



MONITORING AND FORECASTING ACTIVITIES

(An Extract from IASON/WP6/D6.1: Report on Existing or Planned Monitoring Activities and Suggestions for Optimal Modification)

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A1

The presentation is focused on monitoring and forecasting which is an extract from D6.1

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Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Mediterranean (Barcelona Convention Area)

The Barcelona Convention constitutes the legal framework of Mediterranean Action Plan which is a cooperative effort involving 20 countries and EU that committed themselves to prevent/abate/combat and to the fullest possible extent eliminate pollution of the Mediterranean Sea Area and to protect/enhance the marine environment in that area so as to contribute towards its sustainable development.

Policy requirement for the establishment of monitoring systems in the Mediterranean Sea area (from Gibraltar to Dardanelles) basically originates from the Convention (*Article 12*) and three of its six protocols namely:

- **Land Based Sources Protocol**
- **Protocol for preventing operational pollution from ships and in cases of emergency**
- **Protocol for SPA and biological diversity**





Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

- Land Based Sources Protocol

The Protocol concerns the Mediterranean Sea area as well as its hydrological basin, waters on the landward side up to the fresh-water limit, brackish and coastal salty waters inc. marshes, coastal lagoons and ground waters communicating with the sea.

Article 8 of the protocol requires launching of monitoring programmes by the countries

- to assess the levels of pollution along their coasts
- to evaluate the effectiveness of action plans, programmes and measures (e.g. pollution reduction)

The MED POL Programme is since 1975 responsible for establishing at the regional level a pollution monitoring system with common procedures and standards. The implementing bodies at the national level are national institutes designated by the Parties.



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MED POL Monitoring activities will be detailed later in the presentation since it is the most operational and comprehensive programme concerning monitoring

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Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

- Protocol for preventing operational pollution from ships and in cases of emergency

The Protocol concerns the Mediterranean Sea area as defined in the Convention, open sea and coastal waters from Gibraltar to Dardanelles

Article 5 states that Parties shall develop and apply monitoring activities to prevent/detect/combat pollution of the sea by oil, hazardous and noxious substances

REMPEC (one of the RACs of MAP) is the regional implementing body of the Protocol. The Parties have reporting obligations on incidents, spills etc. and to transmit the required information to REMPEC.





Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

- Protocol for Specially Protected Areas and biological diversity

The Protocol concerns the Mediterranean Sea area, including the seabed and its subsoils, waters, seabed/subsoils on the landward side up to the fresh-water limit and the terrestrial coastal areas including wetlands

Articles 3 and 20 of the Protocol state that the Parties shall:

- identify/compile inventories of the components of biological diversity
- identify/plan/undertake scientific and technical research and monitoring programmes necessary for identification/protection of protected areas and species and assessing the effectiveness of management and recovery plans

The SPA/RAC of MAP is the Protocol's regional implementing body. The competent authorities designated by the Parties are responsible for reporting on SPAMIs and the species lists to SPA/RAC.





Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Monitoring design for the LBS Protocol and the concerned SAP

MED POL Phase III Programme:

1. Monitoring of levels and trends of pollutants basically for the state assessment of coastal waters
2. Eutrophication monitoring (pilot) at coastal waters including lagoons where problems exist or potentially present
3. Compliance monitoring of effluents and bathing/shellfish waters applied with national/regional legislation
4. Monitoring and assessment of loads of pollutants from point and non-point sources
5. Monitoring of biological effects (pilot) for the impact of pollutants at the molecular level



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These activities are subject to revision according to the recently adopted principals of MED POL Phase IV. The operational document of the new phase is under preparation and will be finalized in 2006-07.

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Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Monitoring design for the LBS Protocol and the SAP in MED POL III

	Levels and trends of contaminants at coastal waters including hot spots and reference areas		Loads from point and diffuse sources of pollution		Biological effects
Parameters (Matrices)	Mandatory	Recommended	Mandatory	Recommended	Mandatory (pilot)
	Hg and Cd (biota and sediment)	Other heavy metals, halogenated and chlorinated organic contaminants, PAHs	pH, T, Hg, Cd, TSS, BOD ₅ , COD, TP, TN, FC. (effluents, river water, air)	Other heavy metals, HH+, detergents, phenols etc. depending on the character of the input	LMS DNAx EROD MT Stress on stress (biota)
Sampling frequencies	At least once per year for biota at the pre-spawning period & annually or less frequently for surface sediments at the most stable hydrographic conditions		From weekly to seasonal depending on the matrix and the nature of the input (e.g. discharge character)		Quarterly or semi-annually inc. pre-spawning period

<http://195.97.36.231/medpol/>

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- 1) These activities are subject to revision according to the recently adopted principals of MED POL Phase IV. The operational document of the new phase is under preparation and will be finalized in 2006-07. Major changes in the compliance monitoring component might be expected therefore not presented here. The way it is applied in Phase III is presented in D6.1
- 2) Less frequently in sediments means e.g 5 years depending on the sediment accumulation
- 3) In Phase IV, monitoring of loads will be designed more as an assessment effort where models (for diffuse sources including inputs via rivers) and other methods of estimations (like NBBs for industrial effluents) will be used and monitoring and/or already available data will be used as needed (e.g. verification of models and estimations)
- 4) Substance list for monitoring of coastal waters will be updated to make it in line with those prioritized in the SAP
- 5) For the new organization of biological effects monitoring in Phase IV, the two-tiers approach has been proposed which considers LMS, stress on stress and and mortality as core biomarkers that can be easily applied by any MED-lab and then a battery of biomarkers will be analyzed by competent labs of the region.
- 6) Information and an inventory of activities can be found in the web site as well as in the last evaluation report of the 3rd review meeting of MED POL III monitoring activities. Both mentioned below in the slide

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Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Monitoring design for the LBS Protocol and the SAP in MED POL III

Eutrophication Monitoring

Temperature	Dissolved oxygen (measured and saturated)
pH	Chlorophyll "a"
Transparency	Total Nitrogen
Salinity	Nitrate
Orthophosphate	Ammonium
Total phosphorus	Nitrite
Silicate	Phytoplankton (total abundance, abundance of major groups, bloom dominance)

Frequency: Minimum 4/year, 6-12/year recommended.

Station network: Coastal stations and at least 3 transects (min 3 sts at each) for each monitoring site

Sampling depths: Intense surface sampling and vertical profiles at the possible max number of stations

Purpose: To support TRIX index for surface waters, N/P ratios and trends, phytoplankton determinants.

<http://195.97.36.231/medpol/>

UNEP(DEC)/MED WG.282/3



A6

- 1) Activity is applied with the launch of pilot monitoring and an evaluation is found in the meeting document mentioned in the slide
- 2) An assessment report of eutrophication is under preparation to be finalized in 2007.
- 3) Biological and sediment component of the programme is under development. A first draft for the update of the strategy was discussed in the 3rd Review Meeting (Dec 2005) The Strategy document (2003) can be downloaded from the website.

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Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Monitoring/inventorying of biodiversity through SAP-BIO targets/actions to address the Protocol for SPA and Biodiversity

Priority actions of SAP-BIO:

1. Make a complete and integrated inventory (by sub-region) of Mediterranean coastal, wetland, and marine sensitive habitats

Objectives

- Description and GIS-based mapping of the spatial distribution of the sensitive habitats
- Complete checklist of species associated with each sensitive habitat
- Long-term routine monitoring programmes, in order to define temporal variability of abundance, biomass and other assemblage variables within sensitive habitats
- Elaborate national checklists for marine and coastal species for all the Mediterranean countries





Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Monitoring/inventorying of biodiversity through SAP-BIO targets/actions to address the Protocol for SPA and Biodiversity

Priority actions of SAP-BIO (cont.):

2. Establish a monitoring system of endangered and threatened species

Objectives

- Implement a monitoring system for endangered species at regional level
- Establish and update the health and risk status of endangered populations





Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Monitoring/inventorying of biodiversity through SAP-BIO targets/actions to address the Protocol for SPA and Biodiversity

Priority actions of SAP-BIO (*cont.*):

3. Promote the adequate monitoring and survey of the effectiveness of marine and coastal protected areas

Objectives

- Implement sound scientifically-based monitoring programmes on the effectiveness of marine and coastal protected areas
- Improve methods of management planning, implementation and monitoring





Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Monitoring/inventorying of biodiversity through SAP-BIO targets/actions to address the Protocol for SPA and Biodiversity

Priority actions of SAP-BIO (*cont.*):

4. Identify, develop, and validate adequate biological and socio-economic indicators to assess the ecological health of sensitive habitats and species, and to evaluate the effectiveness of management measures

Objectives

- Elaborate a regional strategy on SAP BIO indicators
- Elaborate a list of useful SAP BIO indicators
- Existing and new data collected to construct selected SAP BIO indicators
- Construct SAP BIO indicator set starting from the collected data
- Validate selected SAP BIO indicators





Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Black Sea (Bucharest Convention Area)

Under the framework of the Bucharest Convention on the Protection of the Black Sea against pollution, the six coastal Black Sea States commit themselves to individually and jointly take all necessary measures to prevent, reduce and control pollution (emanating from land-based sources, vessels, dumping, activities on the continental shelf, through the atmosphere, and from transboundary movements of hazardous wastes) in order to protect and preserve the marine environment (inclusive of marine living resources) of the Black Sea.

After the adoption of the related SAP, the initial pollution control approach evolved into a conservation and sustainable use approach





Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Black Sea Monitoring and Assessment Programme (BSIMAP)

An integrated monitoring system initially based on the OSPAR model and tested in the pilot phase of the Programme (2001-2005).

The re-adopted BSIMAP (2006-2010) addresses six policy questions arising from the Convention and the SAP for the Rehabilitation and Protection of the Black Sea.





Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Black Sea Monitoring and Assessment Programme (BSIMAP)

Policy Questions

- 1) Are the regional efforts to combat eutrophication effective and properly reflected in the concentration of nutrients in the Black Sea?
 - Trend analysis of nutrient levels. Assessment criteria would be zero or decreasing trend for nitrogen and phosphorus compounds.

- 2) What are the priority pollutants in the Black Sea and their impact on the ecosystem and human health?
 - Control of background values, trend analysis in water if any. Assessment criteria would be background values.





Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Black Sea Monitoring and Assessment Programme (BSIMAP)

Policy Questions (*cont.*)

- 3) Does pollution reduction in hazardous substances occur?
 - Trend analysis in bottom sediments. Assessment criteria would be background values.
- 4) Is bathing water quality in the Black Sea safe for human health?
- 5) What is the response of biodiversity on main pollution and destruction of habitats?
- 6) Does pollution of biota exceed the human consumption safety limits?
- 7) How does pollution and eutrophication affect the major stocks of marine living resources?





Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Black Sea Monitoring and Assessment Programme (BSIMAP)

	Mandatory monitoring parameters / sampling frequencies	Optional monitoring parameters
	Water	
Eutrophication	Temperature, Salinity, pH, O ₂ (saturation and dissolved), Secchi / 4/year or more TSS, BOD5, PO4-P, TP, NH4-N, NO3-N, NO2-N, TN, SiO3 / 4/year or more Satellite images at regional level	H ₂ S, TOC, Events of hypoxia Satellite images at national level
Priority pollutants	Petroleum Hydrocarbons / 4/year Cd, Cu, Hg, Pb / 1/year	Oil slicks, Lindane, Phenols (volatile & chlorinated), detergents, PAHs Cr, Mn, Co, Fe, Zn, ¹³⁷ Cs, ⁹⁰ Sr
Bathing water quality		Total coliforms, E.Coli, Fecal Streptococci, Visual observations





Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Black Sea Monitoring and Assessment Programme (BSIMAP)

Mandatory monitoring parameters / sampling frequencies	Optional monitoring parameters
Bottom Sediments	
Particle size, description of sediments Cd, Cu, Hg, Pb, DDT, DDD, DDE, Lindane, PCBs, Hydrocarbons total(1/year or every 6 years as recommended by WFD)	TOC, total P, calcination losses Co, Cr, Fe, Zn, Al, Ni, Phenols(chlorinated), PAHs, ¹³⁷ Cs, ⁹⁰ Sr, total radioactivity Any new substance qualified as priority for the Black Sea

Pollution Reduction





Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Black Sea Monitoring and Assessment Programme (BSIMAP)

	Mandatory monitoring parameters / sampling frequencies	Optional monitoring parameters
	Biota	
Response of biodiversity	Chl-a, phytoplankton, mesozooplankton, biomass of Noctiluca / 4/year Macrophytobenthos, Macrozoobenthos, Fish landing(annually)/ 1/year	Fish stocks (annually)
Sea food safety limits	Pollutants in biota {bivalves, fish meat) :	Pollutants in biota {bivalves, fish meat) :
Impacts on marine living resources	Cd, Cu, Hg, Pb, DDT, DDD, DDE, Lindane, PCBs	Co, Cr, Fe, Zn, Al, Ni, Phenols (chlorinated), PAHs, Cs, Sr, Tr, total radioactivity



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A Biodiversity and Landscape Monitoring and assessment programme as required by the draft SAP for the Black Sea Biodiversity and Landscape Protocol has been dealt as an integral part of BSIMAP.

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Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Regional and sub-regional surveys at the project level

Conduction of regional or sub-regional surveys at the project level would be complementary to what has been done and planned within the national monitoring programmes in both Regions.

This approach has been recently adopted by the Mediterranean countries. The MYTILOS Project (2004-2006), developed for the baseline contamination levels of the Western Mediterranean, has been considered by MAP/MED POL. As a continuation, MYTIMED (2006-2007) was developed for the Aegean Sea and the North East Mediterranean and waiting for approval. Similar project proposals for the Adriatic Sea and the South East Mediterranean are still under investigation to be implemented in an acceptable time frame in connection to Mytilos/Mytimed.



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Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Observation and Forecasting Systems

The concept of operational oceanography and the development of monitoring and forecasting systems have been promoted globally through global/regional IOC/GOOS activities to support the sustainable development of the regional sea areas

Initiatives to promote and implement observing and forecasting systems in the Mediterranean and the Black Sea are:

EuroGOOS, MedGOOS, AfricaGOOS, MOON and the BlackSea-GOOS

Networking, capacity building and raising awareness are among their responsibilities.



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Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Observation and Forecasting Systems

System ID	Region	System definition and capabilities
MedGLOSS	Med. & BS 1996- Global/Regional initiative	Sea level observation system operating with NRT monitoring network
MedARGO	Global/ Mediterranean	Global T/S profiling floats providing NRT data to describe the evolving state of the upper world oceans and the patterns of ocean climate variability
Mediterranean Multisensor Moored Array buoy system (M3A)	Mediterranean	NRT monitoring of physical and relevant biochemical and optical parameters
Mediterranean ocean Forecasting System: Toward Environmental Predictions (MFSTEP)	Med Project – continuation of MFSP	Constitutes observation system and a modeling system for forecasts System improvements, technology development



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Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Observation and Forecasting Systems

<u>System ID</u>	<u>Region</u>	<u>System definition and capabilities</u>
POSEIDON	Med- Greek	Operational monitoring system with observational buoys equipped with a variety of sensors to support physical, optical and bio-chemical parameters
MARCOAST	European-Med	Operational detection of oil spills through R/S (SAR) and dispersion forecasting.
ADRICOSM	Med-Adriatic	NRT monitoring system and a NRT basin-shelf marine forecasting system inc. a test case coupling a river basin modelling system and the hydrodynamic modelling of coastal areas
Mediterranean network to Assess and upgrade the Monitoring and forecasting Activities in the region (MAMA)	Mediterranean	Networking and capacity building



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Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Observation and Forecasting Systems

<u>System ID</u>	<u>Region</u>	<u>System definition and capabilities</u>
A Regional Capacity Building and Networking Programme to Upgrade Monitoring and Forecasting Activity in the Black Sea Basin (ARENA)	Black Sea	Networking and capacity building
Black Sea Observation and Forecasting Systems (BSOFS)	Black Sea	Development of BSOFS to address BS-SAP
Black Sea Observation and Prediction Research Project: Initiation of the Black Sea Regional Component of GOOS	Black Sea	



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Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Observation and Forecasting Systems

On the way from *ocean/open sea* to *coastal sea*.

Monitoring and forecasting systems for the coastal waters of concerned regions have been developed and RTD efforts to improve the methods are in progress.

The shelf and coastal marine environment is in many respects more complicated than the open sea, mainly due to the large number and diversity of driving forces (natural and anthropogenic) and the associated pressures on its state/health.

Acceptable operational monitoring and forecasting is still confined to the physical characteristics BUT recently biochemical sensors and satellite remote sensing started to produce reliable time series. HOWEVER, the transition of the related products to an operational mode requires a continuous data flow for routine assimilation and validation.



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Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Observation and Forecasting Systems

Why from *ocean/open sea* to *coastal sea*..

Coastal areas are the major interest for environmental protection agencies at the local and regional level to ensure healthy coastal ecosystems and achieve ICZM objectives.

In this respect, the needs of Barcelona and Bucharest Convention areas are tremendous in terms of environmental and risk assessments, decision-making, predicting the future after actions and measures taken, rehabilitation and protection of ecosystems.

The Coastal Ocean Observations Panel (COOP) of GOOS recognized the needs of Conventions at a global level and recently published "An Implementation Strategy for the Coastal Module of the Global Ocean Observing System" (GOOS report #148, 2005). The COOP report suggests observing strategies that could partially meet the requirements of such Conventions in the short to medium term.



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Monitoring activities current status in the coastal waters of the Mediterranean and the Black Sea

Synthesis and Conclusions

- Monitoring and assessment activities organized in both Convention Areas address certain policy requirements
- At present they are based on different approaches in terms of full integration of ecosystem components and have a different level of implementation
- Considerable geographical gaps in data at both regional and local scale are (or might continue to be) evident in both regions
- The temporal resolution of data is not usually adequate to understand the real status of the environment and to support models
- The inclusion of sites representative of all coastal waters and open seas in routine monitoring efforts (which are usually restricted to inshore and near shore areas), is virtually impossible
- The selection of monitoring sites can not always be made with accuracy
- Finally, even if the programmes are designed for ideal conditions (good sampling design, including all necessary ecosystem components etc), no entity can ensure their smooth implementation because of a lack of financial sustainability.



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Proposed monitoring system requirements for the Mediterranean and Black Seas

Synthesis and Conclusions (*cont.*)

Therefore, the proposed system for monitoring and assessment of environmental and ecosystem quality in the Region should consider these gaps.

In order to fill the gaps in data and information for the basin-wide assessment efforts, two major recommendations could be made:

➤ To further explore the available tools of GOOS related activities and projects in both regions and promote the further development of such activities to address the monitoring requirements of the regional conventions.

Based on applications of MFS and POSEIDON, that provide the larger scale information, an initial coastal observing system could first be developed, as a test case, and its capacity to meet the monitoring requirements could be evaluated for both regions

➤ To promote the organization of regional or sub-regional surveys at project level to complete the data and information gaps evident in both seas to support state assessments with actual and recent data as well as to support various models. (an example: achieving the continuation of the MYTILOS initiative in the Mediterranean Sea in an acceptable time frame)



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Proposed monitoring system requirements for the Mediterranean and Black Seas

When seeking a future approach to **biodiversity monitoring** in the region, an essential requirement is that all opportunities are to be taken and used to monitor biodiversity changes, through the use of individual species that are easy to survey (big macrofauna or macroflora species, charismatic or invasive, and so on), indicator species, or communities.





Proposed monitoring system requirements for the Mediterranean and Black Seas

A future approach to **fisheries monitoring** in the region could draw from the requirements set in the current European regulation on fisheries data collection.

Under this new regulation the priority is to meet the new demands set by the need to move towards a fisheries-based management (fleet- and area- based , rather than fish stock-based) approach and an ecosystem approach.

The intention is to develop a long-term, well-integrated regional sampling programme.

