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Review Meeting of MED POL monitoring activities and the use of indicators

Athens, 12-14 December 2007

REVIEWING MONITORING ACTIVITIES AND THE USE OF INDICATORS

UNEP/MAP
Athens, 2007

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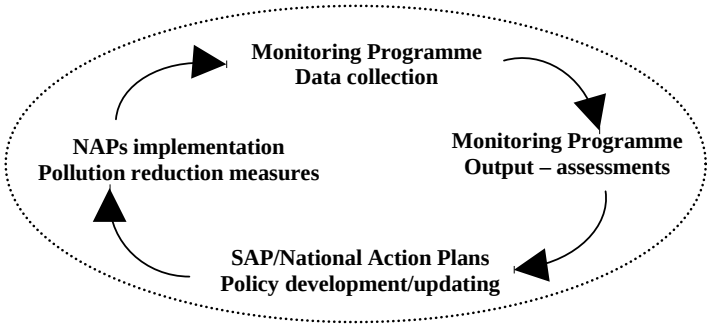
1. Introduction

During the first phases of MED POL the main monitoring objectives were the assessment of the level of pollution and the protection of human health while giving emphasis on capacity building. Since the entry into force of the LBS protocol and the implementation of programmes and measures for the reduction of pollution (in particular the Strategic Action Programme (SAP) to address pollution from land-based activities and the recently endorsed National Action Plans (NAPs)), assessing the effectiveness of measures taken has become the primary objective, as we have to be able to observe and follow the results of our efforts. However, compliance and other types of monitoring remain important.

In fact, MED POL has initiated trend monitoring in time to try to detect any improvement of the situation. However, detecting trends is not an easy exercise as there are a lot of variables that can mask real changes and therefore a very meticulous work is necessary. The figure below depicts the role of the monitoring programme in the cycle of the implementation of the SAP and the NAPs.



Even though pollution monitoring is a legal obligation of the Contracting Parties (art. 12 of the Convention and art. 8 of the LBS protocol), it is still unfortunate that, after so many years, there are still a number of countries in the region, which have not yet been able to establish and routinely carry out a national monitoring programme. Another issue is to see whether those countries that do have a national monitoring programme, were actually able to use the results beneficially for management purposes.

It must be mentioned that with the establishment of a Compliance Committee decided by the Contracting parties and the coming into force of the reporting system, countries will have to indicate their progress in the implementation of the Barcelona Convention and the related Protocols, which also includes monitoring.

2. Review of the elements of monitoring activities

During the last Review meeting of MED POL monitoring activities (Palermo, December 2005), emphasis was given to the presentation of the monitoring data produced. However, as

mentioned above, there are still geographical and temporal gaps. In addition, problems were found in the analysis of data for trends and in their use for management purposes that was not achieved to the extent possible.

At this Meeting, more emphasis will be given to the problems encountered and their solution in an effort to augment their usability. The solution of all problems, so that we can have reliable data from all Mediterranean areas has now become more pressing with the application of the ecosystem approach to the management of human activities. All MAP components will be involved and a road map has already been agreed upon (see section 3.4 below). Having in mind that this new development will influence MED POL activities and that some countries may even decide now to establish or revise their national monitoring programmes, it is now considered useful to review all the elements of the monitoring activities.

2.1 Designing of monitoring programmes

Before attempting to design a monitoring programme, one must first set the objectives. The specific objectives of MEDPOL Phase III relevant to monitoring were:

- **Assessment of all (point and diffuse) sources of pollution**, the load of pollution reaching the Mediterranean Sea, **and the magnitude of problems caused by the effects of contaminants on living and non-living resources**, including human health, as well as on amenities and uses of the marine and coastal regions;
- **Assessment of status and trends** in the quality of the marine and coastal environment as an early warning system for potential environmental problems caused by pollution;
- **Monitoring of the implementation of the actions plans**, programmes, and measures for the control of pollution and the assessment of their effectiveness.

The specific objectives of the monitoring component were:

- To determine temporal trends of some selected contaminants in order to assess the effectiveness of action and policy measures;

- To present periodical assessments of the state of the environment in hot spots and coastal areas (assessments needed to provide information to decision makers on the basic environmental status of the areas which are under anthropogenic pressures); and

- **To enhance the control of pollution by means of compliance to national/international regulatory limits.**

In designing their monitoring programmes, countries were asked to include sampling stations and parameters that would generate information pertaining to the above objectives.

As a result, monitoring programmes included the following components: compliance monitoring (monitoring of loads and health-related monitoring), trend monitoring, and monitoring of coastal areas. In addition, biomonitoring and eutrophication monitoring were added as pilot studies. This approach was selected to respond to the different objectives.

The overall objectives of MED POL Phase IV (2006-2013) relevant to monitoring are:

- **to assess all point and diffuse sources and load of pollution** reaching the Mediterranean, and the magnitude of the problems caused by the **effects of**

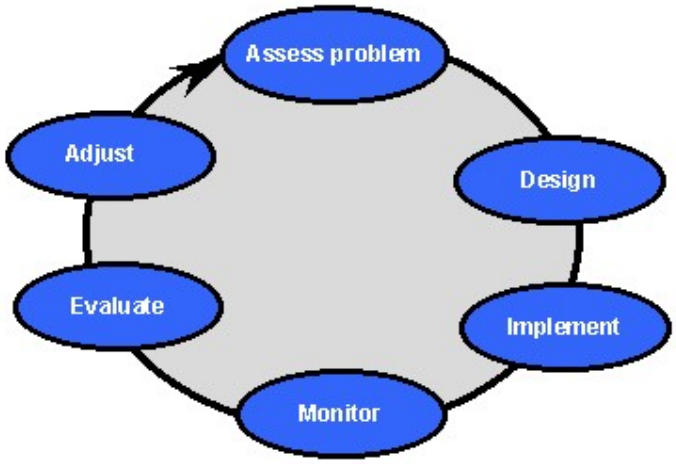
contaminants on living and non-living resources, including human health, as well as on amenities and uses of the marine and coastal regions;

- **to assess status and trends** in the quality of the marine and coastal environment as an early warning system for potential environmental problems caused by pollution and other anthropogenic pressures;

- **to monitor the implementation of the action plans**, programmes and measures for the control of pollution and assess their effectiveness;

- **to contribute, in cooperation with other MAP components, to the application of the ecosystem approach to the management of human activities within MAP, with MED POL as the monitoring and assessment component.**

As can be seen, the objectives of Phase III and Phase IV are alike except for the last one regarding the ecosystem approach. The ecosystem approach to the management of human activities, will, in fact, be applied for the entire MAP, including MED POL, as decided by the Contracting Parties. The ecosystem approach can be considered as complementing the DPSIR (Drivers-pressures-state-indicator-response) approach. Whereas the DPSIR approach has as a general objective, i.e. the reduction of marine pollution, the ecosystem approach includes a vision, strategic goals as well as specific ecological and operational objectives. In addition, the ecosystem approach sets target levels for the indicators and establishes a procedure, using adaptive management, to monitor and review the progress achieved in meeting the objectives as shown below.



Also, within the context of the ecosystem approach, the objectives have to be SMART. According to ICES (2005) SMART means:

Specific. Objectives should clearly specify the state to be achieved and be interpreted unambiguously by all stakeholders.

Measurable. Good objectives should relate to measurable properties of ecosystems and human societies, so that indicators and reference points can be developed to measure progress towards the objective.

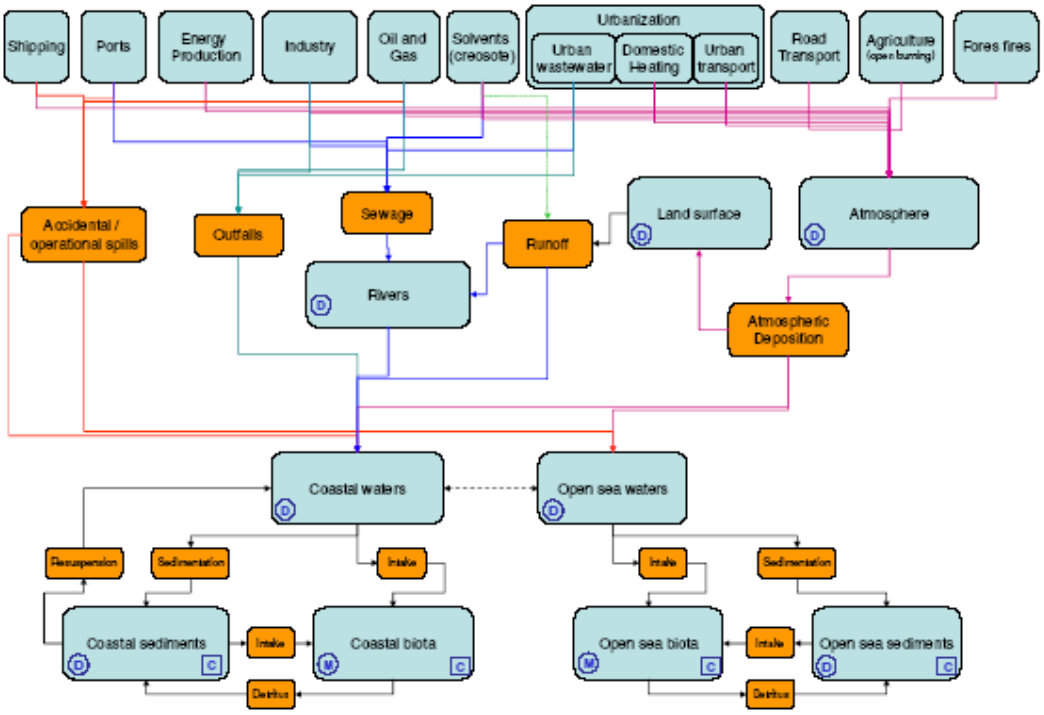
Achievable. Good objectives should not conflict. Within an effective management framework, it should be possible to achieve all objectives. Good objectives should describe a state of the ecosystem, including the position and activities of humans within it, which accurately reflects the values and desires of a majority of stakeholders.

Realistic. Good objectives will be implementable using the resources (research, monitoring, and assessment and enforcement tools) available to managers and stakeholders. Good objectives should reflect the aspirations of stakeholders, such that the majority of stakeholders will strive to achieve them and ensure sustainable development.

Time bound. There should be a clearly defined time scale for meeting objectives.

Before designing a monitoring programme, it would be useful to use the DPS approach to create a simple model as below. This way, monitoring and especially the selection of parameters and matrices would be more targeted to the contaminants at stake. The figure below is a DPS conceptual model of PAHs in the Mediterranean and comes from the Ph.D. thesis of Jordi Peñalba (Technical University of Catalunya, September 2007).

In selecting parameters or substances to monitor, one should not only have in mind the substances listed in the protocols but due attention should also be given to the local conditions. For example, it would not be logical not to monitor a substance in front of a source of that substance, just because it is not included in a list of parameters. Conversely, it would not be logical to keep monitoring frequently a substance that it is not expected to occur in the environment. In other words, **programmes should be designed in such a way so that the results would be useful for management purposes at the national level.** It should be stressed that decisions may be taken by all countries together but when it comes to action it's the individual country that has to act, hence the NAPs; so monitoring must provide information useful for the implementation of the NAPs.



2.1.1 State and trend monitoring

State and trend monitoring can be considered together as the results from trend monitoring can also reflect the state at a certain point in time. However, if the results are going to be used for a regional report it is advised that general coastal stations are used and not hot spots. The state can also be recorded from “snapshot” surveys that are now being implemented using mussels, which are submerged in specific areas for a length of time before analysis. MED POL is involved in such regional activities in the Mediterranean and is a partner of MYTILOS, MYTIMED and ADRIAMED projects.

On the other hand, measures are taken, normally, to improve the situation in hot-spot areas. In such cases, trend monitoring which is defined as the repeated measurement of concentrations or effects over a period of time to detect possible trends, must be employed to assess the effectiveness of measures taken. The major problem in designing monitoring programmes to detect trends, especially when the expected change is of a small magnitude, is to minimize or take into account natural and other variations that mask real changes in contaminant concentrations.

As already stated (MTS 120), a detailed design of an environmental trend monitoring programme should include the following:

- Description of the objective of the trend monitoring programme
- Determination of the stations to be selected for monitoring
- Determination of the contaminants to be measured
- Selection of the sampling matrices
- Determination of the species to be utilized
- Selection of tissues for analysis of contaminants in biota
- The timing and frequency of sampling
- The number of samples and size of specimens to be taken for each sample
- Determination of sampling and analytical methodology

The agreed specific objective for trend monitoring of contaminants in “hot spot” areas was the detection of linear trend of 10% per year in contaminant concentration with a 90% power (i.e. with a 90% probability that the given change in contaminant levels will result in a statistically significant test).

During the last monitoring review Meeting held in Palermo in 2005, a presentation was made of an analysis of the data for trends. This was only possible for data on heavy metals in biota and for those stations for which there were data for at least five years. **While the results were encouraging, a number of problems were identified mainly related to the lack of consistency in the sampling strategy.**

2.1.2 Compliance monitoring

Compliance monitoring, in the framework of MEDPOL Phase IV, will consist of two components:

a) Quantification of pollutant inputs

This type of monitoring deals with the quantification of inputs expressed as loads form point sources based on the National Baseline Budgets of Pollutant Emissions and Releases (NBBs) and aims at following their reduction in view of the application of control measures.

The Mediterranean countries generated their respective NBB for the year 2003 using a harmonized methodology based on Emission Factors (EFs). To this end, MEDPOL developed software that was disseminated throughout the region to national experts to facilitate the preparation of NBBs. The result of this exercise was the establishment of a database (NBB DB) that includes a set of concise, comprehensive and comparable data.

The data and information included in the NBB DB are the following:

- Geographical classification of the national area under concern (Administrative region)
- Information on the types of sources, breakdown into sources, sub-sector, sector according to SIC (Standard Industrial Classification).
- List of pollutants generated by the source
- Quantity of each of the pollutant expressed as kg/year. It has three types of data: a) estimated data based on EFs. b) monitoring data and c) EPER data for Spain, France, Italy which are also based on estimation and monitoring data.

In this framework, monitoring of NBB will be launched every 5 years. This is related to the need to have tangible reduction data taking into consideration the lifetime of pollutants' reduction projects. The second trial will be launched in 2008 and a third one in 2012. An updated format of the NBB software will be disseminated in 2008 to be used as a tool to complete the NBB monitoring for 2008.

Moreover, information obtained from regularly updated national Pollutant Release and Transfer Registers (PRTRs) or similar systems would be most beneficial. **The estimates of pollutant releases should eventually be verified, and the estimation methods used should gradually be replaced by actual monitoring of direct effluent discharges** into the sea.

An assessment of the inputs from rivers and streams within an order of magnitude will be implemented in the framework of the new GEF project (Strategic Partnership for the Mediterranean) in 2008-2009. The assessment report will be used to develop a monitoring programme for inputs from rivers and eventually from diffuse sources.

Diffuse sources notably comprise the atmosphere, run-off and submarine ground water discharges and watershed inputs. **The relative importance of atmospheric inputs of pollutants into the Mediterranean Sea remains an important knowledge gap. In the first instance, this topic can be addressed as a research project whereby an estimation of the role of atmospheric inputs can be made on the basis of a review of existing information, together with modelling, as feasible. The assessment of atmospheric inputs may be gradually implemented through monitoring of atmospheric deposition. Monitoring of atmospheric deposition should be based on a network of coastal stations comprising of, at least one station in each country.**

Similarly, a research mechanism could be used to assess the importance of submarine ground water discharges as a source of pollutants into the marine environment. This could also take the form of a literature review, followed by pilot studies as required. As for inputs from watershed, MEDPOL will make use of the regional state –of-the-art on the subject e.g. the results of EuroHarp project to estimate the order of magnitude of inputs from watersheds.

b) Health-related monitoring

Compliance monitoring as defined by MED POL also includes health related monitoring of coastal marine waters. This type of monitoring is addressed to coastal

recreational water quality activities that are mainly linked to bathing waters and shellfish growing waters, where cultivation of shellfish is practiced.

The joint interim criteria for bathing waters and shellfish growing waters adopted at the Fourth Ordinary meeting of the Contracting Parties (Genoa, 1985) were based on the maximum acceptable concentration of only one indicator organism (faecal coliforms).

Following the implementation of the LBS Protocol, and the introduction of National Monitoring Agreements, compliance monitoring for coastal recreational waters and shellfish growing waters was launched in 1985. Only a limited number of countries submitted monitoring results for sanitary compliance monitoring within their National Monitoring Agreements, during the period 1985-1995. In 1996 the "Assessment of the state of Microbiological pollution of the Mediterranean sea" was prepared. That document attempted to consolidate and update all previous information on the state of microbiological pollution of the Mediterranean sea with particular reference to coastal recreational and shellfish areas through the inclusion of monitoring and research data, drawn from national MED POL monitoring programmes, MED POL research projects, EC annual reports on bathing waters, and other national and international sources.

A major concern was observed when comparing data from EU countries with those from Mediterranean non-EU countries. In fact, the indicators were not only different but even the EU values were stricter than those of the rest of the countries.

In May 2007, an updated report on the assessment of microbial pollution in the Mediterranean was prepared in an effort to provide the most recent information on the subject and also to compare the results of the 1996 report with the data from the past decade. The collection of monitoring data was a difficult exercise, as most of the countries did not submit data through the years, although they obtained them through their national monitoring activities. As a result, the sanitary compliance monitoring activities in the Mediterranean countries were reflected in the new report and the number of countries that have finally submitted the data was significantly increased during the 1995-2005 decade (ref. doc. UNEP(DEPI)/MED W.G.316/Inf.5). A considerable number of countries ranging from thirteen in 1996 to twenty in 2005 have implemented monitoring programmes and have submitted the data for bathing waters compliance.

Around 93% of bathing waters conform to the legislation, and compared with the findings of the past assessment, it shows that the general situation remains unchanged, even with the increase of sampling stations and number of data. There is still a lot to be done for achieving a compliance percentage of about 97-99%, which will provide better degree of safety to the bathers. However, a better look at the national compliance data shows that in some countries including those of the EU, the data conforming to the legislation are in the range of 98-100%, indicating that the compliance percentage in the remaining countries is much less than 98-100% and therefore more efforts have to be made by those countries.

Although the overall quality has shown a very slight decline in recent years (2003-2005), in general there has been an obvious improvement in the quality of Mediterranean bathing waters since 1983. However, following the pattern of the previous years, there is a geographical imbalance in the distribution of the sampling points, the northern and western parts of the region submitting data from a greater number of sampling points than the east and the south. Therefore efforts should be made in order to increase the number of monitoring stations and in parallel to control pollution from land-based sources and activities.

In view of the relative importance of microbial pollution of coastal areas and according to the new operational document for the MED POL Phase IV period (2006-2013), several attempts have been made to follow new criteria and standards for the Mediterranean

countries. It should be noted that in the last years, due to recent advances in the field of epidemiological studies correlating bathing water quality and health effects, the World Health Organization published in 2003 the "Guidelines for safe recreational water environments" and the European Commission launched in 2006 the updated Directive "concerning the management of bathing waters quality", which is based on the WHO guidelines. **Both regulations are based on a common indicator, faecal streptococci, and since more Mediterranean countries joined the European Union, and have to apply stringent legislation, and a number of non-EU countries decided to adopt or follow the European directives, to avoid duplication of efforts by these countries, all countries can monitor for the common indicator.**

During a government-designated experts' meeting, held in Athens (11-12 June 2007), it was agreed to use new criteria and standards for bathing waters that take into consideration the WHO guidelines and are in conformity with the new EC Directive (see document WHO/MED POL EUR/07/5069433/5). A transitional period of five years is provided to all countries, so as to develop the necessary supporting infrastructure related to bathing waters profiles, presenting health risks due to land-based sources of pollution. An outline of the agreed criteria and standards is given in the table below.

AGREED CRITERIA AND STANDARDS FOR BATHING WATERS IN MEDITERRANEAN COUNTRIES

Microbial Water Quality Assessment Category
(based on Intestinal enterococci (cfu/100 mL)

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

Minimum sampling frequency: at least one per month and not less than four in a bathing period including an initial one prior to the bathing period.

* 95th percentile intestinal enterococci/100 mL
** 90th percentile intestinal enterococci/100 mL
- Reference method of analysis: ISO 7899-1 based on membrane filtration technique or any other approved technique
- Transitional period 5 years (starting by 1st January 2008)
(1) For single sample immediate action should be carried out once the count for IE exceeds 500 cfu/100mL

2.2 Sampling strategy

MED POL, realizing the importance of sampling strategy, has put in a lot of effort to prepare agreed strategies for different types of monitoring such as trend monitoring, eutrophication monitoring and monitoring using sediments. Eutrophication and sediment strategies appear as information documents of the present meeting.

The importance of adhering strictly to the sampling strategy for the trend monitoring has already been stressed in the relevant section and lack of consistency was the reason for not being able to analyze the data from certain countries for trends.

In the case of eutrophication, the sampling strategy approved is considered as short-term. What is also important is to agree on assessment methodologies. It is evident from the information received from the countries, in response to a questionnaire, that most countries follow their own national monitoring strategies and assessment methodologies.

Sediments are considered as the final sink of many contaminants; however, their use in monitoring programmes requires a careful sampling design, otherwise interpretation of the results will be difficult. Knowledge of the sedimentation rate in the area, organic carbon content and granulometry of the sediment are very important factors. Also, normalization techniques have to be applied. The sediment manual presented offers two approaches: one, which is simpler and cheaper to use, and one, which is the state-of-the-art.

Even though MED POL National Coordinators have agreed for the preparation of common strategies, it is clear that not everybody follows these. It is hoped that the reasons will be made clear during the discussions of the present meeting.

2.3 Data Quality Assurance

A short presentation of the MED POL DQA activities appears below. It is **considered pertinent to discuss whether these activities are satisfactory and whether they provide the expected results.**

a) Chemical contaminants

The IAEA-MESL has had the prime responsibility of running the data quality assurance programme (DQA) for chemical contaminants for MED POL for the last 30 years.

The DQA comprises several components:

- Reference methods
- Provision of reference materials and standard solutions
- Training in the analysis of chemical contaminants in sediments and biota
- Training in good laboratory practice, including notably QA/QC procedures
- Laboratory performance studies (inter-comparison exercises, proficiency tests)
- Split sample analysis

Particular emphasis was placed on the laboratory performance studies. Such proficiency tests have been held regularly for the determination of both organic and inorganic contaminants. In the alternate years, the test material is either a sediment or biota sample. Laboratories were given about six months to complete analyses and provide results to MESL. The organic compounds encompass petroleum hydrocarbons, including notably polycyclic aromatic hydrocarbons (PAHs); polychlorinated biphenyls (PCBs); several chlorinated pesticides, especially DDT and its breakdown products, and a range of sterols on some occasions. Several metals were tested, especially mercury and cadmium, together with methyl mercury in recent studies.

Overall, participation from laboratories in the region has not been satisfactory. Data are interpreted in terms of a z-score. A combination of z-scores for a range of substances permits classification of the overall performance on a scale of 1 (good) to 4 (poor). Laboratories are given some advice on improving performance. Despite being mandatory for MED POL – designated laboratories, many laboratories have provided results only intermittently. Whereas the improvement in the regional capability to determine trace metals has been noted, the analysis of organic contaminants continues to pose a major analytical challenge for laboratories in the Mediterranean region.

It is believed that the time has come to look closely into these DQA activities that have been going on for more than 30 years and decide whether they should continue or be modified. For example, since 1987 more than 130 people have been trained in the analysis of trace metals and organic contaminants. In many countries, more than ten people have been trained and in one case more than 20. The questions are: Do we not have a sufficient number of trained people in the countries that can also train other people? Should we initiate training on other contaminants? Are countries interested in any specialised courses?

Another issue is the development and publication of standard reference methods. These methods have been widely used in the beginning but judging from the information collected by IAEA during the intercalibration exercises, many laboratories are following modified methods. If there is a consensus for their use, perhaps they should be revised, updated and made available on the web.

b) Biomarkers

The DISAV of the University of Alessandria (Italy) is responsible, on behalf of MED POL, for the data quality assurance of the biomonitoring programme. The DQA programme consists of:

(i) Training courses providing assistance to new researchers to facilitate their integration in the group of scientists already involved in biomonitoring activities in Mediterranean countries. In the framework of this activity, a manual and a video on how to utilise the different biomarker methods (the video was realised in collaboration with RAMOGE) was widely distributed.(ii) Intercalibration exercises to guarantee the comparability of the results. The next intercalibration exercise will take place in 2008 to which non-Mediterranean European laboratories will be invited to participate in the framework of MED POL's cooperation with ICES and the OSPAR and HELCOM Conventions.

In the framework of MED POL's efforts to upgrade the technical capabilities of certain laboratories from LD countries, DISAV has also undertaken to purchase and install the necessary equipment in the labs providing at the same time on-job training. This year the laboratories in Lattakia and Alexandria will benefit.

c) Eutrophication parameters

During the biennium 2003-2004 two training courses took place for the monitoring of eutrophication parameters. Both courses were organized, on behalf of MED POL, by three Italian institutes (ICRAM, CRM and ARPA-ER/SOD) under the coordination of ICRAM. At the same time, a manual for sampling and analysis of nutrients and chlorophyll was prepared and published as MAP Technical Series Report 163 (MTS no.163).

IAEA/MEL organized by in 2005 an exercise through which a set of proficiency test samples on nutrients were distributed initially to the MED POL laboratories participating in pilot monitoring programmes as well as to a few others.

MED POL has recently decided to use the services of QUASIMEME for the organization of intercalibration exercises. An agreement has been signed with QUASIMEME through which fifteen Mediterranean laboratories will be assisted to participate in the activities for the cycle June 2007 to May 2008 and receive test materials for AQ1 (nutrients in seawater), AQ2 (nutrients in estuarine water) and AQ11 (chlorophyll) as appropriate.

2.4 Data collection and reporting

So far, data are collected by countries and reported to MED POL on agreed reporting formats depending on the matrix used and the contaminants analysed. In view of the fact that some countries do not use and do not even consult the explanations on reporting, which provide information on the codes, units required, format, mandatory fields, etc, not all data can be entered into the MED POL database. In most of the cases, however, it is possible to correct the data and this is done by the Secretariat with the help of consultants. There are also cases when the Secretariat cannot help as in the case of missing information. It is most unfortunate that in some cases when the Secretariat went back to the country for assistance, there was no response. While the most common errors encountered in loading the data in the database, appear in **Annex,** it is considered pertinent to mention here certain types of errors that require special attention and should be avoided at all costs:

a) All stations included in the monitoring agreements have been recorded in the database and the system checks for correspondence between “area”, “station” and coordinates. So, if a different station name is entered or different coordinates for a specific station name, the system will show that there is a mistake. If a country decides to change these parameters, they must inform the Secretariat so that the system can be updated.

b) DL (detection limit) and BDL (below detection limit) must be used correctly. DL is a mandatory field and should be reported always. If a concentration is recorded as BDL will have no meaning without the DL value.

c) Use of wrong units. This is a mistake that can create serious problems. The system requires the units mentioned in the reporting formats e.g. for heavy metals in biota, µg/kg. However, many laboratories report data as µg/g without multiplying by 1000. Another common problem is with the units of the eutrophication parameters.

d) Ranges are not accepted by the system. A single number should be given for each concentration or detection limit.

The secretariat is open to suggestions on how the reporting formats could be simplified in order to minimize errors.

MED POL Information System

In the meantime work is going on for the completion of the new web-based MED POL Info System integrating data on pollution sources and pollution levels. By mid-2006 Phase I of the prototype implementation was complete. A Portal Infrastructure with a Graphical Interface to a MED POL data repository was built. The functional features included were mainly limited to user profiles, administrative functionalities, user preferences settings, and basic content uploading/browsing. The Report Submission Module was identified as an important component to further improve and develop the prototype. This module is now ready and allows for the uploading and submission of Report Files; checking conformance and consistency with the MED POL reporting format and providing users (and relevant user groups) a confirmation log file including notification of success or failure of the data submitted. The Report Submission Module is now being tested in-house and with countries.

The MED POL National Coordinators were briefed at their meeting in Mytilini (26-28 March 2007) on the progress of work (Document UNEP(DEPI)/MED WG. 312/5). On the basis of the discussions in Mytilini, a document (UNEP(DEPI)/MED WG.316/6) on data management policy was prepared and submitted to the meeting of MED POL National Coordinators in Hammamet (25-28 June 2007). While the proposed policy was accepted in principle, sufficient time was allowed to countries to submit their observations by the end of 2007.

2.5 Data interpretation and utilization

The raw data collected during monitoring must be treated statistically or otherwise to metadata and then to information so that conclusions can be drawn from them. The information will then be utilized for decision-making. Such decisions could be:

a) Closing or not of a bathing beach on the basis of the monitoring data on microbial pollution.
b) Allowing or not consumption of shellfish on the basis of data on microbial pollution or on biotoxins.
c) Allowing or not consumption (or import) of seafood on the basis of data on chemical contaminants exceeding the maximum permissible level.
d) Taking or not legal action against an establishment in the case when contaminants in effluents exceed the maximum permissible level.
e) Using data on effluents to decide on pollution reduction measures to be taken.
f) Using eutrophication data and/or chemical contaminant data to decide on the degree of treatment of effluents or the length and type of an outfall.
g) Using trend-monitoring data to assess the effectiveness of pollution reduction measures taken in order to decide on further action.
h) Use of monitoring data for scientific purposes e.g. modeling, which will be useful for decision-making.
i) Use of monitoring data as an early warning for taking action.

The secretariat expects to receive information and advice on how to assist on this issue.

3. Specific issues

3.1 Biomonitoring

Biological effects monitoring (monitoring with biomarkers) is included in the MED POL programme but still undertaken as a pilot activity to test the methodology and its use as an early-warning tool to detect any detrimental effects of pollutants on marine life. This activity is considered crucially important for MED POL since it is the only monitoring component that will provide direct information on the “effects of contaminants on marine living resources” which is an objective of MED POL Phase IV.

The results from this type of monitoring should be integrated with the results of the chemical analysis (stressing the importance of collecting both data on the same sample or, at least, at the same site and at the same time). At present, most of the pilot activities were organized to obtain such coupled datasets on chemical contaminant levels and biomarkers.

During the last biennium, a UNEP/MAP/MED POL workshop entitled “Workshop on the MED POL Biological Effects Programme: Achievements and Future Orientations” was organized on 20 and 21 December 2006, at the Department of Environmental and Life Sciences (Dipartimento di Scienze dell’ Ambiente e della Vita, DISAV) of the University of Alessandria, Italy. As it is well known, this Department provides technical/scientific support to the activity and undertakes quality assurance, which includes inter-comparison exercises and training. The workshop had as its aims:

(a) to review the work undertaken during Phase III. Under this item the participants had the opportunity to present the work accomplished during the last decade within national monitoring programmes and other comparable programmes;

(b) to discuss a proposal for the utilization of a 2-tier approach to rank the level of pollutant-induced stress syndrome in sentinel organisms sampled along the Mediterranean coast; and

(c) to make recommendations for MED POL Phase IV and other pertinent issues.

The workshop was attended by 22 Mediterranean scientists, participants of the MED POL biological effects programme, as well as by outside experts (see MTS 166 distributed here as document UNEP(DEPI)/MED WG. 321/Inf.3).

The discussions concentrated on the evaluation of the results obtained, their use for pollution assessment purposes, the assessment criteria to be utilized and the need for harmonization of these assessment criteria with those used by northern European organizations and conventions. Special attention was given to the use biomarker integration indices following the presentation of relevant research. The proposal put forward, that MED POL includes in Phase IV the application of a 2-tier approach using caged molluscs, was discussed and accepted by all participants. The first tier would include only one biomarker, namely, the lysosomal membrane stability and mortality. The second tier would include a number of biomarkers (see point d) below for details).

The conclusions and recommendations of the workshop are presented below so that the meeting can express its views on the feasibility of their implementation, especially the use of the 2-tier approach:

The workshop:

a) Acknowledged with satisfaction the excellent work accomplished during MED POL Phase III and the data presented, in particular, from countries of the southern and eastern Mediterranean. The data presented during the workshop ranged from core biomarkers to new developed omic's (genomics and proteomics) approaches in natural and caged sentinel organisms. Special achievements were obtained in data management and biomarker interpretation.

b) Recognized the need for harmonization of the assessment criteria with those of the northern European organizations and Conventions. Harmonisation should include biomarker selection, standard operating protocols and data management as well as common inter-calibration exercises, training courses and databases.

c) Recognising that biological tools are useful for the evaluation of the impact of chemicals on marine life, considers that biomarkers and bioassays could be utilised as indicators in the European Marine Strategy and the ecosystem approach for the management of human activities impacting on the marine environment.

d) Recommended that MED POL includes in Phase IV the application of a 2-tier approach with caged molluscs: the first tier would include a single biomarker, namely, lysosomal membrane stability, and mortality. The second tier would include a whole set of biomarkers including lipofuscin accumulation, neutral lipid accumulation, micronuclei frequencies, oxidative stress, metallothionein content, acetyl cholinesterase activity, peroxisome proliferation, lysosome to cytoplasm ratio, and stress on stress.

e) Recommended that MED POL promotes biomonitoring in all Mediterranean countries and that it provides the necessary equipment, reagents, and training for the first tier to the countries that are in need. MED POL should also promote inter-calibration exercises on a Mediterranean scale.

f) Recommended to countries to include the 2-tier approach in their national monitoring programmes.

g) Recommended that MED POL provide environmental managers with simple biomarker integration indices (using the expert system or the multi-marker pollution index) to score adverse biological reactions.

As regards recommendation (b), MED POL participated in the ICES Working Group on the Biological Effects of Contaminants that met in Alessandria, Italy, from 19-23 March 2007. The workshop explored ways of cooperation between OSPAR, HELCOM and MED POL with a view to harmonization of work methodologies and proposed possible organization of joint inter-comparison exercises and workshops. It is proposed that during 2008 DISAV undertakes another inter-comparison exercise for the MED POL and that samples are also disseminated to a number of ICES laboratories. The results of this exercise and of the project on integrated monitoring of chemical contaminants will be discussed at a joint OSPAR (ICES)/HELCOM/MED POL workshop to be organised in 2009.

3.2 Sediment strategy

The theory behind the use of sediments as a tool in environmental monitoring is the knowledge that the finer particles in the sediment originate from the suspended particulate matter, and that these particles are the carriers of non-soluble contaminants. Fine material (inorganic and organic) and associated contaminants are preferentially deposited in areas of low hydrodynamic energy, while in areas of higher energy, fine particulate matter is mixed with coarser sediment particles which are generally not able to bind contaminants. This dilution effect will cause lower and variable contaminant concentrations in the resulting sediment. Obviously, grain size is one of the most important factors controlling the distribution of contaminants in sediments. It is, therefore, essential to normalize for the effects of grain size in order to provide a basis for meaningful comparisons of the occurrence of substances in sediments of various granulometry and texture within individual areas, among areas or over time.

The second review meeting of MED POL monitoring activities (Saronida, Greece, 9-11 December 2003, document UNEP(DEC)MED WG.243/4) concluded that the practice of measuring the ratio of contaminants in sediments using annual frequency and one sample per station is not satisfactory to address trends. The high dependence of contaminant ratio and sediment grain size indicate that a new sampling strategy should be developed to satisfy the statistical needs related to trends' evaluation. As a consequence, an experts' meeting was organized (Anavissos, Greece, 14-15 April 2005, document UNEP(DEC)MED WG.273/2) to revise the strategy for trend monitoring of contaminants in coastal water sediments.

On the basis of the discussions, a document on methods for sampling and analysis of sediments was prepared by IAEA/MESL (Dr. Jean-Pierre Villeneuve) and presented at the Third Review Meeting of MEDPOL Phase III Monitoring Activities (Palermo, 12-15 December 2005) as document UNEP(DEC) MED WG.282/Inf.5. The comments of the meeting were incorporated in the document while IOLR (Dr Barak Herut) undertook to improve the section on normalization. **The final result is the "Manual for sediment sampling and analysis" which is presented to this meeting as document UNEP(DEPI) WG 321/Inf.4 for review and discussion.**

3.3 Eutrophication monitoring strategy and assessment

The issue of a monitoring strategy and assessment for eutrophication was first raised at the MED POL National Coordinators' Meeting in 2001 (Venice, Italy, 28-31 May 2001), which recommended to the Secretariat to elaborate a draft programme for monitoring of eutrophication in Mediterranean coastal waters. The draft monitoring programme (UNEP(DEC)/MED WG.196/4) was presented to the Review Meeting on MED POL– Phase III Monitoring Activities (Rome, Italy, 5-7 December 2001) and later discussed at a Consultation Meeting on MED POL Eutrophication Monitoring Strategy (Athens, Greece, 20 September 2002). It was thoroughly reviewed by the experts agreeing on a short-term strategy and making recommendations for planning the mid- and long-term phases of the overall programme. It must be noted that for the short-term strategy a first group of monitoring parameters was proposed, able to support the adoption of the TRIX index as a classification system for trophic status of coastal waters.

At the meeting of the MED POL National Coordinators in 2003 (Sangemini, Italy) document UNEP(DEC)MED WG.231/14 entitled "Eutrophication Monitoring Strategy of MED POL" was approved. Following this, a number of pilot monitoring programmes were formulated for the three different site typologies defined in the document (affected coastal areas, areas with intense aquaculture activities, coastal lagoons under eutrophication risk) to test the strategy.

At the Third Review Meeting of MED POL Phase III Monitoring Activities (Palermo, 12-15 December 2005) a draft proposal entitled "MED POL eutrophication strategy: updated report and proposal for new indicators" was presented by Dr Giulio Izzo (ENEA). He outlined the main notions introduced into the conceptual framework of eutrophication, from the stage of the input of nutrients to that of anaerobic processes, via the proliferation of algae, the increase in organic detritus and oxygen depletion, with a different perception of the processes when examining marine ecosystems at different depths. That conceptual evolution gave emphasis on changes in the chemistry and biology of sediments. It therefore called for the introduction of new parameters and indicators that were more related to the changes in sediments.

The presentation received some criticism especially as regards the table on parameters and indices and that it did not take into consideration relevant work undertaken within EU Mediterranean countries. During the debate a number of views were expressed which necessitated the convening of a group to discuss changes. A number of experts participated and gave their views. In addition, changes were also discussed at the Workshop on Eutrophication Assessment and Strategy (Anavissos, Greece, 5-6 February 2007). **The revised document "Eutrophication Monitoring Strategy for the MED POL (REVISION) that was prepared by Dr G. Izzo, taking into consideration all the views expressed at various occasions, is presented here, as document UNEP(DEPI)/MED WG. 321/Inf. 5, for review and discussion.**

As noted above, the parameters proposed for the short-term strategy can be used in the determination of the TRIX index used as a classification system for the trophic status of coastal waters mainly tested in the Adriatic Sea. The results from the pilot monitoring programmes were subjected to TRIX index analysis by Dr Franco Giovanardi. At the same time a questionnaire was prepared and circulated to all Mediterranean countries to obtain information on national eutrophication programmes, monitoring strategies and assessment methodologies. On the basis of the above, HCMR (Dr Popi Pagou) was entrusted with the preparation of an assessment report to include all the above information. The very first draft of the report was reviewed by a group of experts, which met at HCMR in February 2007. **The report was revised on the basis of the discussions and is presented here as the first draft for review and comments as document UNEP(DEPI)/MED WG. 321/Inf.6.**

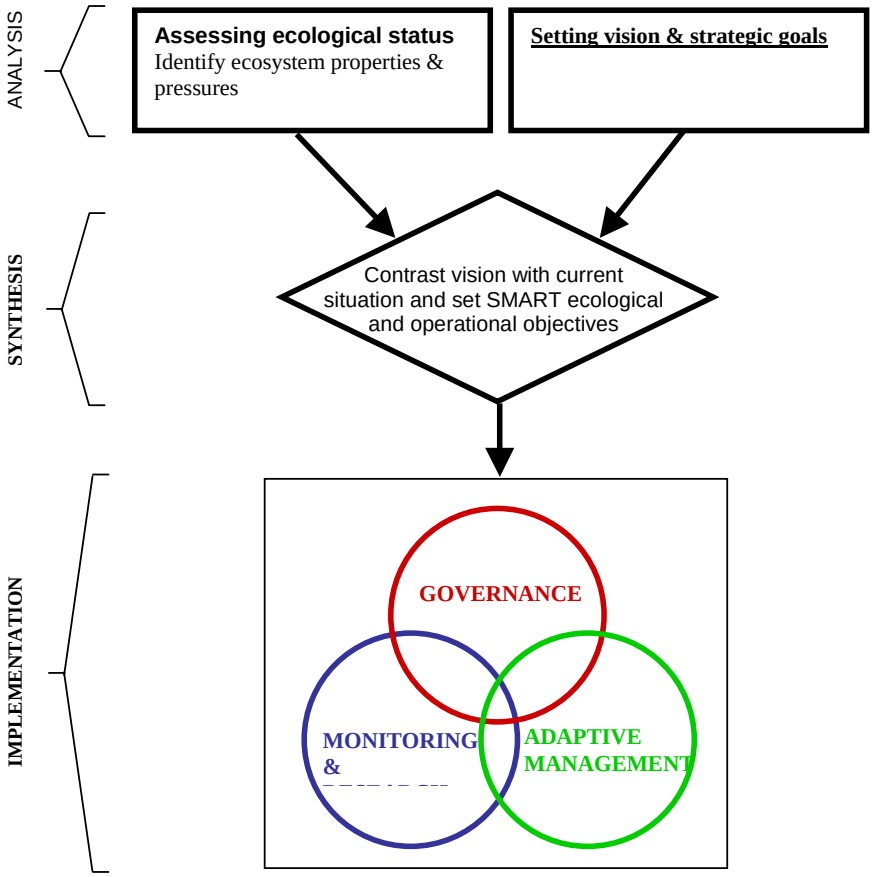
3.4 Ecosystem approach

The Ecosystem Approach was first "officially" adopted by the 5th Conference of the Parties to the Convention on Biological Diversity held in Nairobi, in May 2000 as the fundamental tool for delivery of the Convention's three primary objectives. It was later endorsed by the World Summit on Sustainable Development (WSSD) in Johannesburg (2002) and features strongly in the subsequent Plan of Implementation, which encourages its application in the marine environment by 2010.

The ecosystem approach strives to ensure that those human activities and demands that have an actual or potential impact on the marine environment are managed effectively. The ecosystem approach does not require control of the natural processes of ecosystems; only that these must be considered in managing human activities.

The 5th Conference of the Parties to the Convention on Biological Diversity (Nairobi, 2000), when endorsing the ecosystem approach, adopted, at the same time, twelve complementary and interlinking principles, which should be considered in a holistic way and appropriate weight given to each according to local circumstances. In addition, it proposed five points as operational guidance in applying the principles. The 7th Conference of the Parties to the Convention on Biological Diversity (Kuala Lumpur, 2004) provided further guidance on the implementation of the ecosystem approach principles (see reference document UNEP(DEPI)/MED WG.306/2).

In the framework of an EC/MAP project, a working group was set up composed of 15 experts from Mediterranean institutions, the RACs and OSPAR, HELCOM, ICES and MAP secretariat. The working group met twice (April and November 2006) to agree on a document that included definitions, proposals for a road map, specific proposals for vision and strategic goals and possible implications. The application of the ecosystem approach was presented schematically as shown in the figure below.



The ecosystem approach is defined as "the comprehensive integrated management of human activities based on the best available scientific knowledge about the ecosystem and its dynamics, in order to identify and take action on influences which are critical to the health of the marine and coastal ecosystems, thereby achieving sustainable use of ecosystem goods and services and maintenance of ecosystem integrity."

The final document (UNEP(DEPI)/MED WG 306/2) was the subject of the discussions at the Government-Designated Expert Meeting on the application of the ecosystem approach by MAP, which took place in Athens in February 2007 (Report of meeting UNEP(DEPI)/MED WG 306/4). After discussing the document the meeting agreed on specific recommendations to be made to the 15th Ordinary Meeting of the Contracting Parties (Almeria, January 2008).

The above recommendations were reviewed by the National MAP Focal Points meeting (Madrid, October 2007) and they are now the following:

Road map

a) Progressively apply the ecosystem approach to the management of human activities that may affect the marine and coastal environment for the promotion of sustainable development.

b) Initiate a process, involving scientists and policy makers, and when appropriate, with other competent bodies/organizations/authorities, aiming at the gradual application of the ecosystem approach which would include the following steps:

   i) Definition of an ecological Vision for the Mediterranean.

   ii) Setting of common Mediterranean strategic goals.

   iii) Identification of important ecosystem properties and assessment of ecological status and pressures*.

   iv) Development of a set of ecological objectives corresponding to the Vision and strategic goals.

   v) Derivation of operational objectives with indicators and target levels.

   vi) Revision of existing monitoring programmes for ongoing assessment and regular updating of targets.

   vii) Development and review of relevant action plans and programmes.

c) Consider the launching of pilot projects as a model for the application of the ecosystem approach.

Ecological vision and strategic goals

The meeting also made specific proposals for the first two steps of the road map in (b) above. The proposed vision is:

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

As far as the strategic goals are concerned, on the basis of the objectives of the relevant priority field of action of the MSSD and the experience gained by other international and regional bodies, the meeting proposed the following three goals for marine and coastal areas:

a) To protect, allow recovery and, where practicable, restore the structure and function of marine and coastal ecosystems thus also protecting biodiversity, in order to achieve and maintain good ecological status and allow for their sustainable use.

b) To reduce pollution in the marine and coastal environment so as to minimise impacts on and risks to human and/or on ecosystem health and/or uses of the sea and the coasts.

c) To prevent, reduce and manage the vulnerability of the sea and the coasts to risks induced by human activities and natural events.

After the adoption by the Contracting Parties of the above, it is envisaged to reconvene again the Government-designated Experts' meeting to continue work on the road map.
The meeting, in 2008, will decide on management areas, pilot studies and the table of contents of a report to be prepared for each area on the basis of step (iii) of the road map

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

(Identification of important ecosystem properties and assessment of ecological status and pressures).

The next step will be the development of SMART ecological and operational objectives, having in mind that an ecological objective relates to ecosystem health, structure and/or function. Once operational objectives are set, indicators should be decided for each one. This number will vary. Indicators are needed to monitor the progress being made towards meeting operational objectives and to guide management action. **Indicators are defined as "a variable, pointer, or index of a phenomenon and can reflect the status and changes of well-defined parts of an ecosystem, derived from observations, normally from monitoring programmes." They may describe ecosystem state, activity-specific ecosystem properties, or impacts.**

According to ICES (2005) effective indicators should have the following properties:

(a) **Measurable**. Indicators should be measurable in practice and in theory. They should be measurable using existing instruments, monitoring programmes, and analytical tools available in the regions and on the time-scales needed to support management. They should have minimum or known bias, and the signal should be distinguishable from noise.

(b) **Cost-effective**. Indicators should be cost-effective because monitoring resources are limited. Monitoring should be allocated in ways that provide the greatest benefits to society and the fastest progress towards sustainable development.

(c) **Concrete**. It is desirable to have indicators that are directly observable and measurable rather than indicators reflecting abstract properties that can only be estimated indirectly. This is because concrete indicators are more readily interpretable by the diverse stakeholder groups that contribute to management decision-making.

(d) **Interpretable**. Indicators should reflect properties of concern to stakeholders, and their meaning should be understood by as wide a range of stakeholders as possible. Public understanding of the indicator should be consistent with its technical meaning.

(e) **Grounded in theory**. Indicators should reflect features of ecosystems and human impacts that (according to well-accepted peer-reviewed scientific theory) are relevant to the achievement of operational objectives. They should not be based on theoretical links that are poorly defined or validated.

(f) **Sensitive**. Trends in the indicator should be sensitive to changes in the ecosystem properties or impacts, which the indicator is intended to measure.

(g) **Responsive**. Indicators should be responsive to effective management action and provide rapid and reliable feedback on the consequences of management actions.

(h) **Specific**. Indicators should respond to the properties they are intended to measure rather than to other factors, and/ or it should be possible to disentangle the effects of other factors from the observed response.

Few indicators will have all the properties listed above, and thus several indicators with complementary properties may be needed to provide strong and effective support for management decision-making.

When the time comes to discuss indicators within the ecosystem approach process, the experts' meeting will have in front of it the entire work already taken place within the MED POL. As it is anticipated that these indicators will be mostly ecological, it is proposed to initiate as from now capacity building activities (see section below).

3.5 Indicators

The Contracting Parties to the Barcelona Convention at their 12th Meeting in Monaco (November 2001), requested the MED POL Programme "to review and develop a set of marine pollution indicators, in cooperation with Blue Plan, EEA, UNIDO-ICS and other competent bodies and organizations" to be used in the development of the MEDPOL reporting system**.** To this aim, MEDPOL first prepared in 2003 a concept paper entitled "Strategy for the development of Mediterranean marine pollution indicators (MPI)" (Document UNEP(DEC)/MED WG. 231/17) which has been approved by the Meeting of the MED POL National Coordinators (Sangemini, Italy, 27-30 May 2003).

The strategy document outlines the DPSIR as a framework for the development of MPIs and proposes a list of:

a) Core biomarkers
b) Supplementary biomarkers
c) Biotests
d) Ecosystem indicators (core set)
e) Supplementary ecosystem indicators
f) Chemical Indicators (core set)
g) Supplementary chemical indicators

A list of all indicators appears in document UNEP(DEC)/MED WG.264/Inf.14.

On this basis, MEDPOL prepared:

- Guidelines for the development of Ecological Status and Stress Reduction Indicators (MTS 154)
- Facts sheets for each of the core sets of indicators (UNEP(DEC)/MED WG.264/Inf.14).

The Meeting of experts organized by MEDPOL in Athens 4-5 April 2005 reviewed the fact sheets and proposed the following:

a) To concentrate the short- and medium-term activities on the ecological indicators, namely:

(i) BENTIX (zoobenthos), (ii) Biotic index on benthic macrophytes, (iii) Number and abundance of exotic species (zoobenthos, phytobenthos, zooplankton, phytoplankton, fish), (iv) community diversity (H) (zoobenthos, phytobenthos), (v) Number of benthic species (S) (zoobenthos), (vi) presence/abundance of sensitive/opportunistic zoobenthic species/taxa and (vii) Presence and coverage of benthic macrophytes (sensitive and /or opportunistic).

b) To consider the two tiers approach for biomarkers:

(i) Tier 1- Utilization, as a first screening approach, a set of 2 to 5 sensitive and low cost stress biomarkers such as LM and /or LLA or simple ACHE, GST, CAT in samples obtained from all the sites of the biomonitoring programme
(ii) Tier 2- on those sites where mussels show significant changes in selected biomarkers, utilization of a full battery of 8/12 biomarkers and quantification of the stress syndrome using the expert system. **N.B. This approach has been developed further (See section 3.1 of this document and MTS 166).**

c) To combine the chemical indicators in three clusters:

(i) Indicators of hazardous substances related to health

- HM in effluents
- HH (+PAH) in effluents
- Total mercury in Biota
- Total cadmium in Biota
- Bacterial levels in bathing water
- Bacterial levels in shellfish-growing area

(ii) Indicators of Eutrophication

- Load of nutrients
- Loads of BOD/COD in effluents
- Orthophosphate
- Total phosphorus
- Orthosilisic acid
- Dissolved oxygen
- Nitrate, Nitrite, Ammomium
- Total nitrogen
- Chlorophyll **a**
- Temperature
- Salinity
- Transparency
- pH

(iii) Indicators of natural and man made long term basin –scale changes on seawater properties related to climate change

- Temperature
- Salinity
- Nitrate, Nitrite, Ammonium
- Dissolved oxygen
- Orthophosphate
- Orthosilicic acid
- pH, Alkalinity
- Transparency
- Chlorophyll **a**
- Nutrient atmospheric deposition

The MEDPOL National Coordinators meeting (Barcelona, 24-27 May 2005), adopted the fact sheets on MPIs to be considered as the basis for the preparation of marine environmental assessments in a manner which could facilitate the development of policy for the protection and conservation of the Mediterranean Sea and coastal areas and requested MEDPOL to assess the feasibility of countries to implement the MPIs.

Assessment of the feasibility to implement MPIs at national level

Following the request from the MED POL National Coordinators, an assessment was initiated to evaluate the capacities and capabilities of the Mediterranean countries to generate data and information on MPIs using the data and information made available by the Contracting Parties to the Barcelona Convention (see document UNEP(DEPI)/MED WG. 321/Inf.7). The report is based primarily on information provided by the country on the feasibility of MPIs but in cases where such reports were not available, information was derived from National Diagnostic Analysis Reports. Additional sources were also consulted.

Indicators related to the MEDPOL strategy for monitoring eutrophication (T, S, pH, DO, Transparency, Orthophosphate, Silicate, Chlorophyll-a, Total N, Total P, Nitrate, Nitrite, Ammonium and chlorophyll-a) appear to be in the best stage since they are the most 'measured' parameters in most monitoring programmes of Mediterranean countries. Monitoring of heavy metals in biota and bacterial levels in bathing waters are also very well developed whereas the monitoring of organochlorines and even more so, the monitoring of petroleum hydrocarbons in water, are lagging. The limited monitoring on these parameters can be attributed to the fact that these contaminants are not considered as primary threats to the marine environment of many countries (as in the case of hydrocarbons) and that there are inherent difficulties in their quantification.

Historical data in field application of biomarkers are rare. Unlike other European areas, where a number of field programmes have been established, either at national or regional level (Conventions) and several biomarkers are applied for the measurement of the environmental condition, biomarkers in the Mediterranean are little studied. Some results were produced the last twenty years through individual research projects national or international programmes in marine waters (BIOMAR, BEEP, IOC-IMO-UNEP funded programme of Global Investigation of Pollution of the Marine Environment). These relate to the design and validation of practical approaches and are mostly derived from laboratory experiments. So, it is unlikely that sufficient data will be submitted to the MEDPOL database.

The MPI country reports do not provide sufficient data on the implementation of biotic indices due to the lack of data. However, considering their importance towards the implementation of the ecosystem approach and WFD, a dedicated group undertook the task to test their applicability in EU countries by performing an intercalibration exercise. The Mediterranean Geographic Intercalibration Group (MED-GIG), in operation since 2004, consists of national representatives from Cyprus, France, Greece, Italy and Spain while Slovenia and Croatia are observers. Some countries have already identified existing reference sites/conditions while others consider virtual reference conditions.

According to the latest workshop (MED-GIG, 2007), there is a large amount of data but not for all biological quality elements and all countries. The most promising quality elements appear to be macroalgae and angiosperms.

The conclusions of the assessment report are that many of the problems, issues of concern and constraints were common among the countries and consequently most of the suggestions for improvement of MPI's at a national level were universal at the Mediterranean scale. Some of the suggestions were general, applying to the whole spectrum for MPI's, while others were specific. Finally, suggestions were made on:

- ✓ Data acquisition
- ✓ Data storage / Data base organization
- ✓ Increasing funding and human/laboratory capacities (covering also the needs for intercalibration and QA/QC programmes)
- ✓ Harmonization with EU initiatives/International collaboration
- ✓ National Strategy
- ✓ Adoption of Reference values/stations (in particular for ecological indicators and biomarkers)
- ✓ Reducing proposed MPI's
- ✓ Adding new MPI's
- ✓ Developing further the proposed MPI's

Proposal

National monitoring activities, including the MEDPOL monitoring programme, are generating data and information, which partly cover the sets of chemicals, biological effects and

ecological indicators. While chemical indicators could be used to generate information for managerial purposes such as the assessment of the effectiveness of pollution reduction measures, more efforts should be deployed to generate data and information on biological effects and ecological indicators.

MEDPOL already launched a region wide programme to build the capacity and the capability of several Mediterranean countries in biomarkers monitoring and this activity has started producing results (see relevant section of the document).

As for ecological indicators, it must be stressed that there is no real monitoring programme (except in few European Mediterranean Countries) for the elements of the ecosystem in which data could be generated to develop relevant and pertinent ecological indicators. It is therefore proposed to launch, in the coming biennium, a region wide capacity building programme for ecological indicators similar to the biomarker programme. However, whereas for the biomonitoring programme, DISAV of the University of Alessandria is acting as the reference laboratory, for the ecological indicators another approach is proposed by the Secretariat.

The approach consists of grouping the countries into task forces to ensure the transfer of know-how and state-of-the-art in the development and determination of ecological indicators. Competent laboratories will have to be designated in each country. Such task forces could consist of:

- Algeria, France, Monaco, Morocco, Spain and Tunisia
- Italy, Libya and Malta
- Albania, Bosnia-Herzegovina, Croatia, Italy, Montenegro and Slovenia
- Cyprus, Egypt, Greece, Israel, Lebanon, Syria and Turkey

ANNEX

Common errors encountered during loading of data into the MED POL Database

As a rule, each submitted Excel file contains data in one reporting format, but in certain cases, countries provide only one file with multiple worksheets containing data in different reporting formats. It is unfortunate that almost in no case data can be uploaded without any correction and all the mistakes are due to the fact that originators do not follow the reporting formats and the instructions. Some common mistakes are listed below:

- Lack of correspondence to reporting format. Several countries for unknown reasons decide to rename or even delete several title parameters from the reporting format. This format problem is difficult to locate as loading stops with no clear warning from the system.

- The most common error found during loading is having the wrong format in the cells, for example:

    - The year provided in the “Year” column does not correspond to the dates provided for “sample date”.

    - Date is usually typed in excel (or copy/pasted) as text. This although looks normal in excel, it is in a different format than what the MED POL database expects.

    - Numbers (usually in the CONC columns) are typed in (or copy/pasted) as text. This, as above, causes errors.

    - Reporting worksheets may contain cells with spaces, which look like empty ones. It is difficult to find such a cell and correct the error, since it is “invisible” for the eye. In addition, spaces may be included before the words, causing again problems. A general solution to this is to (fx:TRIM) everything before loading.

    - Wrong column naming (e.g., name contain spaces, or symbol “-“instead “_”). This usually causes the database to think that new parameters are being loaded in the system. It requires checking of each individual cell in the excel file.

    - Inserting symbols (“-“, “*”, “**”) into cells that are supposed to be empty. Also some countries use the “less than” symbol e.g. “<0.05” to indicate that the concentration is less than the detection limit which equals 0.05. The correct way is to indicate BDL in the CONC column and the detection limit in the DL column.

- Missing elements

    - Mandatory parameters are usually missing. Most common is “Area”, “Country”, “Station” name and Sample ID. There are cases where the originator of the document only fills up the first row of data and expects that it will be the same for the ones below as well.

  - Parameters are missing from some rows in the reporting table. If the parameter missing is CONC or DL or another mandatory field, such data are eliminated during loading and are not loaded. There are countries that have sent files that essentially contained no viable data.

- Duplicate Sample IDs

  - Missing sample IDs. The sample IDs system that is used in each country doesn't necessary work for the MED POL database. Since some countries use different attributes for separating their data like station name/coordinates etc, there are instances where a country doesn't provide a Sample ID at all. In these cases a fake sample id is usually required to continue loading.

  - Another problem to the above is when the sample IDs are duplicated within the file and, even worse, if duplicates exist in the database from older files.

- Duplicate stations

  - Problems with countries sending different coordinates for the same station name. Such loading should not be performed, as it will create multiple instances of the same station within the database.

  - Wrong / Different Area specified for the station in question. Like the above the database will create multiple station instances for each area given.

  - New / Wrong name for station given. A country may have typed a station named wrongly in a file. In cases, where new stations need to be introduced, the competent MED POL Officer should be contacted.

  - In certain cases stations are reported without coordinate information. This is not wrong but be aware that the database will use the default coordinates for the station.

- Incorrect filling of data in certain columns and units

  - BDL is often renamed or mistyped as BLD, BD or BL. Also, some countries tend to report the DL and BDL values in one column.

  - Ranges in the DL column are not accepted by the system.

  - Using the wrong units, for example mg/kg instead of µg/kg, etc.

  - Absence of UNIT column or empty UNIT column. In this case data are loaded with the assumption that the correct units are used.

  - Using ranges instead of single values (in most cases ranges are not supported in the Database, for example, analysis date range, sample temperature range)

- Introducing new / wrongly named parameters

- The agreed codes are not used. There are countries using their own codes. Of course there are also cases where new parameters (do not exist in the database) are introduced. Common mistakes in station type, area, institute, tissue, species, etc. In the analytical methods, the database is looking for RM 11, 12, etc.