific pressures or areas which merit a specific protection regime.

Biological features

- A description of the biological communities associated with the predominant seabed and water column habitats. This would include information on the phytoplankton and zooplankton communities, including the species and seasonal and geographical variability,
- information on angiosperms, macro-algae and invertebrate bottom fauna, including species composition, biomass and annual/seasonal variability,
- information on the structure of fish populations, including the abundance, distribution and age/size structure of the populations,
- a description of the population dynamics, natural and actual range and status of species of marine mammals and reptiles occurring in the marine region or subregion,
- a description of the population dynamics, natural and actual range and status of species of seabirds occurring in the marine region or subregion,

— a description of the population dynamics, natural and actual range and status of other species occurring in the marine region or subregion which are the subject of regional conventions, protocols, directives or international agreements,

— an inventory of the temporal occurrence, abundance and spatial distribution of nonindigenous, exotic species or, where relevant, genetically distinct forms of native species, which are present in the marine region or subregion.

Other features

— A description of the situation with regard to chemicals, including chemicals giving rise to concern, sediment contamination, hotspots, health issues and contamination of biota (especially biota meant for human consumption),

— a description of any other features or characteristics typical of or specific to the marine region or subregion.

Table2. Pressures and impacts

Physical loss

— Smothering (e.g. by man-made structures, disposal of dredge spoil),

— sealing (e.g. by permanent constructions).

— Change in land use of coastal ecosystems and landscapes.

Physical damage

— Changes in siltation (e.g. by outfalls, increased run-off, dredging/disposal of dredge spoil),

— abrasion (e.g. impact on the seabed of commercial fishing, boating, anchoring),

— selective extraction (e.g. exploration and exploitation of living and non-living resources on seabed and subsoil).

Other physical disturbance

— Underwater noise (e.g. from shipping, underwater acoustic equipment),

— Marine litter,

— Beach cleaning by mechanical means, sand mining, beach sand nourishment.

Interference with hydrological processes

— Significant changes in thermal regime (e.g. by outfalls from power stations),

— significant changes in salinity regime (e.g. by constructions impeding water movements, water abstraction).

Contamination by hazardous substances

- introduction of non-synthetic substances and compounds (e.g. heavy metals, hydrocarbons, resulting, for example, from pollution by ships and oil, gas and mineral exploration and exploitation, atmospheric deposition, riverine inputs),
- Introduction of synthetic compounds (which are relevant for the marine environment such as pesticides, antifoulants, pharmaceuticals, resulting, for example, from losses from diffuse sources, pollution by ships, atmospheric deposition and biologically active substances),
- introduction of radio-nuclides.

Systematic and/or intentional release of substances

- Introduction of other substances, whether solid, liquid or gas, in marine waters, resulting from their systematic and/or intentional release into the marine environment, as permitted in accordance with other regional obligations and/or international conventions.

Nutrient and organic matter enrichment

- Inputs of fertilisers and other nitrogen and phosphorus-rich substances (e.g. from point and diffuse sources, including agriculture, aquaculture, atmospheric deposition),
- inputs of organic matter (e.g. sewers, mariculture, riverine inputs).

Biological disturbance

- Introduction of microbial pathogens,
- introduction of non-indigenous species and translocations,
- selective extraction of species, including incidental non-target catches (e.g. by commercial and recreational fishing).

Annex II

Alternative monitoring approaches that could be of value for an effective monitoring of the spatial scale relevant for the ECAP UNEP MAP

1) Moorings and buoys

Moored and free-floating buoys have a long history of use in oceanography and coastal sciences, measuring a large variety of important physical, chemical and biological variables such as salinity, temperature, turbidity, dissolved oxygen, trace metals, pCO₂ and others, depending on the number of instruments they can handle.

Data can be measured at high frequency at strategic sites and at different depths owing to sophisticated profiling equipment. Data are then transmitted in real-time to land-based observatories via communication satellites. The efficiency of buoys has been considerably increased owing to advanced technology including solar storage batteries, data logging controller, environment-friendly antifouling coatings. The ARGOS buoy network provides data from buoys which are periodically sinking to depth and transmit the data when surfacing.

Offshore spatial coverage is provided. Periodic visits for maintenance and cleaning of instruments is required. Provides point measurements over the water column.

2) Ships of opportunity / FerryBox system

The use of volunteer merchant vessels to gather oceanographic data is an important cost-effective component of any monitoring programmes. As for the moorings, ships of opportunity can be fitted with various instrumentations to collect data related to physical, chemical and biological oceanography. As an alternative to often expensive and time-consuming research vessels, merchant fleet and specifically ferries offer a regular line sampling frequency across a wide range of water types. The so-called FerryBox system consists of an automatic flow-through system pumping sea water on the side of the ship and propelling it in an internal loop at constant velocity to conduct the various measurements. The FerryBox community is continuously increasing and represents ca. 20 different institutions in Europe. More details on the system and the operating companies can be found at <http://www.ferrybox.org>.

Offshore spatial coverage is provided. Transect measurements at one depth level (surface or sub-surface), use of fishery vessels for sampling.

3) Continuous Plankton Recorder (CPR)

The CPR is a plankton sampling instrument designed to be towed from ships. The CPR is towed at a depth of approximately 10 metres. Water passes through the CPR and plankton is filtered onto a slow-moving band of silk. In the laboratory CPR samples are analyzed in two ways. The Phytoplankton Colour Index (PCI), a semiquantitative estimate of phytoplankton biomass, is determined for each sample. Then, microscopic analysis is undertaken for each sample, and individual phytoplankton and zooplankton taxa are identified and counted. CPR can sample larger areas than other phytoplankton and zooplankton devices such as bottles and nets. Data on biomass that are needed for many indicators can easily be taken while taxonomic identification needed for other indicators needs the same skills and human power as with any other sampling method.

CPR has also been used to monitor micro-litter in the water column. However the CPR samples at approximately 10m depth and so will not sample floating debris.

Offshore spatial coverage is provided. The device needs to be towed from a special vessel with a specific speed.

4) Underwater video & Imagery

Video can be used to take images of both the sea-bed and the water column. Video cameras can be tethered to oceanographic vessels as well as other non-research vessels (ferries, fishing vessels, ships of opportunity). Depending on the quality of the images recorded they can provide information on the structure of the seabed, the composition and abundance of macroscopic benthic biota and the composition and abundance of macroscopic pelagic biota. Non-living items, such as litter, can also be recorded. The technique performs well in terms of resolution and information content but not so good in relation to workload and areal coverage.

Offshore spatial coverage is provided. This is better applied to benthic habitats and biota. Taxonomic resolution is not always comparable to the one achieved by traditional tools (eg. grabs, corers), applicable to surveys of marine litter including image acquisition and recognition technology.

5) Underwater acoustics

Hydroacoustics (echo sounding or sonar), is commonly used for detection, assessment, and monitoring of underwater physical and biological characteristics. The very efficient transmission of sound in water makes this remote-sensing technique highly effective in most aquatic ecosystems and under many environmental conditions providing a valuable complement to capture-based sampling techniques.

Sonars can be used for the detection of animal and plant populations and provide some information on their abundance, size, behavior and distribution. They are already widely in use in the marine environment both by fishermen and by fisheries scientists for the investigation of fish populations. Hydroacoustic surveys provide for non-intrusive methods for quantifying the abundance and distribution of fish. Advances in acoustic technology, and especially data analysis software, have made this survey method even more powerful in recent years. While there are limitations in terms of species identification, acoustic surveys used in conjunction with other methods or as a relative measure, provide a quantifiable metric over the years.

Validation should occur simultaneously through the use of high resolution sonar imaging, underwater cameras, and other methods.

Sonars are also used for habitat mapping (mainly depth, bottom roughness and hardness reflecting differences in sub-stratum types). More recently, the combination of different hydroacoustic methods (i.e. single beam echosounder, multi-beam sonar and side scan sonar) enables the spatial classification of the seafloor and its vegetation. The resulting 3 D images are of the same quality and precision as those found in the field of biomedicine.

Recording of sounds produced by marine animals (mainly mammals) could possibly provide info on their population abundance, their movements and location of their habitats. A related project is running in Catalonia: <http://listentothedeep.com/>.

Offshore spatial coverage provided. Taxonomic identification is not always at the species level.

6) Remote sensing

Earth Observation (EO) from satellite provides information at unprecedented time scales over large and distant areas of the world ocean in a real cost-effective way, where only few observations can be conducted by traditional methods using oceanographic vessels. Satellite remote sensing techniques also grant consistent methodologies while capturing the regional and local variability at a frequency nearly compatible with the dynamics of marine processes. Such kind of synoptic observations have made important contributions to monitor the state of the marine environment in terms of its physical and biological properties and is increasingly used to foster sustainable management of the marine and coastal resources, including fisheries.

Optical sensors on-board satellite (e.g. MERIS on ENVISAT; <http://envisat.esa.int/instruments/meris>) relates to the 'colour' of the sea surface, which varies with the concentration and composition of a large variety of living and non-living material in suspension. An important quantity is the concentration of chlorophyll, an omnipresent pigment in all phytoplankton species commonly used as an index of phytoplankton biomass. Other products of interest include total suspended matter, pigmented fraction of dissolved organic matter, as well as some indication of phytoplankton functional groups. Data can be accessed freely through space agencies or via specific web sites such as the Environmental Marine Information System from the Joint Research Centre (<http://emis.jrc.ec.europa.eu>).

Offshore spatial coverage provided. Passive optical and thermal sensors are of limited use under cloud cover and low sun angle. The taxonomic resolution is restricted to phytoplankton functional groups.

7) Autonomous Underwater Vehicles (AUVs) and Gliders

The development of AUV technology for marine and coastal studies has increased considerably over the last decade as an alternative to costly and heavy logistic demand of research vessels. AUVs are free-swimming torpedo-shaped devices remotely operated from the surface within the range of the telemetry system onboard.

Owing to a number of propulsion techniques most often powered by rechargeable batteries, AUVs can cover large distance (ca. 10 miles) at various depths to provide a 3D view of the water column. Gliders are specific AUVs propelling themselves using buoyancy-based techniques, increasing the underwater autonomy of the vehicle for observations of longer time-scale features. The scientific payload of AUVs and gliders can be set with physical and bio-optical instruments measuring water quality variables (such as nutrients and contaminants), phytoplankton biomass, in addition to physical and geochemical properties such as temperature, oxygen, conductivity. They can also transport video-cameras to get pictures of organisms (mostly pelagic) and/or debris and also detectors of passive acoustic signals. The European Gliding Observatories (EGO; <http://www.ego-network.org/>) has been set up to promote the use of glider technology in marine and coastal studies, to share data, and to provide technical advices and training.

Offshore spatial coverage is provided. The cost depends on the onboard instrumentation. Considerable technical expertise is required.

Annex III

Research Projects relevant for an effective integrated monitoring programme for UNEP MAP

- 1) **CleanSea** <http://www.cleanease-project.eu> (Towards a Clean **Litter**-Free European Marine Environment through Scientific Evidence Innovative Tools and Good Governance) aims at providing knowledge and tools to be able to better define, monitor and achieve GES. CleanSea looks at marine litter impacts on ecosystems, its monitoring and characterization, remediation techniques, the economic dimension of the issue and the policy options to address it. The result is a Roadmap to Good Environmental Status for Marine Litter in 2020 derived from a transparent, coherent synthesis in an integrated assessment framework of natural and social science research outcomes and stakeholder's needs and perceptions.
- 2) **CoCoNET** <http://www.coconet-fp7.eu> (Towards COast to COast NETworks of **marine protected areas** (from the shore to the high and deep sea, coupled with sea-based wind energy potential) focuses on MPAs, including coastal, off-shore and deep sea habitats, and will individuate areas where offshore wind farms might become established, avoiding too sensitive habitats but acting as stepping stones through MPAs. The project will produce the guidelines to design, manage and monitor network of MPAs, and an enriched wind atlas for the Mediterranean and the Black Seas.
- 3) The **CREAM** <http://www.cream-fp7.eu> FP7 project (Coordinating Research in support to application of Ecosystem Approach to **fisheries** Management advice in the Mediterranean and Black Seas) will be based on existing data and will propose a series of key prioritized indicators, models and methodologies for the implementation of the ecosystem approach for fisheries in the Mediterranean and Black Seas. More related to monitoring, it will develop protocols for data collection and quality evaluation.
- 4) The **DEVOTES** <http://www.devotes-project.eu> project (Development Of innovative Tools for understanding **marine biodiversity** and assessing good Environmental Status <http://www.devotes-project.eu/>) addresses specifically marine biodiversity (D1, 4 & 6) and is closely related with the implementation of the MSFD. It started in 2012 and aims at improving understanding of human activities impacts (cumulative, synergistic, antagonistic) and variations due to climate change on marine biodiversity, using long-term series (pelagic and benthic). It starts from cataloguing indicators (including the ones proposed by the EC) and critically reviewing them in relation to their response to pressures and their geographical scope. The gaps that will be revealed will be covered by the development of amended, new and innovative indicators for assessment at species, habitats and ecosystems level. It will integrate the indicators into a tool that will allow unified assessment of the biodiversity and status classification of marine waters. Monitoring is also addressed and existing monitoring networks will be reviewed and innovative monitoring techniques (e.g. remote sensing, high definition multibeam, genomics) will be developed. It will also determine the socio-economic implications of maintaining or changing monitoring and management practices in order to support development of cost-effective monitoring systems and cost-effective adaptive management strategies and measures. Furthermore, it will further develop the work of MEECE on models by developing/testing/validating innovative integrative modelling tools to further strengthen our understanding of ecosystem and biodiversity changes (space & time); such tools can be used by statutory bodies, small medium enterprises and marine research institutes to monitor biodiversity, applying both empirical and automatic data acquisition. It will be completed in 2016 but outcomes will be communicated to the MSFD CIS (and to others stakeholders and end users) as soon as they emerge.

- 5) **MEDINA** <http://www.medinaproject.eu/puplic/home.php> is a 3-year European Union funded project aiming at enhancing the capacities of Northern African Countries (Morocco, Algeria, Tunisia, Libya and Egypt) to monitor their Mediterranean **coastal ecosystems**. The project is oriented towards a full integration of coastal monitoring into GEOSS, taking full advantage of the tools available upon the Group of Earth Observation (GEO) and contributing to GEO activities and Communities of Practice.
- 6) The **MedSeA** <http://medsea-project.eu> FP7 project (Mediterranean **Sea Acidification** in a changing climate) addresses marine acidification in the Mediterranean and, among other things, will generate new observational and experimental data on Mediterranean organism and ecosystem responses to acidification and fed into existing fine-scale models of the Mediterranean Sea that are modified to better represent key processes, and then used to project future changes. The outputs of the project could be potentially useful for Member States considerations on addressing this emerging pressure.
- 7) The aim of **MERMAID** <http://www.seas-era.eu/np4/20.html> project is to provide additional scientific understanding for assessing GES in a coherent and holistic manner by a state of the art methodology that will be developed and applied in three study areas of the Mediterranean Sea (the Gulf of Lions, Saronikos Gulf and Cilician basin); set targets for the achievement of GES; and proceed with linking management measures designed for these areas to the targets. Five descriptors for 'Good Environmental Status' (GES) were selected to be the main focus of this study related to **fisheries** (D3), **hydrology** (D7), **chemical pollution** of the environment (D8) and biota (D9) and **marine litter** (D10). These descriptors are selected based on the existing knowledge related to the main pressures exerted on the ecosystem of the study areas, on the direct societal impact of these pressures, as well as on already identified data/knowledge gaps that need further scientific support that the project aims to provide.
- 8) **MESMA** <http://www.mesma.org> is an EU-FP7 project on monitoring and evaluation of **spatially managed marine areas** (2009-2013). Monitoring related outputs include the Katsanevakis et al. (2012) and the Stelzenmüller et al. (2013) publications. The first reviews monitoring methods for marine populations such as plot sampling, distance sampling, repetitive surveys for occupancy estimation and modeling, mark-recapture techniques and removal methods for specific biodiversity components. The second provides guidance on the selection, mapping, and assessment of ecosystem components and human pressures, the evaluation of management effectiveness and potential adaptations to management.
- 9) The **MyOcean2** <http://www.myocean.eu/web/76-coastal-marine-environment-description.php> project aims to deliver and operate a rigorous, robust and sustainable **Ocean Monitoring and Forecasting system** of the Global Monitoring for Environment and Security Marine Service GMES to users for all marine applications, including marine resources, marine and coastal environment and climate. MyOcean2 produces and delivers services based on the common-denominator ocean state variables that are required to help meet the needs for information of those responsible for environmental and civil security policy making, assessment and implementation. Frequently requested parameters include temperature, salinity, currents, sea level, chlorophyll-a, dissolved oxygen, nutrients and PAR(light).
- 10) The **ODDEM** <http://www.liv.ac.uk/odemmm> project (Options for Delivering Ecosystem-based **Marine Management**), covers Europe's four regional seas and focuses on supporting implementation of the MSFD by developing tools and understanding required to weigh up options by Member States, Regional bodies and the EC. A tool on pressure assessment http://www.liv.ac.uk/media/livacuk/odemmm/docs/Pressure_Assessment_Guidance.pdf has been developed which identifies the sector/pressure combinations that currently present the greatest threat to marine habitats and their associated assemblages and

its application to Europe's regional seas. This tool will help identifying the key pressures, specifically from human activities, on marine ecosystem characteristics and will allow management action to be focused on the most damaging activities and identify the most vulnerable ecosystem characteristics and consequently, prioritise resources. Although more directly related to measures, this prioritization could also be useful for the establishment of monitoring programmes under the light of the risk-based approach. Furthermore, the ODEMM Linkage Framework http://www.liv.ac.uk/media/livacuk/odemmm/docs/ODEMM_Linkage_Framework.pdf provides a conceptual tool to describe the relationships between the ecological, socio-cultural and economic characteristics of the European marine environment and addresses the integrated approach required by the MSFD. This linkage framework guidance document presents part of this integrated concept by specifically describing the linkages between the MSFD High Level Objectives, the ecological characteristics of the natural environment, and the ecosystem goods and services provided by these ecological characteristics. It can thus be useful for planning the monitoring of the social and economic component.

- 11) The **PERSEUS** <http://www.perseus-net.eu> project (**Policy-orientated marine Environmental Research** for the Southern European Seas (SES) <http://www.perseus-net.eu/>) is also directly related to the MSFD implementation and focuses on the Mediterranean and the Black Seas (SES). The project aims to assess the current environmental status of the Mediterranean and the Black Seas, in a coherent and integrated manner, fill the existing scientific knowledge gaps and then design and support an ecosystem-based approach to management so that the EU goal of Clean Seas by 2020 can become a reality, while conserving the surrounding marine environment. Particularly useful for monitoring is objective 2 on developing tools for the evaluation of the environmental status using existing and upgraded monitoring and modeling capabilities. This objective is intended to propose options which ensure that monitoring and modeling capabilities remain well-coordinated in the long-term. In other words, the project will develop the overall strategy for monitoring the SES using existing structures while developing new ones in line with the latest technological developments. To this end, a small research and survey vessel concept will be also designed for use in areas where currently available research vessels cannot operate effectively and can serve as a scientific survey tool beyond the project's duration. Moreover, modeling systems will address both basin and coastal scales, while tools will explicitly tackle specific quantitative/qualitative descriptors of the MFSD and will support a results-based approach that will allow identification of the most efficient strategies to achieve or maintain GES.
- 12) **VECTORS** <http://www.marine-vectors.eu/> is a multidisciplinary large-scale integrated European Project supported within the Ocean of Tomorrow call of the European Commission Seventh Framework Programme, which aims to improve our understanding of how environmental and man-made factors are **impacting marine ecosystems** now and how they will do so in the future. The project will examine how these changes will affect the range of goods and services provided by the oceans, the ensuing socio-economic impacts and some of the measures that could be developed to reduce or adapt to these changes. The VECTORS project will inform the development and implementation of forthcoming strategies, policies and regulations such as the International Maritime Organization Convention on Ballast Water Management, the EU Maritime Policy and the EU Marine Strategy Framework Directive.

Annex IV

EcAp related integrated monitoring in other Regional Seas Conventions and Commissions, International Bodies

1. Monitoring under the OSPAR Convention

1.1. Background

The OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic commits Contracting Parties to collaborate in regular monitoring and assessment of the state of the marine environment in the maritime area. Annex IV to the Convention provides for cooperation in monitoring programmes, joint quality assurance arrangements, the development of scientific assessment tools, such as modeling, remote sensing and risk assessment strategies, and the preparation of assessments. Environmental assessment and monitoring related work is implemented by each of OSPAR's thematic committees. With OSPAR Recommendation 2010/1 on the Strategy for the Joint Assessment and Monitoring Programme, OSPAR Ministers re-confirmed in 2010 their commitments in relation to the Convention's obligations in relation to monitoring and assessment, including to evaluate the progress in the implementation of its thematic strategies and to support an integrated approach to the protection and conservation of the marine environment through establishing the quality status of all its aspects and identifying priorities for action.

The Joint Assessment and Monitoring Programme sets out the details of cooperation between Contracting Parties on monitoring and assessment requirements. The JAMP 2010-2014 follows the JAMP 2003-2010 which delivered as its endpoint the holistic OSPAR Quality Status Report 2010. It is currently under revision, including with a view to increase further the dual use of monitoring and assessment under OSPAR and MSFD. For the purposes of the MSFD, OSPAR has compiled the status quo for monitoring and assessment in so-called "advice documents" for the MSFD descriptors (with the exception of Descriptor 3 fisheries); the advice documents have been made available to the EU and on CIRCAB.

Convention:

http://www.ospar.org/html_documents/ospar/html/OSPAR_Convention_e_updated_text_2007.pdf

Recommendation 2010/1:

http://www.ospar.org/documents/dbase/decrecs/recommendations/10-01e_JAMP%20recommendation.doc

Joint Assessment and Monitoring Programme (JAMP) 2010-2014:

http://www.ospar.org/html_documents/ospar/html/10-04e_jamp.doc

Advice documents on GES descriptors: Available on the OSPAR website page 'Publications'

1.2. The Joint Assessment and Monitoring Programme (JAMP)

The current JAMP (2010-2014) is mainly orientated at supporting the activities of Contracting Parties in respect of the EU Marine Strategy Framework Directive and has as its end point the establishment of monitoring programmes under the Directive by 2014. The revised monitoring programmes will build on the existing *acquis* of monitoring arrangements which will be adjusted and expanded to monitoring needs of Contracting Parties for the MSFD. The revision will closely link with the common indicators identified by Contracting Parties in 2013

for future use in support of assessments in relation to the good environmental status under the MSFD. This means that in addition to current monitoring (e.g. for eutrophication, contaminants, inputs, discharges, human activities etc.), future monitoring programmes are intended to cover additional parameters relating for example to biodiversity, hydromorphology, foodwebs, litter or noise. The future monitoring programmes will close gaps in current monitoring and will bring the different monitoring activities together into one framework. Many of the existing monitoring activities (e.g. for EcoQOs or human activities) are not yet organised through a formal “monitoring programme” while still following agreed and coordinated approaches, procedures, methods and standards (see monitoring activities at

<http://www.ospar.org/content/content.asp?menu=01511400000000 000000 000000>).

Table3.1. provides an overview of existing data collection systems.

Existing marine monitoring in OSPAR builds on national monitoring and has been further adjusted to link-up with various national monitoring needs. Hence the design of the monitoring programmes takes account of and links up with monitoring for other purposes such as WFD, Habitats-Directive or other national needs. Similar pressure monitoring is orientated towards synergies for OSPAR and other purposes (e.g. EMEP, EEA). Also cooperation between OSPAR and other entities collecting data (e.g. ICES, industry) exist in order to ensure best use of data collected elsewhere also for OSPAR purposes. The ongoing review of existing monitoring arrangements in OSPAR will benefit from an analysis of the need for further approximation of OSPAR and EU technical guidelines (methods, standards, protocols) and their adjustments in the appropriate forum so as to safeguard comparability of data in Europe.

Formal monitoring programmes in place include:

- the *Coordinated Environmental Monitoring Programme (CEMP)*. Its purpose is to assess temporal trend and spatial distribution of concentrations of contaminants in sediment and biota (Cd, Hg, Pb, PCBs, PAHs, TBT, BFRs, dioxins and PFOS), and contaminant-specific as well as general biological effects. It has recently been extended to include, on a voluntary basis (‘pre-CEMP’) measurement pH, total alkalinity, dissolved inorganic carbon and pCO₂ to assess the progression of ocean acidification, and measurement of beach litter to assess temporal trends of litter on selected beaches. Mandatory CEMP-monitoring requires agreed technical guidelines, established QA and assessment criteria. See CEMP monitoring manual <http://www.ospar.org/content/content.asp?menu=00170301000135 000000 000000> and CEMP assessment manual http://www.ospar.org/documents/dbase/publications/p00379_cemp_assessment_manual.pdf
- the *Eutrophication Monitoring Programme* as part of the CEMP (see CEMP monitoring manual). It sets out monitoring requirements for nutrient concentrations (NH₄-N^{2,4}, NO₂-N^{2,4}, NO₃-N^{2,4}, PO₄-P^{3,4}, SiO₄-Si⁴) and supporting parameters (salinity, temperature) as well as for eutrophication effects in (potential) eutrophication problem areas (chl-a concentration, TOC, POC, phytoplankton indicator species, oxygen concentration/saturation, benthic communities)
- the *Comprehensive Study on Riverine Inputs and Direct Discharges (RID)*. Its purpose is to assess trends in riverborne and direct inputs of selected contaminants (Hg, Cd, Cu, Zn, Pb, lindane) and nutrients (ammonia, nitrates, orthophosphate, total N and P, suspended particulate matter) to marine waters. It includes supporting parameters such as salinity and freshwater flow. See RID Principles and associated guidance and guidelines at <http://www.ospar.org/content/content.asp?menu=00920301420000 000000 000000>.

This programme is due to be revised by 2014

- the *Comprehensive Atmospheric Monitoring Programme (CAMP)*. Its purpose is to monitor concentrations of selected contaminants (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, lindane) and nutrients (ammonium, nitrate) in precipitation and air and their depositions in order to assess trends in their atmospheric inputs to the sea. CAMP monitoring and assessment is complemented by periodic emission-based modeled estimates of atmospheric inputs and source-receptor matrices which are commissioned with EMEP. See CAMP Principles and associated guidelines at http://www.ospar.org/content/content.asp?menu=00910301410000_000000_000000. This programme is to be revised in the near future.

Table 1. Existing data collection systems which are not formalized as a “monitoring programme”

Data collection Systems	Basis for reporting, monitoring guidelines and arrangements	Status
Nutrient emissions, discharges and losses	Recommendation 88/2 in the reduction of nutrient inputs to the Paris Convention Area with reporting based on HARPNUt-Guidelines (agreements 2004-2a – 2004-2i, 2007-8) on quantification and reporting of N and P http://www.ospar.org/content/content.asp?menu=0019030300000_0_000000_000000	Halted but under revision for restart
Hg emissions from chlor-alkali industry	Data collection by Eurochlor from chlor-alkali industry	Existent
Discharges of radioactive substances from nuclear installations and non- nuclear Sectors	Suite of Recommendations and Decisions on use and discharge of radioactive substances http://qsr2010.ospar.org/en/ch06_01.html http://www.ospar.org/content/content.asp?menu=0151140000000_0_000000_000000	Existent
Concentrations of radioactive substances in the marine environment	http://www.ospar.org/content/content.asp?menu=0151140000000_0_000000_000000	Existent
Offshore discharges and use of chemicals	Suite of Recommendations and Decisions on use and discharges of offshore chemicals http://qsr2010.ospar.org/en/ch07_02.html http://www.ospar.org/content/content.asp?menu=0151140000000_0_000000_000000 http://www.ospar.org/content/content.asp?menu=0086030536000_0_000000_000000	Existent
Inventory of offshore oil and gas installations	http://www.ospar.org/content/content.asp?menu=0084030534000_0_000000_000000	Existent
Inventory of offshore windfarms	http://www.ospar.org/content/content.asp?menu=0151140000000_0_000000_000000	Existent
Dumping of waste	http://www.ospar.org/content/content.asp?menu=0151140000000_0_000000_000000	Existent
Sand and gravel extraction statistics	Data collection by ICES	Existent

Dumped chemical and conventional munitions	http://www.ospar.org/content/content.asp?menu=0151140000000_0_000000_000000	Existent
MPA network	http://www.ospar.org/content/content.asp?menu=0151140000000_0_000000_000000	Existent
EcoQO monitoring in the North Sea	Spawning tock biomass (ICES), seal populations, harbor porpoises, oiled guillemots	
Fishing for litter Initiative		

1.3. Geographical scope and methodologies

The OSPAR maritime area is a huge area encompassing different biogeographic regions and hydrographic conditions, remote areas beyond national jurisdiction, areas with heavily populated and industrialised coasts and different environmental problems. Monitoring necessarily needs to differ depending on the distribution of ecosystems and their sensitivity and the distribution and extent of human activities. The Quality Status Report 2010 provides an overview of the differences of the OSPAR Regions and provides a background for justifying different monitoring approaches (see Chapters 2 and 12 of the QSR 2010, <http://qsr2010.ospar.org/en/ch02.html> and <http://qsr2010.ospar.org/en/ch12.html>).

Environmental conditions are also taken into account in monitoring methods. For example, EcoQO monitoring currently exists for the North Sea only and will need adjustment (e.g. in relation to indicator species) to allow their application to other OSPAR Regions. Another example is contaminant monitoring in sediments under the CEMP; depending on the sediments, different methodologies e.g. for normalization, apply. On-going work for monitoring in relation of 'biodiversity descriptors' (D1, D2, D4, D6) equally takes account of the wide geographic range of environmental conditions.

1.4. Coordination within and between RSC

OSPAR and HELCOM have common commitments and cooperate on their implementation. When opportunities arise to exchange or mutually adjust practices, these are considered and/or implemented.

Both organisations rely on cooperation with ICES on technical scientific issues, such as monitoring guidelines, which helps coordination of monitoring approaches in both RSCs. A number of Contracting Parties to OSPAR have also coasts in the Baltic Sea and the Mediterranean Sea Regions. This fact is an additional driver for coordination of monitoring approaches in the three marine regions.

HELCOM, ICES and OSPAR currently have active cooperation on data and GIS, aiming to ensure consistency/interoperability and sharing of experience on data management and reporting.

2. Relevant monitoring activities of HELCOM

The HELCOM Monitoring and Assessment Strategy⁵, first adopted in 2005, is a plan laying out a monitoring and assessment system which assists in evaluating whether visions, goals and objectives for the Baltic Sea marine environment are being met:

⁵ http://www.helcom.fi/groups/monas/en_GB/monitoring_strategy

Currently, this strategy is being revised under the HELCOM MORE project (2012-2013). The main idea of the revised strategy is to make a revision of the joint HELCOM monitoring programme in the Baltic Sea so that it is scientifically sound, well-coordinated, optimised and cost-effective. It will provide the necessary data for HELCOM's Baltic-wide indicator-based assessment activities, focusing on the state of the marine environment but also on human-induced pressures impacting the status. In addition, there are manuals and guidelines that describe the methods to carry out the HELCOM monitoring programme. The COMBINE manual⁶ (Cooperative Monitoring in the Baltic Marine Environment Manual), which was instituted in 1992, defines the contributions made by all Contracting Parties and regulates all methods used for monitoring biological parameters, hazardous substances, hydrography and nutrients. Updating this and other manuals will be carried out at a later step in the next biennium.

The ICES Data Centre hosts the database for the HELCOM COMBINE Programme for the Baltic Sea. COMBINE monitoring data can be downloaded from the ICES Oceanographic database. Monitoring data can be also visualized and downloaded in the ICES EcoSystemData map service and from the HELCOM map service.

HELCOM regularly produces a Pollution Load Compilation (PLC) which assesses the data collected by the Contracting Parties on total waterborne loads of nutrients and some hazardous substances to the Baltic Sea. The aim of PLC is to quantify and describe the waterborne discharges and loads. PLC aims also to explain to which extent changes are caused by human activities or natural variations.

The monitoring of radioactive substances is being carried out within a specific HELCOM expert group called HELCOM MORS. The HELCOM CORESET project (2010-2013) develops a set of core indicators for following up the effectiveness of the implementation of the Baltic Sea Action Plan. The core indicators also support the EU Member States in the Baltic Sea region in implementing the EU Marine Strategy Framework Directive. The Monitoring and Assessment Strategy is taking into account the indicators developed by the CORESET project for its revision.

Currently, there are seven components in the HELCOM monitoring programme that are being monitored (See Table 3.2.): Hydrography, nutrients, biological effects, hazardous substances and radioactive. Some of them are on a voluntary basis. All components are included in the revision of the strategy including marine litter and underwater noise which are not currently covered in the COMBINE manual.

There are three groups dealing with monitoring and sharing information about zooplankton, phytoplankton and seal monitoring. They meet every year:

- *HELCOM Zooplankton Expert Network (HELCOM ZEN)*⁷ is a forum to share information about zooplankton research.
- *HELCOM Phytoplankton Expert Group (HELCOM PEG)*⁸ organizes training courses and intercalibrations to ensure and maintain quality standards of phytoplankton monitoring.
- *HELCOM Seal Expert Group (HELCOM SEAL)*⁹ is developing a coordinated monitoring programme for seals.

⁶ http://www.helcom.fi/groups/monas/CombineManual/en_GB/Contents

⁷ http://www.helcom.fi/projects/activities/en_GB/zooplankton

⁸ http://www.helcom.fi/projects/on_going/peg/en_GB

⁹ http://www.helcom.fi/groups/habitat/en_GB/SEAL

Table 2. HELCOM monitoring activities

Components of the HELCOM monitoring programme	COMBINE manual		Pollution Load Compilation (Air and Water)	Included in revised strategy
	Mandatory	Voluntary		
Biological				
Chlorophyll-a/Phytoplankton	●			●
Zoobenthos	●			●
Zooplankton		●		●
Phytobenthos		●		●
Birds				●
Mammals				●
Fish		●		●
Non-indigenous species				●
Hazardous Substances				
PAH (Polycyclic Aromatic Hydrocarbons)			●	●
Metals	●		●	●
Organotins		●		●
POPs (Persistent Organic Pollutants)	●		●	●
Biological effects		●		●
Hydrography	●		●	●
Marine litter				●
Nutrients	●		●	●
Radioactive	●			●
Underwater noise				●

3. Monitoring under the Black Sea Commission (BSC)

According to the basic principles of the Convention on the Protection of the Black Sea Against Pollution and translated into practical steps of the Strategic Action Plan on Rehabilitation and Protection of the Black Sea Against Pollution, the Contracting Parties developed the Black Sea Integrated Monitoring and Assessment Programme (BSIMAP)¹⁰ for the period 2001 – 2006. The first BSIMAP was updated in 2006 and approved by the Black Sea Commission for the period 2006 – 2011. In 2009, based on the Transboundary Diagnostic Analysis (TDA) Report published in 2008, the BSC approved the updated Strategic Action Plan for the Environmental Protection and Rehabilitation of the Black Sea (BSSAP 2009). The BSSAP 2009 is based on the four Ecosystem Quality Objectives (EcoQOs) addressing the main transboundary issues identified in the TDA Report: preservation of commercial marine living resources; conservation of Black Sea biodiversity and habitats; reduction of eutrophication; good water quality for human health, recreational use and aquatic biota.

¹⁰ http://www.blacksea-commission.org/_bsimap.asp

The aim of the integrated monitoring programme is to provide data for assessing the ecological status of the Black Sea ecosystem. The BSIMAP was initiated as activities affordable by the all Black Sea countries in terms of mandatory parameters, optional parameters, monitoring frequencies and monitoring sites. The Black Sea countries agreed to provide the raw data for the agreed parameters using comparable metrics in order to harmonize the monitoring (frequencies, sites, indicators) and to assess the ecological status of the Black Sea ecosystems.

The Black Sea Commission notably approved a guiding document for the commencement of BSIMAP based on the OSPAR Joint Monitoring and Assessment Programme and an initial integrated monitoring programme was implemented in 2003. The basic principles of the WFD were considered and followed to the extent possible.

The monitoring programme of each country differs as every country has its own legislation. However mandatory and recommended parameters (see Table 3.3) have been set up through the work of the Pollution and Monitoring Assessment Advisory Group (PMA AG). The frequency of sampling, number of cruises, number of sampling points, the sampling media (water, sediment and biota) also differ. The institutions involved in the monitoring process are very different from one country to another. The funding of monitoring is an important challenge for all countries. To minimize the costs of monitoring, under Grant Agreement Baltic2Black, a small scale project funded by the EC DG Environment for the period 2011-2013, a feasibility study to use remote sensing and automated systems to monitor the eutrophication parameters was considered, extending the monitoring from the coastal area to the offshore.

The BSIMAP comprises of the following features:

1. the formulation of common principles and a platform for the elaboration of a regionally coordinated monitoring and assessment system (COAST; Black Sea Integrated Monitoring and Assessment System, WFD principles)
2. establishment of an initial affordable monitoring programme in order to harmonize assessment methodologies, analytical techniques, commonly agreed reporting formats and other relevant components important for the harmonization of the monitoring and assessment of the Black Sea environment
3. establishment of approaches for the elaboration of environmental quality criteria/objectives
4. establishment of a mechanism for the integration of scientific results into the assessment process (ARENA, IAEA, other scientific projects)
5. elaboration of mechanisms and procedures for quality assurance and quality control
6. elaboration and maintenance of the Black Sea Information System for supporting the decision making process of the Black Sea Commission
7. setting up the preparatory process for the compilation of the State of the Black Sea Environment report.

The development of BSIMAP was initially supported by GEF through the various environmental projects implemented in the region.

According to agreed Terms of Reference, the PMA AG is involved in the coordination of monitoring activities and the PMA Activity Centre is involved in developing methods, the regional database and harmonization of country activities.

The monitoring activity is mostly focused in coastal waters. A limited number of countries monitor the open sea; the activity is not on a regular basis and depends primarily on on-going projects. A number of countries (Romania, Turkey and Bulgaria) recently revised their monitoring networks however the monitoring frequency is not always consistent. Data regarding the status of the open sea are therefore limited or lacking due to the shortage of funds.

While the monitoring system has improved since 2003, with an increase in the number of sampling stations, mandatory parameters, especially for biota and sediments are not covered by all countries. Water quality classification and the establishment of reference conditions are important unresolved issues.

A new draft BSIMAP has recently been prepared, with the support of EU funding, taking into consideration the EcoQOs stated in the 2009 BSSAP and the ecosystem approach requirements of the MSFD.

Table 3.3. Parameters of the Black Sea Integrated Monitoring and Assessment Programme

Mandatory					Optional
Water - Eutrophication	Biota contamination	Biota	Water-pollution	Sediments pollution	Optional parameters
BOD ₅	Heavy metals (Cd, Cu, Hg, Pb)	Phytoplankton (total density, total biomass)	TPH	Particle size	Radioactivity
N (NH ₄)	Persistent pesticides (organochlorine pesticides)	Chlorophyll "a"	Cd	Description of sediments	Heavy metals (Co, Cr, Fe, Zn, Ni)
N (NO ₂)	PCBs	Mesozooplankton	Cu	Heavy metals (Cd, Cu, Hg, Pb)	Persistent pesticides (organochlorine pesticides)
N(NO ₃)		Biomass of Noctiluca	Hg	Pesticides (DDT, DDD, DDE, Lindane)	Detergents
N total		Macrophytobenthos	Pb	PCBs	Alkalinity
O ₂ (dissolved and saturation)		Macrozoobenthos		Total hydrocarbons	
P (PO ₄)		Fish landing (annually)			HCH
P total					TOC
SiO ₄					Phenols volatile

pH					Conductivity
Salinity					PAHs
Secchi depth					TOC
Temperature					HCH
Total suspended solids (TSS)					