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## Background

The Mediterranean, a semi-enclosed sea which occupies a major part of the basin area, presents a number of physical and geographical features that, in turn, determine which environmental factors play an important role in degrading the marine and coastal environment which makes up nearly the whole basin.

International efforts to protect the Mediterranean Sea resulted in the adoption by the Mediterranean Countries and the EU of the Mediterranean Action Plan (MAP) in 1975 and the adoption of the Barcelona Convention and two related protocols in 1976.

MAP was intended to assist the Mediterranean Governments in improving the quality of the environmental information on which formulation of their national development policies is based and to improve the ability of Governments to better identify options for alternative patterns of development and make better rational choices for allocation of resources.

Since the adoption of MAP, Mediterranean Countries did join their efforts in studying the problems and in proposing, adopting and implementing actions necessary to protect the Mediterranean Sea.

The initial focus of MAP was on marine pollution control, an obvious subject of high priority requiring a harmonized regional policy and strategy. However, experience soon confirmed that poor management and planning of development are at the roots of most environmental problems and that meaningful and lasting environmental protection is inseparably linked with social and economic development. Therefore, focus of the action plan gradually shifted from a sectorial approach of pollution to integrated coastal zone planning and management as the key tool through which solutions are being sought.

The recent revisions of MAP, the Barcelona Convention and its related protocols (1995) directed the whole system towards development and implementation of the basis which should gradually lead towards the sustainable development of the Mediterranean Sea and its coastal region.

The Coordinating Unit of MAP in Athens, with its six Regional Activity Centres located around the Mediterranean, did carry out numerous studies in order to assess the problems and to propose actions necessary to solve those problems. Amongst the numerous assessment documents the "State of the Marine and Coastal Environment in the Mediterranean Region", issued in 1989 and 1996, could be singled out as an overview of the state of the Mediterranean Sea and associated problems.

Following the gradual shift from assessment of problems towards solution of problems through costed and targeted actions, the Global Environment Facility (GEF) block B Grant "Formulation of a Strategic Action Programme for the Mediterranean Sea for the Mediterranean Sea (SAP MED), to address pollution from land-based activities" was prepared and approved in 1996.

The main objectives of this initiative was to prepare a targeted and costed Strategic Action Programme (SAP MED) to address pollution from land-based activities including the elements for the formulation of national action plans and a GEF Project Brief for submission to the GEF Council. The initiative would be concluded by the convening of a Donors' Conference at which the full GEF Project would be discussed containing proposals for remedial interventions related to well defined and costed transboundary pollution issues.

The GEF Operational Strategy lists the "degradation of the quality of transboundary water resources, caused mainly by pollution from land-based activities" and "physical habitat degradation of coastal and near-shore marine areas, lakes, and watercourses as a result of inappropriate management" as two of the four major global environmental concerns relating to international waters. Furthermore, the Strategy recognizes that "GEF projects integrating several focal areas have the potential to multiply global benefits from GEF interventions".

SAP MED was prepared on the basis of the "Transboundary Diagnostic Analysis for the Mediterranean Sea" (TDA MED).

## Introduction

According to the GEF policy, the TDA had to be an overview of all regional problems to be used not only for the preparation of the SAP, which relates to land-based pollution, but also for other possible projects to be implemented in the future. In other words, the TDA provides a platform with data and information on which to base future regional interventions by individual countries and outside donors. The success of the planned activity mostly depends on the active involvement and participation of the National Coordinator for the preparation of the SAP MED and the TDA MED in view of the type of data that needed to be collated and the need to involve governments in the identification of priority issues and identification of possible remedial actions.

The purpose of the TDA MED is to address the transboundary concerns of the Mediterranean Sea and as such contribute directly to the development of the Waterbody – based Operational Programme of the GEF Operational Strategy.

The aim of the TDA MED is to identify the perceived issues and problems affecting the Mediterranean Sea and associated with land-based activities, to assess their relative magnitude and importance. TDA MED provides the basis for determining the nature of interventions (national or regional) and associated costs, required to address the problems and issues resulting from land-based activities and is thus fundamental to the successful development of the SAP MED. TDA MED provides the justification for the actions proposed in the SAP MED.

The TDA MED was prepared on the basis of existing data and information collected through the past activities of the MAP and other regional and national activities, projects and programmes in the Mediterranean. The fact that the TDA MED was prepared on the basis of already existing data was a factor which made the exercise feasible in spite of the very short time available. Whenever possible gaps in the information were identified and proposal made to fill in such gaps.

The TDA MED includes:

- Review of the data and information relating to transboundary issues, such as shared fisheries resources, regionally and globally important biodiversity, land based activities and water quality in the Mediterranean region;
- Identification of the perceived issues and problems affecting the Mediterranean and assessment of their relative magnitude and importance;
- Identification of the causes, both proximate and ultimate, of the issues and problems and where possible quantification by source;
- Identification where possible of the geographic sites of impact and the nature of the affected resources;
- Assessment of the extent to which individual issues and problems are national and/or transboundary in nature and the extent to which the cumulative effect on the MED of national issues and problems might itself be considered transboundary;

- Constraints to action, including financial, legal and institutional issues at national and regional level; and
- Assessment where possible of the economic costs or losses associated with the identified issues and problems.

The methodology for the preparation of the TDA MED was the following:

- Each country was requested to nominate a National Coordinator for the preparation of the SAP MED and TDA MED;
- Each country was asked to establish interministerial committee, if necessary, which should facilitate the collection and interpretation of information and data;
- For each of the subject of the TDA MED a responsible international organization and/or a component of MAP was identified;
- For each of the subjects of the TDA MED a consultant was selected (in the case of Hot Spots and Sensitive Areas a team of consultants was established);
- Reports for each of the subjects of the TDA MED which were received from consultants were used as a base to prepare chapters of the section 3, which are actually a shortened version of reports received; and
- Reports were used as a base for the preparation of tables presented in the section 2 of this document.

The TDA MED consists of the following three sections:

- Section 1 – Perceived major problems

This section is actually the Executive Summary of the whole document which was prepared on the basis of all information contained in the TDA MED and addresses:

- Major perceived problems;
- Transboundary elements;
- Main root causes; and
- Areas where action is proposed;

- *Section 2 – Specific actions prepared for each of the identified problems*

This section contains for each of the subjects of the document a table which summarizes following main points:

- Problems;
- Character of impacts;
- Main stakeholders;
- Uncertainties;

- Proposed actions and associated costs; and
- Major products and milestones.

This section in itself represents a plan of action with associated costs, which was the basis for the preparation of the SAP MED; and

- *Section 3 – Relevant data and information and detailed analysis of the problem*

This section contains relevant data and information and detailed analysis of the each of the subjects decided to be included in the TDA MED.



**Transboundary Diagnostic Analysis for the Mediterranean  
(TDA MED)**

**Section 1**

**Perceived Major Problems**

MAIN ROOT CAUSES	
1. Inadequate legal and institutional framework	<ul style="list-style-type: none"> <li>Inadequate cooperation on the regional level</li> <li>Inadequate legislation at the national level relevant to regional problems</li> <li>Inadequate institutional framework and capacity necessary for the implementation of legislation, ICZM and EIA</li> <li>Inadequate pollution compliance and trend monitoring</li> <li>Ineffective coordination between various governmental sectors and local and national level</li> </ul>
2. Inadequate planning and management at all levels	<ul style="list-style-type: none"> <li>Poorly coordinated intersectoral planning and management</li> <li>Lack of integrated watershed/coastal zone management plans</li> <li>Lack of application of ICZM and its tools</li> <li>Inappropriate harvesting practices in fisheries</li> <li>Inadequate pollution control strategies with monitoring</li> </ul>
3. Insufficient human and institutional capacity	<ul style="list-style-type: none"> <li>Inadequate human and institutional capacity (at national and local level) for the implementation of the legislature and ICZM with its tools</li> <li>Inadequate human and institutional capacity (at national and local level) for compliance and trend monitoring of pollution</li> <li>Lack of general environmental awareness</li> <li>Poor identification of stakeholders</li> <li>Lack of adequate participation of stakeholders in the planning and management of environmental problems</li> </ul>
4. Insufficient involvement of stakeholders	<ul style="list-style-type: none"> <li>Lack of effective economic instruments</li> <li>Lack of internalization of environmental costs</li> <li>Low value assigned to environment within national economic policies</li> </ul>
5. Inadequate financial mechanisms and support	

AREAS WHERE ACTION IS PROPOSED	
A. Reduction of pollution	<ul style="list-style-type: none"> <li>Identification and elimination of pollution hot-spots</li> <li>Adequate compliance and trend monitoring</li> <li>Full implementation of relevant regional and national legislation</li> </ul>
B. Resource management	<ul style="list-style-type: none"> <li>Full implementation of relevant regional and national legislation</li> <li>Sustainable management of resources</li> <li>Protection of biodiversity, endangered and endemic species, habitats and sensitive areas</li> <li>Development of sustainable fisheries, aquaculture and tourism</li> </ul>
C. Integrated planning and management	<ul style="list-style-type: none"> <li>Improvement of legal and institutional framework at regional and national level for ICZM and its tools</li> <li>Development of integrated management for river basin/coastal areas and for urban agglomerations</li> <li>Improved involvement of stakeholders in environmental decision-making</li> </ul>

PERCEIVED MAJOR PROBLEMS	TRANSBOUNDARY ELEMENTS	Main root causes*	C	A	B
Degradation of coastal and marine ecosystems	<ul style="list-style-type: none"> <li>Damage to transboundary ecosystems, including loss in productivity, biodiversity and stability</li> <li>Reduction of regional values</li> <li>Decreased quality of life</li> <li>Degradation due to pollution and eutrophication</li> <li>Region-wide loss of revenue</li> <li>Impacts on habitats and biodiversity</li> <li>Impacts of physical changes in coastal and beach dynamics</li> <li>Loss of existing and potential income from fishing and tourism</li> <li>Conflicts between user groups</li> </ul>	2 5 1 3 4			
Unsustainable exploitation of coastal and marine resources	<ul style="list-style-type: none"> <li>Damage to migratory species and their habitat changing patterns of migration</li> <li>Endangered biotic resources</li> <li>Loss of values for development</li> <li>Habitat and food web changes</li> </ul>	2 5 4 3 1			
Loss of habitats supporting living resources	<ul style="list-style-type: none"> <li>Loss of regional values</li> <li>Damage to endangered and endemic species of regional and global significance</li> <li>Loss of genetic biodiversity</li> </ul>	2 5 1 3 4			
Decline in biodiversity, loss of endangered species and introduction of non-indigenous species	<ul style="list-style-type: none"> <li>Reduction of regional values</li> <li>Loss of revenues</li> <li>High costs of curative interventions</li> <li>Decreased quality of life</li> </ul>	2 5 1 3 4			
Inadequate protection of coastal zone and marine environment and increased hazards and risks (health risks, seismic risk, climate change, pollution, fires, accidents, extreme events)	<ul style="list-style-type: none"> <li>Human health impacts</li> <li>Costs of dealing with human migration</li> <li>Reduced human and institutional capacity</li> <li>Reduction of development potential</li> <li>Increased poverty with transboundary impacts</li> </ul>	2 5 1 3 4			
Worsened human related conditions (worsened quality of life, unemployment and poverty, socio-economic degradation, increased quality gap in development level)	<ul style="list-style-type: none"> <li>Ineffective protection of the marine and coastal environment</li> <li>Inadequate monitoring of pollution and consequently inadequate data interpretation for managerial purposes</li> <li>Poor public education and awareness regarding scientific and economic values and technical options</li> </ul>	1 2 5 3 4			

Action areas

Note: Major root causes and areas where action is proposed are indicated in the descending order of significance.

# **Transboundary Diagnostic Analysis for the Mediterranean (TDA MED)**

## **Section 2**

### **Specific Actions Proposed for each Identified Problem**

This section examines the specific problems identified in the course of the preparation of the Transboundary Diagnostic Analysis for the Mediterranean (TDA MED)

These problems were identified on the basis of the information obtained for the purpose of this document from Mediterranean countries and relevant international organizations, as well as information collected over the two decades of MAP and associated international organizations.

The following chapters (topics) are contained in this Section 2:

- 2.1 Sources of pollution
  - 2.1.1 Rivers
  - 2.1.2 Ports – to be prepared
  - 2.1.3 Maritime transport – to be prepared
  - 2.1.4 Agricultural run-off – to be prepared
  - 2.1.5 Airborne pollution
  - 2.1.6 Exploitation of seabed and its subsoils
- 2.2 Pollution “hot spots”
- 2.3 Sensitive areas
- 2.4 Tourism – to be prepared
- 2.5 Living marine resources
  - 2.5.1 Fishery
  - 2.5.2 Aquaculture
- 2.6 Critical habitats and ecosystems, and endangered species – to be prepared
- 2.7 Coastal zone management and planning
- 2.8 Institutional arrangements
- 2.9 Public participation
- 2.10 Summary of estimated investment costs of projects and programme – to be prepared

Results of the analysis of each topic are presented in corresponding table(s) which include:

- problem;
- impact (including transboundary);
- stakeholders;
- uncertainties;
- proposed actions with estimated costs; and
- products and milestones.

The topics “coastal cities” and “industrial pollution from coastal installations” are covered by chapter 2.2 “Pollution hot spots” due to the fact that during the work on the analyses of the hot spots it was concluded that in most cases problems of cities and coastal industrial installations are intimately merged together and can not be separated.

The cost of proposed activities were estimated for most of the chapters but unfortunately not for all. The available estimates obviously need to be revised as to the cost indicated as well as the methodology used.

There are four main reasons that the analysis could be improved in the future:

- lack of methodology for comparative analysis of potential hot spots;
- lack of methodology for establishment of "sensitive areas";
- lack of methodology for costing of activities; and
- lack of information necessary for the assessment.

In spite of above problems this analysis is a significant contribution to the analysis of the problems in the Mediterranean and should serve as a valuable basis for the development of the Strategic Action Plan for the Mediterranean.

**Table 2.1.1.1 Rivers – Proposed Actions**

PROBLEMS	IMPACTS*	STAKEHOLDERS	UNCERTAINTIES	ACTIONS AND ASSOCIATED COSTS	PRODUCTS AND MILESTONES
<p>1. Insufficient and outdated information on actual water discharge to the sea in a fast-changing conditions</p>	<p>L - H N - H T - H</p>	<ul style="list-style-type: none"> <li>• Local institutions</li> <li>• Government agencies</li> <li>• Intergovernmental agencies</li> <li>• Research institutes</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of reliable data on changes in water discharge due to human impacts</li> <li>• Lack of exact data on key rivers (e.g. Nile)</li> </ul>	<ul style="list-style-type: none"> <li>• Checking long-term trends in water discharge mainly due to irrigation and/or reservoir construction</li> <li>• Developing a regionalized topology of river hydrological regimes (natural and impacted)</li> </ul>	<ul style="list-style-type: none"> <li>• Comprehensive register of monthly discharges of 50 Mediterranean rivers over the last 30 years – by year 1998</li> <li>• River topology – by year 1998</li> <li>• Established total water inputs from land to sea per subbasins for the period 1950-2000 - by year 2000</li> </ul>
<p>2. Insufficient information on river sediment (SS) discharge to the sea, their impact on coastal zone morphology, on pollutant transport and storage, and related information on erosion processes. (The Mediterranean Basin has one of the highest variability of SS due to natural conditions and fast evolving human impacts, like damming and diversion)</p>	<p>L - H N - H T - H</p>	<ul style="list-style-type: none"> <li>• Local institutions</li> <li>• Government agencies</li> <li>• Intergovernmental agencies</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of adequate monitoring for suspended sediment on near all rivers</li> <li>• Very rapid change of sediment transport due to human activities</li> <li>• Extreme events not taken into account</li> </ul>	<ul style="list-style-type: none"> <li>• Establishing ad hoc monitoring of SS for 20 selected rivers of the Basin, on a long-term basis</li> <li>• Establishing the key impacts of reservoir construction on sediment transport on a long-term basis (sometimes 30 years) and their influence on coastal zone</li> </ul>	<ul style="list-style-type: none"> <li>• Established permanent register of selected river sediment discharge (monthly loads) based on specific monitoring – by year 2001</li> <li>• Register of past trends of suspended sediments including extreme events and storage in reservoirs – by year 2000</li> <li>• Specific guidelines for suspended sediment surveys adopted by the experts meeting - by year 1998</li> </ul>

<p>3. Inadequate surveys of water quality for the establishment of river fluxes. Present surveys are based on regular sampling, typically 12/year, not focused on period of high fluxes. Inadequate surveys of metal pollution for flux estimates. (In Mediterranean rivers typically 90 to 99% of metals and some organic micropollutants, as PCBs, DDT, some PAH, are attached to suspended particulates)</p>	<p>L - M N - M T - M</p>	<ul style="list-style-type: none"> <li>Local institutions</li> <li>Government agencies</li> </ul>	<ul style="list-style-type: none"> <li>Fluxes of dissolved matter are known with uncertainties (20% to 50% typically)</li> <li>Fluxes of particulate pollutants are even much more uncertain</li> <li>Typically 90% of particulate pollutants may be discharged in less than 5% of the time</li> <li>Smaller and unregulated rivers need more samples than bigger and regulated rivers</li> </ul>	<ul style="list-style-type: none"> <li>Programme of sampling and analysis during periods of high water flows</li> <li>Measurements of extreme flood events of rare occurrence</li> <li>Increase of sampling frequency for small rivers</li> <li>Focus on separate analysis of particulate pollutants of filtered material</li> <li>Measurement of high turbidity periods in surveys</li> </ul>	<ul style="list-style-type: none"> <li>Guidelines for water quality survey and flux estimates adopted by meeting of experts - by year 1998</li> </ul>
<p>4. Lack of relevant information on micropollutants for many rivers. Lack of information on trends, of contamination at river mouth. Lack of natural background levels.</p>	<p>L - H N - M T - I</p>	<ul style="list-style-type: none"> <li>Research institutes</li> </ul>	<ul style="list-style-type: none"> <li>In many countries river quality surveys are still inappropriate or too recent to assess i) pollution vs natural contents, ii) trends in the last 30 years, and iii) levels of some organic micro pollutants</li> </ul>	<ul style="list-style-type: none"> <li>Coordination of a large scale study of environmental archives based on the sampling of selected and dated cores taken at river mouths</li> <li>Analysis of heavy metals, persistent organic pollutants and nutrients in deposited sediments</li> </ul>	<ul style="list-style-type: none"> <li>Reconstruction of past history of river inputs combining pollutants inputs, extreme natural events, pollutant storage - 2000 - 2003</li> </ul>
<p>5. Lack of coordinated data bank on human</p>	<p>L - I N - H T - H</p>	<ul style="list-style-type: none"> <li>Research institutes</li> <li>Governmental agencies</li> <li>Intergovernmental agencies</li> </ul>	<ul style="list-style-type: none"> <li>Basic information (as total population, industrial sources of pollution, fertilizer and pesticides use; location of dams and diversions) on river pollutant sources is not presently available and/or distributed per Mediterranean subbasins</li> </ul>	<ul style="list-style-type: none"> <li>Establishing a data bank on socio-economic indicators related to river quality and pollutants fluxes</li> <li>The data bank on GIS to be prepared, made available and distributed</li> <li>Updating of the data bank should be carried out regularly (every 5 years)</li> <li>Linking socio-economic indicators to water-quality indicators through GIS to check pollution control (Guidelines to be developed)</li> </ul>	<ul style="list-style-type: none"> <li>Established permanent data bank of socio-economic indicators associated with GIS - by year 2000</li> <li>Guidelines adopted by experts meeting - by year 1998</li> </ul>

<p>6. Identification of pristine Mediterranean rivers and river mouths to be preserved</p>	<p>L - H N - H T - M</p>	<ul style="list-style-type: none"> <li>Local institutes</li> <li>Governmental agencies</li> <li>Intergovernmental agencies</li> </ul>	<ul style="list-style-type: none"> <li>Typical unspoiled rivers (including river mouths) are now rare in the basin, although a comprehensive list is not available</li> </ul>	<ul style="list-style-type: none"> <li>Setting up criteria for selection of pristine rivers</li> <li>Setting up a register of pristine rivers based on proposal of focal and governmental agencies</li> <li>Setting up a plan to protect pristine river basins and related river mouths whenever appropriate</li> </ul>	<ul style="list-style-type: none"> <li>Register on pristine rivers established - by year 1998</li> <li>Action plan adopted - by year 2000</li> </ul>
<p>7. Lack of basin-wide information on pesticides use and river inputs. Lack of basin-wide information on persistent organic pollutants</p>	<p>L - M N - M T - M</p>	<ul style="list-style-type: none"> <li>Local institutes</li> <li>Governmental agencies</li> </ul>	<ul style="list-style-type: none"> <li>More than 50 different agrochemicals are presently used in the basin. Monitoring of these chemicals is too expensive and should be focused on few targeted products</li> <li>Considering the long list of organic micro pollutants a selection of pollution indicators of various sources should be made for regular surveys</li> </ul>	<ul style="list-style-type: none"> <li>Compile the list and quantities of agrochemicals used in the Mediterranean watershed</li> <li>Select a short list of organic micro pollutants to be monitored in rivers as indicators of domestic, agricultural and industrial pollution</li> <li>Prepare an optional list of selected pesticides to be surveyed by countries</li> </ul>	<ul style="list-style-type: none"> <li>List of agrochemicals and organic micro pollutants adopted by the meeting of experts - by year 1998</li> </ul>
<p>8. Lack of permanent links between riparian countries concerning river pollutant monitoring and inputs</p>	<p>L - I N - M R - H</p>	<ul style="list-style-type: none"> <li>Governmental agencies</li> <li>Intergovernmental agencies</li> </ul>	<ul style="list-style-type: none"> <li>River surveys are not harmonized</li> <li>Lack of common methodology</li> <li>Lack of accessible integrated database</li> </ul>	<ul style="list-style-type: none"> <li>Convene a meeting of Mediterranean experts to agree on guidelines of water quality/quantity surveys, pristine rivers to be protected, and permanent registers to be established</li> <li>Prepare a river quality monitoring manual adapted to Mediterranean conditions</li> <li>Setting up permanent registers of river water quality and quantity accessible to all riparian countries on selected rivers (about 50)</li> </ul>	<ul style="list-style-type: none"> <li>Expert meeting - by year 1999</li> <li>River survey manual prepared - by year 2000</li> <li>Permanent river water quality register established - by year 2000</li> <li>Permanent river water discharge register established - by year 2000</li> </ul>



<p>9. Reduction of diffuse pollution sources</p>	<p>L - H N - H T - I</p>	<p>• Governmental agencies</p>	<p>• Inability to predict and control the levels of nitrate and pesticides</p>	<p>• Prepare a "good practice guide" adapted to Mediterranean conditions for the control of nutrients and pesticides use in agriculture</p> <p>• Prepare, by major river basin and/or by countries, plans of activities (2000-2010) to identify and control the diffuse sources of nutrients and pesticides</p> <p>• Start experimental control of nutrients and pesticides on selected river watersheds in NW basin or 'Tyrrhennian, Adriatic, Aegean subbasins (1999-2003)</p>	<p>• "Good practice guide" adopted - by year 1999</p> <p>• plans of activities (2000-2010) to control diffuse sources of nutrients and pesticides adopted - by year 2000</p> <p>• experimental control of nutrients and pesticides on selected river watersheds established - by year 2003</p>
<p>10. Reduction of phosphorus inputs</p>	<p>L - H N - H T - I</p>	<p>• Governmental agencies</p>	<p>• Increasing levels of phosphorus from many countries</p>	<p>• Prepare a calendar of drastic reduction, or ban, of phosphorus containing detergents in the basin</p> <p>• Prepare calendar for tertiary treatment of phosphorus in existing major sewage treatment plants in the vicinity of identified eutrophic areas</p>	<p>• Calendar of reduction of phosphorus containing detergents adopted - by year 1998</p> <p>• Calendar for tertiary treatment adopted and implemented in years 2000 - 2010</p>
<p>11. Reduction of industrial and mining sources of pollution within river basins</p>	<p>L - H N - H R - I</p>	<p>• Governmental agencies</p>	<p>• Need for better control of pollutants sources</p>	<p>• Prepare plans of actions (2000-2010) by major river basins and/or countries to identify/control pollutant sources from industries and mines</p>	<p>• Plans of actions (2000-2010) adopted - by year 2000 - and implemented</p>
<p>12. Reduction of domestic sources of organic pollutants within river basins</p>	<p>L - H N - H T - I</p>	<p>• Governmental agencies</p>	<p>• Need for better control of pollutants sources</p>	<p>• Prepare plans of actions (period 2000-2010) by major river basins and/or by countries to identify and control the remaining domestic wastes to be treated within the basin</p>	<p>• Plans of actions (2000-2010) adopted - by year 2000 - and implemented</p>

\* L - Local; N - National; T - Transboundary; I - Insignificant; M - Medium; H - High

**Table 2.1.2.1 Ports – Proposed Activities and Associated Costs**

**TO BE PREPARED**

**Table 2.1.3.1 Maritime Transport – Proposed Activities and Associated Costs**

**TO BE PREPARED**

**Table 2.1.4.1 Agricultural Run-off – Proposed Activities and Associated Costs**

**TO BE PREPARED**

**Table 2.1.5.1 Airborne Pollution – Proposed Actions and Associated Costs**

PROBLEMS	IMPACT*	STAKEHOLDERS	UNCERTAINTIES	PROPOSED ACTIONS AND ASSOCIATED COSTS	PRODUCTS AND MILESTONES
1. Identification of point and diffuse emission sources	L - H N - H T - H	<ul style="list-style-type: none"> <li>Relevant ministries</li> <li>Industry</li> <li>NGOs</li> <li>Scientific community</li> <li>International organizations</li> </ul>	<ul style="list-style-type: none"> <li>Inventories exist only for ECE countries for S and N and are under development for HM and POPs</li> <li>Large uncertainties exist for all pollutants</li> </ul>	<ul style="list-style-type: none"> <li>Establish inventory for major point sources following EMEP/CORINAIR guidelines <i>Cost estimate: US\$ 200,000</i></li> <li>Prepare a map on a grid of seasonal emissions of main pollutants – compilation of available data on industrial and agricultural activity, land use, traffic and current and past product use <i>Cost estimate: US\$ 200,000</i></li> </ul>	<ul style="list-style-type: none"> <li>Guidelines and other relevant materials – by year 1999</li> <li>Workshops and training – by year 1999</li> <li>Emission database based on updated activity data and emission factors for Mediterranean countries – by year 2000</li> <li>Map on a spatial grid of seasonal emissions – by year 2000</li> </ul>
2. Identification of atmospheric transport	L - I N - H T - H	<ul style="list-style-type: none"> <li>Relevant ministries</li> <li>Industry</li> <li>NGOs</li> <li>Scientific community</li> <li>International organizations</li> </ul>	<ul style="list-style-type: none"> <li>Large uncertainties exist in measurements for all pollutants</li> <li>Lack of precise knowledge on gas/liquid/solid phase partition, particle size, and dissolved and adsorbed fractions</li> </ul>	<ul style="list-style-type: none"> <li>Development of the measurements network and its intercalibration and compilation of existing measurements <i>Cost estimate: US\$ 500,000</i></li> <li>Establishment of a Network of National Focal Points to meet on a regular basis and adopt reference methods, reference stations and report data <i>Cost estimate: US\$ 500,000</i></li> <li>Extension of current ECE/LRTAP/EMEP models to the Mediterranean and development of source receptor relations <i>Cost estimate: US\$ 300,000</i></li> </ul>	<ul style="list-style-type: none"> <li>Established measurements network - by year 2000</li> <li>Established Network of National Focal Points – by year 1998</li> <li>Priorities and potential field work defined by the Meetings of the Network of National Focal Points – by year 1999</li> <li>Linkages with analogous work in other fora</li> </ul>

<p>3. Identification of direct and indirect effects of transboundary air pollution</p>	<p>L - I N - H T - H</p>	<ul style="list-style-type: none"> <li>• Relevant ministries</li> <li>• Industry</li> <li>• NGOs</li> <li>• Scientific community</li> <li>• International organizations</li> </ul>	<ul style="list-style-type: none"> <li>• Actual fluxes, dynamic responses, and pathways of air pollution are not well known</li> </ul>	<ul style="list-style-type: none"> <li>• Measurements of current levels in biotic and abiotic environment and effects on health and ecosystems <i>Cost estimate: US\$ 600,000</i></li> <li>• Develop models for the Mediterranean basin of exposure pathways to air pollution, dose/response, effective dose, critical limits for direct and indirect effects stock at risk <i>Cost estimate: US\$ 600,000</i></li> </ul>	<ul style="list-style-type: none"> <li>• Reference methods, reference stations and reported data adopted by meetings of the Network of National Focal Points – by year 2000</li> <li>• Operational, calibrated model – by year 2002</li> </ul>
<p>4. Inadequate control strategies:</p> <ul style="list-style-type: none"> <li>- Best Available Techniques (BAT)</li> <li>- Effects based abatement strategies and Integrated Assessment Modeling</li> <li>- Information exchange</li> <li>- International agreements</li> </ul>	<p>L - H N - H T - H</p>	<ul style="list-style-type: none"> <li>• Relevant ministries</li> <li>• Industry</li> <li>• NGOs</li> <li>• Scientific community</li> <li>• International organizations</li> </ul>	<ul style="list-style-type: none"> <li>• Importance of local conditions in assessment of BAT</li> <li>• Cost curves and the importance in local conditions; structural changes</li> </ul>	<ul style="list-style-type: none"> <li>• Identify current best practices, product and process alternatives; BAT for new sources and implement incentives/disincentives <i>Cost estimate: US\$ 3,000,000,000</i></li> <li>• Extend existing ECE/LRTAP/WGE/IAM models to include the Mediterranean; development of cost curves and scenarios for air pollution abatement strategies based on the protection of ecosystems and human health <i>Cost estimate: US\$ 500,000</i></li> <li>• Improve access to information on process / product alternatives and risks <i>Cost estimate: US\$ 200,000</i></li> <li>• Ratification of ECE/LRTAP Protocols by ECE countries and development of analogous agreements for the Mediterranean ssECE countries to facilitate extension to the Mediterranean of the abatement strategies developed in ECE/LRTAP</li> </ul>	<ul style="list-style-type: none"> <li>• Developed Network of National Focal Points and regular exchange of information – by year 1999</li> <li>• Established link with industry and NGOs – by year 1998</li> </ul>

\* L - Local; N - National; T - Transboundary; I - Insignificant; M - Medium; H - High

**Table 2.1.6.1 Exploitation of Seabed and Subsoils – Proposed Actions and Associated Costs**

PROBLEM	IMPACTS*	STAKEHOLDERS	UNCERTAINTIES	PROPOSED ACTIONS AND ASSOCIATED COSTS	PRODUCTS AND MILESTONES
1. Assessment of the scope of the problem associated with the exploitation of the seabed and the long term potential for possible transboundary effects	L - I N - I T - H	<ul style="list-style-type: none"> <li>Relevant ministries</li> <li>Industry</li> <li>Private sector</li> <li>NGOs</li> <li>International organizations</li> </ul>	<ul style="list-style-type: none"> <li>Readiness of relevant ministries and industry to approach the problem</li> <li>Availability of funds</li> </ul>	<p>Implement a data collection programme to provide details of pollutant loadings from oil and gas exploration and production activities :</p> <ul style="list-style-type: none"> <li>Desk study to provide rough estimate of loads</li> </ul> <p><i>Cost estimate: US\$ 15,000</i></p> <ul style="list-style-type: none"> <li>Draft data reporting guidelines and establishment of database for discharges</li> </ul> <p><i>Cost estimate: US\$ 10,000</i></p>	<ul style="list-style-type: none"> <li>Estimates of pollution loads – by year 1998</li> <li>Guidelines on data reporting – by year 1998</li> <li>Established database for discharges – by year 1999</li> <li>Guidelines for undertaking acoustic operations – by year 1999</li> <li>Criteria for assessment of discharges of annex 2 substances – by year 1999</li> </ul>
2. Reduction of acoustic effects	L - H N - I T - H	<ul style="list-style-type: none"> <li>Relevant ministries</li> <li>Industry</li> <li>Private sector</li> <li>NGOs</li> <li>International organizations</li> </ul>	<ul style="list-style-type: none"> <li>Readiness of relevant ministries and industry to approach the problem</li> <li>Availability of funds</li> <li>Adequacy of the scientific knowledge on the problem</li> </ul>	<p>Development of guidelines for undertaking acoustic operations to minimize environmental impacts and adopt these guidelines as and additional annex to the Offshore Protocol</p> <p><i>Cost estimate: US\$ 5,000</i></p>	<ul style="list-style-type: none"> <li>Guidelines for undertaking acoustic operations – by year 1999</li> </ul>
3. Lack of criteria for acceptance of substances listed in annex 2 of the Offshore Protocol	L - I N - I T - H	<ul style="list-style-type: none"> <li>Relevant ministries</li> <li>Industry</li> <li>Private sector</li> <li>NGOs</li> <li>International organizations</li> </ul>	<ul style="list-style-type: none"> <li>Readiness of relevant ministries and industry to approach the problem</li> <li>Availability of funds</li> </ul>	<p>Establish criteria for assessment of discharges of annex 2 substances of Offshore Protocol</p> <p><i>Cost estimate: US\$ 15,000</i></p>	<ul style="list-style-type: none"> <li>Criteria for assessment of discharges of annex 2 substances – by year 1999</li> </ul>

<p>4. Lack of regional guidelines for offshore exploitation to use best industry practice to minimize the risk of oil spills</p>	<p>L - I N - I T - H</p>	<ul style="list-style-type: none"> <li>• Relevant ministries</li> <li>• Industry</li> <li>• Private sector</li> <li>• NGOs</li> <li>• International organizations</li> </ul>	<ul style="list-style-type: none"> <li>• Readiness of relevant ministries and industry to approach the problem</li> <li>• Availability of funds</li> </ul>	<p>Review response strategies</p> <p><i>Cost estimate: US\$ 20,000</i></p> <p>Design reporting structure and database for spills form offshore exploitation</p> <p><i>Cost estimate: US\$ 10,000</i></p> <p>Develop guidelines for best practice to minimize spills</p> <p><i>Cost estimate: US\$ 15,000</i></p>	<ul style="list-style-type: none"> <li>• Proposals for amendments of the response strategies – by year 1998</li> <li>• Reporting structure and database for spills from offshore exploitation – by year 1998</li> <li>• Guidelines for best practice to minimize spills – by year 1998</li> </ul>
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\* L – Local; N – National; T – Transboundary; I – Insignificant; M – Medium; H - High



**Table 2.2.1 Pollution Hot Spots – Proposed Actions and Associated Costs**

PROBLEMS	IMPACTS	STAKEHOLDERS	UNCERTAINTIES	PROPOSED ACTIONS AND ASSOCIATED COSTS	PRODUCTS AND MILESTONES
<p>1. Control of pollution at 29 Priority Hot Spots in the Mediterranean</p> <p>List of 109 pollution hot spots (of which 29 were identified as Priority Hot Spots with weighted impact factor of 20 or more) was prepared on the basis of assessment carried out at the country level by national and local authorities and experts preparing national reports. Hot spots were ranked by weighted factors determined by multicriteria analysis and according to the relative importance of their impacts on public health, drinking water quality, recreation and other beneficial uses, aquatic life (including biodiversity) and economy and welfare. Summary of the results of the assessment are presented in chapter 3.2 and details of the assessment are contained in country reports</p>	<p>L - H N - H T - H</p>	<ul style="list-style-type: none"> <li>National and local authorities</li> <li>Polluting enterprises</li> <li>Municipalities</li> <li>Industry</li> <li>Tourism</li> <li>Private sector</li> <li>Academic institutions</li> <li>NGOs</li> <li>General public</li> <li>International organizations</li> </ul>	<ul style="list-style-type: none"> <li>Cost estimate for individual hot spots were either given by national or local authorities or were estimate by experts preparing national reports. Further work is needed to improve the reliability of estimates</li> <li>Methodology for the determination of weighted factors for impact should be revised and improved</li> <li>Financing of preinvestment studies, remedial actions and monitoring programmes is uncertain</li> <li>Methodology for identification of transboundary impacts is not standardized</li> </ul>	<ul style="list-style-type: none"> <li>Present a list of 29 Priority Hot Spots to the Conference of Donors</li> <li>Prepare preinvestment studies for each of the Priority Hot Spots</li> </ul> <p><i>Cost estimate: US\$ 2,900,000</i></p> <ul style="list-style-type: none"> <li>Prepare action plan for remedial actions in order to control pollution at Priority Hot Spots</li> </ul> <p><i>Cost estimate: US\$ 50,000</i></p> <ul style="list-style-type: none"> <li>Implement action plan for remedial actions based on preliminary assessment</li> </ul> <p><i>Cost estimate: US\$ 1,366,100,000</i></p> <ul style="list-style-type: none"> <li>Revision of methodology used in determination of weighted factors for impact (including transboundary impact) and their comparative analysis</li> </ul> <p><i>Cost estimate: US\$ 50,000</i></p> <ul style="list-style-type: none"> <li>Implement. of relevant compliance and trend pollution monitoring programmes at the locations of 29 hot spots</li> </ul> <p><i>Cost estimate: US\$ 2,000,000</i></p> <ul style="list-style-type: none"> <li>Study on approaches in ICZM to clarify and optimise the complex relationship between urbanisation and industrialisation in the Mediterranean coastal zone</li> </ul> <p><i>Cost estimate: US\$ 30,000</i></p>	<ul style="list-style-type: none"> <li>List presented at the Conference of Donors – by the end of 1997</li> <li>Preinvestment studies prepared – by year 1998</li> <li>Action plan for remedial actions prepared – by year 1998</li> <li>Methodology for the determination of weighted factors revised – by the end of year 1997</li> <li>Pollution monitoring programmes prepared – by year 1998</li> <li>Study on approaches in ICZM prepared – by year 1998</li> <li>Environmental audit prepared – by year 1998</li> </ul>

<p>2. Control of pollution at 80 Hot Spots in the Mediterranean (See explanation under point 1. above)</p>	<p>L - H N - H T - M</p>	<ul style="list-style-type: none"> <li>• National and local authorities</li> <li>• Polluting enterprises</li> <li>• Municipalities</li> <li>• Industry</li> <li>• Tourism</li> <li>• Private sector</li> <li>• NGOs</li> <li>• General public</li> <li>• International organizations</li> </ul>	<ul style="list-style-type: none"> <li>• Cost estimate for individual hot spots were either given by national or local authorities or were estimate by experts preparing national reports. Further work is needed to improve the reliability of estimates</li> <li>• Methodology for the determination of weighted factors for impact should be revised and improved</li> <li>• Financing of preinvestment studies, remedial actions and monitoring programmes is uncertain</li> <li>• Identification of transboundary impacts is unreliable</li> </ul>	<ul style="list-style-type: none"> <li>• Carry out environ. audits of industries in priority hot spots &amp; revise cost estimates accordingly</li> </ul> <p>Cost estimates: US\$ 2,900,000</p> <ul style="list-style-type: none"> <li>• Present a list of 80 Hot Spots to the Conference of Donors</li> <li>• Select hot spots for which preinvestment studies will be prepared and prepare such studies</li> </ul> <p>Cost estimate: US\$ 2,000,000</p> <ul style="list-style-type: none"> <li>• Prepare action plan for remedial actions in order to control pollution at selected Hot Spots</li> </ul> <p>Cost estimate: US\$ 20,000</p> <ul style="list-style-type: none"> <li>• Implement action plan for remedial actions</li> </ul> <p>Cost estimate: US\$ 1,000,000,000</p> <ul style="list-style-type: none"> <li>• Implementation of relevant compliance and trend pollution monitoring programmes at the locations of selected hot spots</li> </ul> <p>Cost estimate: US\$ 1,000,000</p>	<ul style="list-style-type: none"> <li>• List presented at the Conference of Donors -- by the end of 1997</li> <li>• Preinvestment studies prepared -- by year 1998</li> <li>• Action plan for remedial actions prepared -- by year 1998</li> <li>• Pollution monitoring programmes prepared -- by year 1998</li> </ul>
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\* L - Local; N - National; T - Transboundary; I - Insignificant; M - Medium; H - High

**Table 2.3.1 Sensitive Areas – Proposed Actions and Associated Costs**

PROBLEMS	IMPACTS*	STAKEHOLDERS	UNCERTAINTIES	PROPOSED ACTIONS AND ASSOCIATED COSTS	PRODUCTS AND MILESTONES
<p>1. Assessment and protection of sensitive coastal areas</p> <p>Twenty five sensitive areas were identified but criteria for their selection was not standardized</p>	<p>L – H N – H T – M</p>	<ul style="list-style-type: none"> <li>• National and local authorities</li> <li>• Municipalities</li> <li>• Private sector</li> <li>• Tourism</li> <li>• Industry</li> <li>• NGOs</li> <li>• International organizations</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of standard methodology for the selection of establishment of sensitive areas</li> <li>• Information on sensitive areas is incomplete</li> </ul>	<ul style="list-style-type: none"> <li>• Prepare action plan for the remedial actions for identified sensitive areas</li> </ul> <p><i>Cost estimate: US\$ 30,000</i></p> <ul style="list-style-type: none"> <li>• Remedial actions for identified sensitive areas, in accordance with preliminary cost estimates</li> </ul> <p><i>Cost estimate: US\$ 80,000,000</i></p> <ul style="list-style-type: none"> <li>• Development of the standardized methodology for the selection of sensitive areas and for the determination of the cost of their protection</li> </ul> <p><i>Cost estimate: US\$ 30,000</i></p>	<ul style="list-style-type: none"> <li>• Action plan prepared – by year 1998</li> <li>• Remedial actions implemented – by year 2000</li> <li>• Standardized methodology developed – by year 1998</li> </ul>

\* L – Local; N – National; T – Transboundary; I – Insignificant; M – Medium; H - High

**Table 2.4.1 Tourism – Proposed Activities and Associated Costs**

**TO BE PREPARED**

**Table 2.5.1.1 Living marine resources (fishery) - proposed actions and associated costs**

PROBLEM	STAKEHOLDERS	UNCERTAINTIES	PROPOSED ACTIONS AND ASSOCIATED COSTS (Numbered items correspond to items in Table 3.5.6.)	PRODUCTS AND MILESTONES
<p>1. Poor capacity for planning for responsible management of fisheries within international waters, including applications of the UN Agreement on Straddling fish stocks and highly migratory fish stocks</p>	<ul style="list-style-type: none"> <li>Governmental agencies responsible for fisheries management</li> <li>Research institutes</li> </ul>	<ul style="list-style-type: none"> <li>Lack of national source of funding to recruit social scientists in the administration</li> </ul>	<p>1. Increase institutional capacity:</p> <ul style="list-style-type: none"> <li>training in the field of social science</li> <li>developing socio-economic analyses and instruments</li> <li>developing transparent precautionary and adaptive decision-making mechanisms</li> <li>encourage technical cooperation between both competent institutions within countries, and between institutions in countries bordering the Mediterranean</li> </ul> <p>Cost: US\$ 258,000</p>	<ul style="list-style-type: none"> <li>A strengthened institutional capacity to formulate and follow-up rational fisheries management strategies</li> </ul>
<p>2. Poor communication between policy makers, fishers and fishery scientists</p>	<ul style="list-style-type: none"> <li>Governmental agencies responsible for fisheries management</li> <li>Research institutes</li> <li>Fisher's/Produce r's organisations</li> </ul>	<ul style="list-style-type: none"> <li>Reliability of current fishery statistics and socio-economic information</li> </ul>	<p>2. Develop tools for dissemination of information:</p> <ul style="list-style-type: none"> <li>publish a newsletter</li> <li>organise meetings</li> <li>revise administration's procedures to ensure larger dissemination of management-related information</li> </ul> <p>Cost: US\$ 100,000</p>	<ul style="list-style-type: none"> <li>A better transparency in information circulation resulting in an increased commitment of fishers to the management process</li> </ul>
<p>3. Inadequate formulation of regulations and in particular poorly defined rights and responsibilities of those with established local access rights to resources within national legislation</p>	<ul style="list-style-type: none"> <li>Governmental agencies responsible for fisheries management</li> <li>Fisher's/Produce r's organisations</li> </ul>	<ul style="list-style-type: none"> <li>Insufficient level of organisation of fishers</li> </ul>	<p>3. Reconcile "top-down" with 'bottom-up' mechanisms:</p> <ul style="list-style-type: none"> <li>revise institutional and legal frameworks to clarify rights and responsibilities concerning access to fisheries</li> <li>adapt mechanisms to support management process in partnership</li> <li>educate fishermen on the needs and approaches for sustainable development of fishery resources in coastal communities</li> </ul> <p>Cost: US\$ 139,000</p>	<ul style="list-style-type: none"> <li>A cost-effective responsible management regime of coastal fisheries</li> </ul>

<p>4. Inadequate enforcement of national fisheries regulations</p>	<ul style="list-style-type: none"> <li>Governmental agencies responsible for fisheries management</li> <li>Inspectors of fisheries</li> <li>Fisher's/producer's organisations</li> </ul>	<ul style="list-style-type: none"> <li>Governmental agencies responsible for fisheries management</li> <li>Inspectorates of fisheries</li> <li>Fisher's/producer's organisations</li> </ul>	<p>4. Improve fishery monitoring, control and surveillance (MCS) systems:</p> <ul style="list-style-type: none"> <li>Devise cost-effective MCS systems</li> <li>Fisher's/producer's organisations and relevant administrations should share responsibilities in MCS</li> <li>Strengthen logistical support to enable concerned administrations to make full use of its prescriptive and enforcement powers</li> </ul> <p>Cost: US\$ 119,000</p>	<ul style="list-style-type: none"> <li>An adequate and implementable legal regime for fisheries management measures enforcement within territorial waters</li> </ul>
<p>5. Inadequate provisions for fisheries monitoring, and statistical data gathering</p>	<ul style="list-style-type: none"> <li>GFCM</li> <li>Governmental and intergovernmental agencies responsible for fisheries management</li> <li>The fisheries sector</li> </ul>	<ul style="list-style-type: none"> <li>Reliability of current fishery statistics.</li> <li>Transparency of data</li> <li>Confidentiality of data where necessary</li> </ul>	<p>5. Provide networks for information and develop data collection methods by creating a very basic fishery data elaboration system<sup>1</sup>. These very basic data should be reported (through a standardised schemes designed in advance), on timely basis, to the GFCM secretariat where a common data base has to be created</p> <p>Cost: US\$ 119,000</p>	<ul style="list-style-type: none"> <li>An adequate system to gather reliable statistics in real time for assessments purposes, especially for transboundary stocks</li> </ul>
<p>6. Lack of multidisciplinary approaches to fishery management issues and of co-ordination between fishery researchers and regulatory agencies</p>	<ul style="list-style-type: none"> <li>Scientific national institutions</li> <li>Scientific regional organisations</li> <li>GFCM</li> </ul>	<ul style="list-style-type: none"> <li>Need for intern. body able to provide independent scient. advice for manag.purposes.</li> <li>Difficulties to implement coord. Intern. Res. projects involving the main fishery states in the region</li> </ul>	<p>6. Revise international organisation's schemes to provide advice for Management needs. Collaborate at the national and international levels. The existing international organisations dealing with assessment issues for management must collaborate to ensure efficient assessment of stocks and to provide advice for fishery management. This can be done by means of annual meetings of an Advisory WG for Fishery Management based on the work of several Technical Subgroups</p> <p>Cost: US\$ 250,000</p>	<ul style="list-style-type: none"> <li>A regional system that annually provides a comprehensive and scientifically acceptable overview of the state of fishery resources and fishery activities and provide recommendations for management</li> </ul>

<sup>1</sup> Total annual landings by species in finer time-area-gear resolutions, fleet size and vessel power, effort by fishing gear, following procedures compatible with the requirements of further elaboration of catch at length or/and age statistics  
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<p>7/8. Weak subregional cooperation and insufficient input from GFCM secretariat due to lack of staff/funding. Inadequate co-ordination and harmonisation of national measures for fisheries in international waters and on shared, straddling and migratory stocks. Inadequate implementation of the UN Agreement on Straddling fish Stocks and Highly Migratory Fish Stocks and the provisions of the Code of Conduct for responsible Fisheries Management. Overexploitation of demersal, anchovy and highly migratory fish stocks and overcapitalization of fleets</p>	<p>GFCM</p> <ul style="list-style-type: none"> <li>• Governmental and intergovernmental agencies responsible for fisheries management</li> <li>• The fisheries sector</li> </ul>	<ul style="list-style-type: none"> <li>• Unclear jurisdiction and regulations</li> <li>• Questionable availability of resources for GFCM (funds, structures, man power, etc).</li> <li>• Reliability of current fisheries statistics and inaccurate registry of fishing vessels</li> </ul>	<p>7/8. Strengthen effectiveness of international management bodies:</p> <ul style="list-style-type: none"> <li>• Revise terms of reference and rules of GFCM so as to make it in particular a self running and financing body</li> <li>• Set up several independent and preferably sub-regional commissions that would work as management bodies for local resources coordinated by GFCM</li> <li>• Harmonize of management policies</li> <li>• Establish cooperative manag. systems to share a limited total of standard effort units to adapt the fishery capacity to potential produc. of resources</li> <li>• GFCM should encourage member countries to adhere to United Nations international fishery agreements and to endorse and implement council's formal resolutions</li> <li>• Effective control of fishing effort: set up a registry of fishing boats (characterisation of vessels into categories and fishing gears) and keep this register updated. Setting up cooperative management systems like shares in total number of standard effort units</li> </ul> <p>Cost: US\$ 400,000</p>	<ul style="list-style-type: none"> <li>• Coordinated fisheries management policy for the Mediterranean and a system to gradually adapt fishing effort – by year 2000</li> </ul>
<p>9. Inadequate fisheries regulation and enforcement and weak and uncoordinated fishery control and surveillance in international and national waters, including port control, leads to overexploitation of demersal, anchovy and highly migratory fish stocks, and overcapitalization of fleets</p>	<p>GFCM</p> <ul style="list-style-type: none"> <li>• Governmental and intergovernmental agencies responsible for fisheries management</li> <li>• Inspectories of fisheries</li> <li>• The fisheries sector</li> </ul>	<ul style="list-style-type: none"> <li>• Reluctance of countries to allow inspections of their fishing vessels by other countries on high seas</li> <li>• Reliability of current fisheries statistics and inaccurate registry of fishing vessels</li> </ul>	<p>9. Establish co-ordinated international systems of monitoring, control and surveillance (Fisheries patrols, satellite/telemetry systems)</p> <ul style="list-style-type: none"> <li>• Provide developing countries with technical assistance, and advice for the establishment of these MCS systems</li> <li>• Improve MCS systems to ensure an effective control of fishing effort within internat. waters:</li> <li>- Devise cost-effective MCS systems</li> <li>- Establish a registry of fishing boats (characterisation of vessels into categories and fishing gears) and keep this register updated</li> </ul> <p>Cost: US\$ 119,000</p>	<ul style="list-style-type: none"> <li>• Coordinated fish vessel inspection system for the Mediterranean supported by an adequate and nationally harmonised legal regime for fisheries management measures and their enforcement – by year 2000</li> </ul>

<p>10. Absence of research work on the impacts of nutrient enrichment and pollutants from land runoff on marine fisheries. Inadequate quantification of nutrient and pollutant. Poor communication between research on fisheries and on pollution issues</p>	<ul style="list-style-type: none"> <li>• Ministries of environment and fisheries of all Mediterranean countries</li> <li>• Research institutions</li> <li>• Governmental Agencies</li> <li>• Fisheries sector</li> </ul>	<ul style="list-style-type: none"> <li>• Reliability of current information</li> <li>• Format of available data</li> <li>• Lack of quantitative surveys</li> </ul>	<p>10. Research impact of nutrient enrichment and pollutants on fisheries:</p> <ul style="list-style-type: none"> <li>• Conduct preliminary study to review existent information for each Mediterranean catchment basin</li> <li>• Pool existent information in one central location, standardise formats and analyse existent trends</li> <li>• Establish priorities for additional research and monitoring programs needed</li> <li>• Establish a Mediterranean centre that will coordinate the above activities through existing international bodies (MAP, IOC, CIESM) and utilising resources and information from established international projects (MEDPOL)</li> </ul> <p>Cost: US\$ 2,550,000</p>	<ul style="list-style-type: none"> <li>• Quantified amounts of nutrients and non-biodegradable pollutants entering Mediterranean catchment basins</li> <li>• Determined the type and magnitude of correlation existing between nutrient enrichment, pollutants and fisheries production (over the last 20 years)</li> <li>• Recommendations for the management of Mediterranean catchment basins as it relates to fisheries</li> </ul>
<p>11. Insufficient research on incidental impacts of trawling and other non selective gears on marine ecosystems. Lack of monitoring systems to detect introduced species. Inadequate regulations and enforcement regarding trawling and dredging on critical habitats, nursery/spawning and inshore/estuarine and vegetated areas</p>	<ul style="list-style-type: none"> <li>• Ministries of environment and fisheries of all Mediterranean countries</li> <li>• Research institutions</li> <li>• Governmental Agencies</li> <li>• Fisheries sector</li> </ul>	<ul style="list-style-type: none"> <li>• Reliability of current information</li> <li>• Format of available data</li> <li>• Lack of quantitative surveys</li> </ul>	<p>11. Research on impacts of fisheries and introduced species and implementation of regulations:</p> <ul style="list-style-type: none"> <li>• Research.</li> <li>• Control of introduced species CITES mechanisms.</li> <li>• Ban on use of Trawl gears in less than 50 meters depth.</li> <li>• Reconvert vessels to selective gears.</li> </ul> <p>Cost: US\$ 400,000</p>	



**Table 2.5.2 Living Marine Resources (Aquaculture) – Proposed Actions and Associated Costs**

PROBLEMS	IMPACTS'	STAKEHOLDERS	UNCERTAINTIES	PROPOSED ACTIONS AND ASSOCIATED COSTS	PRODUCTS AND MILESTONES
1. Poor implementation of proper criteria and methodology while siting aquaculture	L - H N - H T - I	<ul style="list-style-type: none"> <li>Coastal authorities</li> <li>Responsible ministries</li> <li>International organizations</li> <li>GFCM through regional networks</li> </ul>	<ul style="list-style-type: none"> <li>Lack of knowledge and technical skill</li> </ul>	<ul style="list-style-type: none"> <li>Test cases at different scenarios applying CAM guidelines and GIS methodology as a tool</li> <li><i>Cost estimate: US\$ 170,000</i></li> </ul>	<ul style="list-style-type: none"> <li>Three GIS mapping models to be used as a strategic management tool by the sectors decision makers – by year 1999</li> </ul>
2. Shellfish affected by toxic algae	L - H N - H T - H	<ul style="list-style-type: none"> <li>National authorities</li> <li>International organizations</li> <li>Regional networks</li> </ul>	<ul style="list-style-type: none"> <li>Reliability of current information</li> <li>Lack of quantitative surveys</li> </ul>	<ul style="list-style-type: none"> <li>Conduct a preliminary study to review existing information</li> <li>Training of scientists and technicians</li> <li>Create a positive image of shellfish product</li> <li><i>Cost estimate: US\$ 500,000</i></li> </ul>	<ul style="list-style-type: none"> <li>Increase of shellfish production by 50% in next decade</li> </ul>
3. Poor diversification and quality of farmed products	L - H N - H T - H	<ul style="list-style-type: none"> <li>Aquaculture Producer's organizations</li> <li>GFCM with Regional networks</li> <li>European Union</li> </ul>	<ul style="list-style-type: none"> <li>Lack of relevant information on target species</li> <li>Quality of aquaculture environment and post-harvesting approach</li> </ul>	<ul style="list-style-type: none"> <li>Strengthening of research on biology and farming performances of newly selected species</li> <li>Encourage scientific and technical cooperation on promoting quality of aquaculture products</li> <li><i>Cost estimate: US\$ 500,000</i></li> </ul>	<ul style="list-style-type: none"> <li>Improved aquaculture potential and easier approach to market – by year 1999</li> </ul>
4. Inadequate formulation of national aquaculture regulations	L - I N - H T - I	<ul style="list-style-type: none"> <li>Inspectorates</li> <li>Responsible agencies</li> <li>Producer's organizations</li> <li>Regional networks</li> </ul>	<ul style="list-style-type: none"> <li>Unclear jurisdiction over aquaculture sector and lack of adequate regulations</li> </ul>	<ul style="list-style-type: none"> <li>Comparative analyses of the regulation relating to the bureaucratic aspects in the Mediterranean; including a seminar</li> <li><i>Cost estimate: US\$ 60,000</i></li> </ul>	<ul style="list-style-type: none"> <li>Improvement of aquaculture regulations and harmonization with other sectors – by year 1999</li> </ul>

5. Inadequate coordination and harmonization of aquaculture production in accordance to market opportunities	L - H N - H T - H	<ul style="list-style-type: none"> <li>• Aquaculture Producer's organizations</li> <li>• Regional networks</li> <li>• European Union</li> </ul>	<ul style="list-style-type: none"> <li>• Producer's profit margins</li> <li>• Lack of planning of aquaculture investment according to market opportunities</li> </ul>	<ul style="list-style-type: none"> <li>• Support to responsible administration in their planning of aquaculture investments</li> <li>• Initiate a project aiming to develop further European demand of finfish by including: <ul style="list-style-type: none"> <li>• ad hoc workshop with experts from Central and North European countries;</li> <li>• seminar on how to approach better potential consumers;</li> <li>• campaigns to inform consumers about characteristics of farmed products</li> </ul> </li> <li>• <i>Cost estimate: US\$ 1,000,000</i></li> </ul>	<ul style="list-style-type: none"> <li>• Provision of overall information on market trends - by year 1998</li> <li>• Created new market strategy for Central and North European countries - by year 2000</li> </ul>
6. Inadequate qualification and quantification of incidents in aquaculture	L - H N - H T - I	<ul style="list-style-type: none"> <li>• Responsible national authorities</li> <li>• International insurance companies</li> <li>• Regional networks</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of insurance records of losses in aquaculture</li> </ul>	<ul style="list-style-type: none"> <li>• Develop a methodology for economic risks assessment including a meeting to establish and discuss an updated registry of risks; cross-checking with other data sources</li> <li>• <i>Cost estimate: US\$ 120,000</i></li> </ul>	<ul style="list-style-type: none"> <li>• Report that include prevention control and mitigation of causes</li> <li>• Better approach to factors that cause main risks</li> </ul>
7. Inadequate enforcement of national aquaculture statistics and statistical data gathering on regional level	L - I N - H T - H	<ul style="list-style-type: none"> <li>• Governmental agencies</li> <li>• Aquaculture Producer's</li> <li>• FAO/GFCM through Regional networking activities</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of national sources of funding</li> <li>• Lack of homogeneity to the gathering of the data</li> </ul>	<ul style="list-style-type: none"> <li>• Create a very basic data elaboration approach and seminar to be organized each year with the responsible persons</li> <li>• <i>Cost estimate: US\$ 70,000</i></li> </ul>	<ul style="list-style-type: none"> <li>• Use of real-time data through communication via modem and by publishing a regular bulletin</li> </ul>

\* L - Local; N - National; T - Transboundary; I - Insignificant; M - Medium; H - High

**Table 2.6.1 Critical Habitats and Ecosystems and Endangered Species in the Mediterranean - Legislation and Regulatory systems - Proposed Actions and Associated Costs**

Problems	Impact *	Stakeholder	Uncertainties	Proposed actions and costs **	Products / Milestones
Inadequate national legislation on nature protection in many Mediterranean countries  Inadequate transposition of relevant regional and international treaties into the national legislation	L - H N - H T - H	<ul style="list-style-type: none"> <li>Responsible ministries / governmental agencies</li> <li>Secretariats of relevant treaties/agreements</li> <li>General public</li> </ul>		<ul style="list-style-type: none"> <li>Analytical reviews of existing national legislation on nature conservation <i>Cost estimate: US\$ 10,000/country</i></li> <li>Preparation and adoption of adequate legislation suitable to support the implementation of conservation policies <i>Cost estimate: US\$ 80,000/country</i></li> <li>Preparation of guidelines for the transportation of international treaties into national legislations <i>Cost estimate: US\$ 30,000</i></li> </ul>	<ul style="list-style-type: none"> <li>Analytical studies - by year 2000</li> <li>Revised national legislations on nature protection - by year 2002</li> <li>Guidelines - by year 2000</li> </ul>
Weak legal and institutional framework of ICZM  Insufficient consideration of conservation issues in coastal zone management schemes	L - H N - H T - M	<ul style="list-style-type: none"> <li>Responsible ministries</li> <li>Coastal authorities</li> <li>Competing sectors</li> <li>General public</li> <li>International organizations</li> </ul>		<ul style="list-style-type: none"> <li>Development of the ICZM approach (see section 2.7.1)</li> <li>Preparation of guidelines for addressing conservation and management of marine and coastal within ICZM <i>Cost estimate: US\$ 100,000</i></li> </ul>	<ul style="list-style-type: none"> <li>Guidelines - by year 2000</li> </ul>
Lack of Strategies for the conservation and sustainable use of biodiversity in several Mediterranean countries  Poor consideration of marine biodiversity in existing strategies	L - M N - H T - M	<ul style="list-style-type: none"> <li>Responsible ministries</li> <li>International organizations</li> </ul>		<ul style="list-style-type: none"> <li>Elaboration and adoption of national strategies for the conservation and sustainable use of biodiversity <i>Cost estimate: US\$ 300,000/country</i></li> <li>Sectional studies for the integration of marine issues into existing biodiversity conservation strategies <i>Cost estimate: US\$ 50,000/country</i></li> </ul>	<ul style="list-style-type: none"> <li>National strategies - by year 2000</li> <li>Sectional studies - by year 2000</li> </ul>
Inadequate legal framework and regulatory systems for addressing the issue of the introduction of non-indigenous species	L - H N - H T - H	<ul style="list-style-type: none"> <li>Responsible ministries / governmental agencies</li> <li>Secretariats of relevant treaties/agreements (CITES, Barcelona Convention, etc.)</li> <li>Concerned commercial sectors (fisheries, agriculture, aquaria, maritime transport, etc.)</li> <li>General public</li> </ul>		<ul style="list-style-type: none"> <li>Guidelines for addressing the issue of the introduction of non-indigenous species in the natural environment <i>Cost estimate: US\$ 100,000</i></li> </ul>	<ul style="list-style-type: none"> <li>Guidelines - by year 2000</li> </ul>

Insufficient enforcement of the legislation due to lack of trained staff and equipment	L - H N - H T - H	<ul style="list-style-type: none"> <li>Responsible ministries / agencies</li> <li>Coastal authorities</li> </ul>	<ul style="list-style-type: none"> <li>Training programmes on legislation enforcement <i>Cost estimate: US\$ 50,000/country/yr</i></li> </ul>	<ul style="list-style-type: none"> <li>Training and information documents, trained target groups, increased institutional capacity - to start in year 1998</li> </ul>
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\* L - Local; N - National; T - Transboundary; I - Insignificant; M - Medium; H - High  
 \*\* Indicated costs for activities are broad estimates. A range of fluctuation of 30% in the actual costs of possible projects can be considered. Costs of activities per country are average, and the actual costs of projects would vary considerably according to the country.

**Table 2.6.2 Critical Habitats and Ecosystems and Endangered Species in the Mediterranean - Conservation and Management - Proposed Actions and Associated costs**

Problems	Impact*	Stakeholders	Uncertainties	Proposed actions and costs **	Products / Milestones
Marine turtles threatened by the degradation or loss of some of their critical habitats (sandy beaches, sea grasses) and by fishing activities (international fishing and incidental catches)	L - H N - H T - H	<ul style="list-style-type: none"> <li>Ministries/departments concerned with environment, fisheries, coast-planning, tourism</li> <li>Secretariats of international agreements or conventions such as UNEP/MAP, FAO/GFCM, Council of Europe (Bern Convention)</li> <li>International organizations</li> <li>Research institutions</li> <li>Coast developers</li> <li>Fishermen</li> <li>General public</li> </ul>	<ul style="list-style-type: none"> <li>Incomplete data on Mediterranean populations of marine turtles (in particular population estimates and dynamics)</li> </ul>	<ul style="list-style-type: none"> <li>Enforcement of the existing action plan (MAP): Coordinated research programme on population dynamics and migration patterns of Mediterranean populations <i>Cost estimate: US\$ 50,000/yr - for 5 yrs</i></li> <li>Research on improved fishing gear to minimize by-catches <i>Cost estimate: US\$ 100,000/yr - for 2 yrs</i></li> <li>Creation and management of protected areas for the most important nesting beaches and adjacent sea areas <i>Cost estimate: US\$ 100,000/area</i></li> <li>Training for concerned administrations and nesting beach managers <i>Cost estimate: US\$ 20,000/yr</i></li> <li>Information and awareness campaign for target groups (fishermen, coast developers, tourists) and the public at large <i>Cost estimate: US\$ 30,000/yr</i></li> </ul>	<ul style="list-style-type: none"> <li>Studies clarifying the population dynamics and migration patterns of marine turtles in the Mediterranean - by year 2002</li> <li>Established network of researches/observers/collaborators for continued monitoring</li> <li>Technical documents on improved fishing gear - by year 2000</li> <li>Protected areas covering the most important nesting beaches - by year 2002</li> <li>Training and information documents, trained target groups, increased institutional capacity - to start in year 1998</li> <li>Awareness material, increased awareness of target groups and general public - to start in year 1998</li> </ul>
Mediterranean monk seal threatened by intentional and incidental killing, disturbance, fishing activities and pollution	L - H N - H T - M	<ul style="list-style-type: none"> <li>Ministries/departments concerned with environment, fisheries, coast-planning, tourism</li> <li>Secretariats of international agreements or conventions such as UNEP/MAP, FAO/GFCM, Council of Europe (Bern Convention)</li> </ul>	<ul style="list-style-type: none"> <li>Incomplete data on most aspects of the biology of Mediterranean sub-populations, in particular distribution and population dynamics</li> </ul>	<ul style="list-style-type: none"> <li>Enforcement of the existing action plan (MAP): Assessment and monitoring of remaining populations <i>Cost estimate: US\$ 50,000/yr - for 5 yrs</i></li> <li>Creation and management of protected areas for priority caves and feeding grounds <i>Cost estimate: US\$ 150,000/area</i></li> </ul>	<ul style="list-style-type: none"> <li>Assessment studies on the status and population dynamics of main remaining monk seal sub-populations - by year 2002</li> <li>Established network of researchers for continued monitoring</li> <li>Protected areas covering the most important nesting beaches - by year 2002</li> </ul>

	<ul style="list-style-type: none"> <li>Coast developers</li> <li>Fishermen</li> <li>General public</li> </ul>		<ul style="list-style-type: none"> <li>Ministries/departments concerned with environment, fisheries, sport</li> <li>Secretariat of international agreements of conventions such as UNEP/MAP, IMO, FAO/GFCM, UNEP/CMS, IWC,...</li> <li>International organizations</li> <li>Research institutions</li> <li>The fisheries sector</li> <li>General public</li> </ul>	<p>Insufficient data on the status and behavior of most species, in particular for the Eastern and Southern basins</p>	<ul style="list-style-type: none"> <li>Training for administration and protected areas managers <i>Cost estimate: US\$ 20,000/yr</i></li> <li>Information and awareness campaign for target groups (fishermen, coast developers, tourists) and the public at large <i>Cost estimate: US\$ 30,000/yr</i></li> </ul>	<ul style="list-style-type: none"> <li>Training and information documents, trained target groups, increased institutional capacity - to start in year 1998</li> <li>Awareness material, increased awareness of target groups and general public - to start in year 1998</li> </ul>
<p>Other marine mammals threatened by pollution and fishing activities</p>	<p>L - H N - H T - H</p>		<ul style="list-style-type: none"> <li>Enforcement of the existing action plan (MAP) and other relevant instruments:</li> <li>Coordinated programmes of field studies aimed at improving knowledge on the status, migration pattern and habitat requirements of cetacean in the Mediterranean, particularly the Eastern and the Southern part <i>Cost estimate: US\$ 100,000/yr for 5 yrs</i></li> <li>Elaborate and adopt within the competent regional instruments (FAO/GFCM) fishery policies and regulations for fisheries in international waters aimed at minimizing the impact of fisheries on the conservation status of cetaceans <i>Cost estimate: US\$ 300,000</i></li> <li>Research programme aimed at the shaping of fishing gear and practices in order to prevent/reduce by- catches of cetaceans <i>Cost estimate: US\$ 500,000 for 3 yrs</i></li> <li>Creation of marine protected areas including the main feeding, breeding and calving grounds for cetaceans in the Mediterranean <i>Cost estimate: US\$ 150,000/area</i></li> <li>Information and awareness campaign for target groups (fishermen, law enforcement bodies) and the public at large <i>Cost estimate: US\$ 30,000/yr</i></li> </ul>	<ul style="list-style-type: none"> <li>Studies on the main conservation-related aspects of cetacean biology in the Mediterranean - by the year 2002</li> <li>Established network of researchers/institutions for continued research and monitoring</li> <li>Adapted fishery policies and regulations - by the year 2000</li> <li>Adapted fishing gear - by the year 2000</li> <li>Protected areas covering the most important feeding, breeding and calving grounds - by the year 2002</li> <li>Awareness material, increased awareness of target groups and general public - to start in year 1998</li> </ul>	<ul style="list-style-type: none"> <li>Training and information documents, trained target groups, increased institutional capacity - to start in year 1998</li> <li>Awareness material, increased awareness of target groups and general public - to start in year 1998</li> </ul>	

<p>Other endangered species threatened by pollution, habitat loss of degradation, overexploitation and other human activities</p>	<p>L - H N - H T - M</p>	<ul style="list-style-type: none"> <li>Ministries - departments concerned with environment, fisheries, tourism, coast-planning</li> <li>Secretariats of international agreements of conventions such as UNEP/MAP, FAO/GFCM, Council of Europe (Bern Convention)</li> <li>International organizations</li> <li>Coast developers</li> <li>Fisheries sector</li> <li>General public</li> </ul>	<ul style="list-style-type: none"> <li>Insufficient data on the status and habitat requirement of several species;</li> <li>Insufficient data on the impact of several human activities (fisheries, coastal development) and introduced species</li> </ul>	<ul style="list-style-type: none"> <li>Inventories of marine endangered species at the national level <i>Cost estimate: US\$ 100,000/country</i></li> <li>Research on habitat requirements and monitoring of the status of insufficiently known threatened species (\$ 200,000/year for 5 years) <i>Cost estimate: US\$ 200,000/yr for 5 yrs</i></li> <li>Research on the impact of fisheries and introduced species on Mediterranean threatened species (cfr. table "living marine resources, 2.6.3)</li> <li>Development of guidelines for the elaboration and adoption of adapted regulations for fisheries in national waters <i>Cost estimate: US\$ 100,000</i></li> <li>Elaboration of guidelines for addressing introduction of non-indigenous species (\$ 100,000) <i>Cost estimate: US\$ 100,000</i></li> <li>Creation &amp; management of fishery or marine reserves encompassing the critical habitats or threatened species (see table 2.6.3)</li> <li>Training for administration for implementing regulations <i>Cost estimate: US\$ 20,000/yr</i></li> <li>Public awareness campaign for target groups, e.g. fishermen and divers <i>Cost estimate: US\$ 30,000/yr</i></li> </ul>	<ul style="list-style-type: none"> <li>National inventories - by year 2002</li> <li>Studies on the status and habitat requirements of threatened species - by year 2002</li> <li>Guidelines for fishery regulations and introduction of non-indigenous species - by year 2000</li> <li>Network or protected areas covering critical habitats for threatened species</li> <li>Training and information documents, trained target groups, increased institutional capacity - to start in year 1998</li> <li>Awareness material, increased awareness of target groups and general public - to start in year 1998</li> </ul>
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\* L - Local; N - National; T - Transboundary; I - Insignificant; M - Medium; H - High

\*\* Indicated costs for activities are broad estimates. A range of fluctuation of 30% in the actual costs of possible projects can be considered. Costs of activities per country are average, and the actual costs of projects would vary considerably according to the country.

**Table 2.6.3 Critical Habitats and Ecosystems and Endangered Species in the Mediterranean – Habitat Conservation and Management – Proposed Actions and Associated costs**

Problems	Impact*	Stakeholders	Uncertainties	Proposed actions and costs**	Products / Milestones
Sea grass meadows degradation and dwindling due to pollution (including turbidity), coastal development, fishing activities	L - H N - H T - M	<ul style="list-style-type: none"> <li>Ministries – departments concerned with environment, fisheries, coast-planning, tourism</li> <li>Coast developers</li> <li>Fishermen</li> <li>General public</li> </ul>	<ul style="list-style-type: none"> <li>Lack of sufficiently detailed data on sea grass meadows coverage in most areas of the Mediterranean</li> <li>Weak enforcement of relevant fishery regulation (trawling)</li> </ul>	<ul style="list-style-type: none"> <li>Elaboration and adoption of integrated coastal zone management plans for areas of special importance for the conservation of sea grass meadows <i>Cost estimate: US\$ 300,000/plan</i></li> <li>Creation of protected areas for the conservation of sea grasses <i>Cost estimate: US\$ 150,000/area</i></li> <li>Establishment of a network for the monitoring of sea grasses evolution, as a sea quality indicator <i>Cost estimate: US\$ 250,000/yr – for 3 yrs</i></li> <li>Preparation of guidelines for sustainable use and restoration of sea grass meadows <i>Cost estimate: US\$ 30,000</i></li> <li>Training for administration and protected areas managers &amp; technician <i>Cost estimate: US\$ 20,000/yr</i></li> <li>Information and awareness campaign for target groups (fishermen, coast developers) and the public at large <i>Cost estimate: US\$ 30,000/yr</i></li> </ul>	<ul style="list-style-type: none"> <li>Integrated coastal zone management plans</li> <li>Protected areas covering representative examples of Mediterranean sea grass meadows – by year 2002</li> <li>Sea grass monitoring network - by year 2000</li> <li>Guidelines for Sea grasses management - by year 2000</li> <li>Training and information documents, trained target groups, increased institutional capacity – to start in year 1998</li> <li>Awareness material, increased awareness of target groups and general public - to start in year 1998</li> </ul>
Wetlands loss due to changes in water use, reclamation, pollution and overexploitation of resources	L - H N - H T - H	<ul style="list-style-type: none"> <li>Ministries – departments concerned with environment, fisheries, agriculture, coast planning, tourism</li> <li>Secretariats of international agreements of conventions (Ramsar, Barcelona, Bern)</li> <li>Coast developers</li> <li>Fishermen</li> <li>General public</li> </ul>		<ul style="list-style-type: none"> <li>Elaboration and adoption of integrated coastal zone management plans for main wetland areas <i>Cost estimate: US\$ 300,000/plan</i></li> <li>Creation of protected areas for the conservation of wetlands <i>Cost estimate: US\$ 150,000/area</i></li> <li>Training for administrations and wetland managers <i>Cost estimate: US\$ 20,000/yr</i></li> <li>Information and awareness campaign on the use and values of wetlands for target groups (admin., fishermen, farmers, coast developers) and the public at large <i>Cost estimate: US\$ 30,000/yr</i></li> </ul>	<ul style="list-style-type: none"> <li>ICZM plans</li> <li>Protected areas covering main wetlands of the region - by year 2000</li> <li>Training and information documents, trained target groups, increased institutional capacity – to start in year 1998</li> <li>Awareness material, increased awareness of target groups and general public - to start in year 1998</li> </ul>



<p>Beaches degradation (erosion) due to changes in sediment flow, degradation of sea grasses, coast development and sand extraction</p>	<p>L - H N - H T - L</p>	<ul style="list-style-type: none"> <li>Ministries - departments concerned with environment, fisheries, coast planning, tourism</li> <li>Coast developer</li> </ul>	<ul style="list-style-type: none"> <li>Elaboration and adoption of integrated coastal zone management plans for important beach areas <i>Cost estimate: US\$ 200,000/plan</i></li> <li>Elaboration of guidelines for beach management and dune restoration <i>Cost estimate: US\$ 30,000</i></li> <li>Training for administration and target groups <i>Cost estimate: US\$ 20,000/yr</i></li> </ul>	<ul style="list-style-type: none"> <li>Integrated coastal zone management plans</li> <li>Guidelines for beach management and dune restoration - by year 2000</li> </ul>
<p>Disappearance of biogenic construction due to pollution and physical alteration</p>	<p>L - H N - H T - L</p>	<ul style="list-style-type: none"> <li>Ministries - departments concerned with environment and tourism</li> </ul>	<ul style="list-style-type: none"> <li>Creation of protected areas including representative examples of biogenic constructions <i>Cost estimate: US\$ 150,000/area</i></li> <li>Public awareness for target public (tourists, divers) <i>Cost estimate: US\$ 20,000/yr</i></li> </ul>	<ul style="list-style-type: none"> <li>Protected areas covering representative examples of biogenic construction - by year 2002</li> </ul>
<p>Loss and degradation of habitats critical to endangered species (see also Table 2.6.2)</p>	<p>L - H N - H T - H</p>	<ul style="list-style-type: none"> <li>Ministries - departments concerned by environment, fisheries, coast planning, tourism</li> </ul>	<ul style="list-style-type: none"> <li>Preparation of inventories of critical habitats at the national level <i>Cost estimate: US\$ 100,000/country</i></li> <li>Monitoring programmes of identified critical habitats <i>Cost estimate: US\$ 50,000/country/yr</i></li> <li>Establishment and management of marine and coastal protected areas <i>Cost estimate: US\$ 150,000/area</i></li> <li>Development of a Mediterranean networks of managers of coastal and marine protected areas (reinforcement, coordination) <i>Cost estimate: US\$ 50,000/yr</i></li> <li>Training for administrations and protected area managers <i>Cost estimate: US\$ 20,000/yr</i></li> </ul>	<ul style="list-style-type: none"> <li>National inventories - by year 2002</li> <li>National monitoring programmes - by year 2002</li> <li>Protected Areas encompassing representative examples of critical habitats - by year 2000</li> <li>Network of protected areas managers (existing-reinforced)</li> <li>Training and information documents, trained target groups, increased institutional capacity - to start in year 1998</li> </ul>

\* L - Local; N - National; T - Transboundary; I - Insignificant; M - Medium; H - High

\*\* Indicated costs for activities are broad estimates. A range of fluctuation of 30% in the actual costs of possible projects can be considered. Costs of activities per country are average, and the actual costs of projects would vary considerably according to the country

**Table 2.7.1 Coastal Zone Management and Planning – Proposed Actions and Associated Costs\***

PROBLEMS	IMPACT*	STAKEHOLDERS	UNCERTAINTIES	PROPOSED ACTIONS AND ASSOCIATED COSTS*	PRODUCTS AND MILESTONES
1. Weak and inconsistent legal and institutional framework of ICZM at regional and national level	L - I N - H T - H	<ul style="list-style-type: none"> <li>Responsible ministries</li> <li>Coastal authorities</li> <li>Competing sectors</li> <li>General public</li> <li>International organizations</li> </ul>	<ul style="list-style-type: none"> <li>Political will of Contracting Parties</li> <li>Adaptability of some national planning and management systems to ICZM</li> <li>Resilient changes reducing sectorial competencies</li> </ul>	<ul style="list-style-type: none"> <li>Preparation and adoption of a MAP framework protocol on implementation of ICZM (A1)**</li> <li><i>Cost estimate: \$ 280,000 (\$ 70,000 per year)</i></li> </ul>	<ul style="list-style-type: none"> <li>MAP ICZM framework protocol – adopted by year 2001</li> </ul>
2. Weak and unharmonized implementation of ICZM in the region	L - H N - H T - H	<ul style="list-style-type: none"> <li>Responsible ministries</li> <li>Coastal authorities</li> <li>Competing sectors</li> <li>General public</li> <li>International organizations</li> </ul>	<ul style="list-style-type: none"> <li>Absence of clear proofs on benefits when implementing ICZM</li> <li>Lack of local/national funds for implementing ICZM projects</li> <li>Resilient changes reducing sectorial competencies</li> </ul>	<ul style="list-style-type: none"> <li>Development of regional strategy for ICZM (B1)</li> <li><i>Cost estimate: \$ 150,000 (\$ 75,000 per year)</i></li> <li>Implementation of two regional and/or sub regional ICZM pilot projects on transboundary related issues (B2)</li> <li><i>Cost estimate: \$ 500,000 (\$ 200,000 per year)</i></li> <li>One coastal and one insular areas study on cost/benefit when implementing ICZM (B3)</li> <li><i>Cost estimate: \$ 200,000 (\$ 50,000 /study/ year)</i></li> <li>Implementation of a pilot project on integrated river basin management including transboundary affected coastal areas (B4)</li> <li><i>Cost estimate: \$ 400,000 (\$ 200,000 per year)</i></li> </ul>	<ul style="list-style-type: none"> <li>Regional strategy for ICZM – adopted by year 1999</li> <li>ICZM plans contributing to sustainable development – one project completed by year 2000, second started</li> <li>Study document including calculated benefits – by year 2000</li> <li>Integrated river basin management plan – by year 2000</li> </ul>

<p>3. Poor implementation of the transboundary segment of ICZM in the region</p>	<p>L - I N - M T - H</p>	<ul style="list-style-type: none"> <li>Responsible ministries</li> <li>Coastal authorities</li> <li>Competing sectors</li> <li>General public</li> <li>International organizations</li> </ul>	<ul style="list-style-type: none"> <li>Political will of affected /involved countries to cooperate</li> <li>Resilience due to costs of mitigation measures</li> <li>National institutional capacities for addressing transboundary related projects</li> </ul>	<ul style="list-style-type: none"> <li>Implementation of three regional projects addressing transboundary issues and applying ICZM (one coastal urban/industrial, one coastal, one insular) (C1) <ul style="list-style-type: none"> <li>Cost estimate: \$ 240,000 (\$ 40,000 per project per year)</li> </ul> </li> <li>Preparation of Regional Guidelines for addressing transboundary related issues within ICZM (C2) <ul style="list-style-type: none"> <li>Cost estimate: \$100,000 (\$ 50,000 per year)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Project report including prevention, control and mitigation of causes/impacts of transboundary related issues – by year 2000</li> <li>Regional guidelines for addressing transboundary issues within ICZM – by year 2000</li> </ul>
<p>4. Absence of islands specific related ICZM segment</p>	<p>L - H N - M T - M</p>	<ul style="list-style-type: none"> <li>Responsible national authorities</li> <li>Sub-national and insular authorities</li> <li>Competing sectors</li> <li>Insular population</li> <li>NGO's and "INSULA"</li> <li>International tour operators</li> <li>International organizations</li> </ul>	<ul style="list-style-type: none"> <li>Political will</li> <li>Adaptability of present institutional and governance arrangements to insular specific requirements</li> <li>Legal national frameworks enabling islands specific planning and management</li> </ul>	<ul style="list-style-type: none"> <li>Implementation of two pilot projects in selected groups of islands, applying Integrated Management of Mediterranean Islands (D1) <ul style="list-style-type: none"> <li>Cost estimate: \$ 300,000 per project (\$ 75,000 per project per year)</li> </ul> </li> <li>Preparation of Guidelines on Integrated Management of Medium and Small Mediterranean Islands (D2) <ul style="list-style-type: none"> <li>Cost estimate: \$ 100,000 (\$ 50,000 per year)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Project report including approach, principles, tools and all major issues relevant to insular specific problems – by year 2000</li> <li>Guidelines on Integrated Management of Medium and Small Mediterranean Islands – by year 2000</li> </ul>

<p>5. Poor implementation of the coastal urban related ICZM segment and tools</p>	<p>L - H N - M T - M</p>	<ul style="list-style-type: none"> <li>Responsible national authorities</li> <li>Local urban authorities</li> <li>General public</li> <li>International organizations</li> </ul>	<ul style="list-style-type: none"> <li>Applicability of internationally tested tools within national local planning and management related legislation</li> <li>Lack of funds for implementation of pilot projects</li> </ul>	<ul style="list-style-type: none"> <li>Implementation of two ICZM projects in selected large coastal urban areas, applying specific tools (one in a developing country, one in a large insular urban agglomeration) (E1) <ul style="list-style-type: none"> <li>Cost estimate: \$ 600,000 (\$ 150,000 per project per year)</li> </ul> </li> <li>Preparation of Guidelines for Integrated Management of Mediterranean Coastal Urban and Industrial Agglomerations (E2) <ul style="list-style-type: none"> <li>Cost estimate: \$ 100,000 (\$ 50,000 per year)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Project reports including implementation of specific tools - one project by 2000, one by year 2002</li> <li>Guidelines for Integrated Management of Mediterranean Coastal Urban and Industrial Agglomerations - by year 2000</li> </ul>
<p>6. Low human and institutional capacity for the implementation of transboundary related projects</p>	<p>L - M N - M T - M</p>	<ul style="list-style-type: none"> <li>Responsible national ministries</li> <li>Local authorities</li> <li>Local affected population</li> <li>Interested groups</li> <li>International bodies</li> </ul>	<ul style="list-style-type: none"> <li>Present level of human capacities in some coastal/insular areas</li> </ul>	<ul style="list-style-type: none"> <li>Formulation and implementation of a comprehensive regional training and education programme on ICZM and addressing of transboundary and other major segments (F1) <ul style="list-style-type: none"> <li>Cost estimate: \$ 250,000 per year</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Training and education documents, trained target groups, increased human and institutional capacity in various areas - to start in year 1998</li> </ul>

• For more detailed information see 3.7. and Tables 3.7.1. and 3.7.3.; the "problems" related numbers in 2.7.1. correspond to those of "issue" related numbers in 3.7.1. and 3.7.3.

• \*\* Codes in brackets (eg. A1) are the same as used in Table 3.7.3.

\* L - Local; N - National; T - Transboundary; I - Insignificant; M - Medium; H - High

**Table 2.8.1 Institutional Arrangements – Proposed Actions and Associated Costs\***

PROBLEMS	IMPACT <sup>1</sup>	STAKEHOLDERS	UNCERTAINTIES	PROPOSED ACTIONS AND ASSOCIATED COSTS	PRODUCTS AND MILESTONES
1. Inadequate regional institutional arrangements for transboundary related issues	L – I N – M T – H	International and UN agencies (MAP-UNEP, MAP MCSD, UNDP, FAO, UNESCO, WB-METAP, GEF)  Responsible authorities of Mediterranean coastal states  General public, NGOs  Interested competing sectors	<ul style="list-style-type: none"> <li>Political will of Contracting Parties</li> <li>Willingness of international agencies and bodies to reach interagency agreement</li> </ul>	<p>(a) Confirm MAP as the regional Lead Agency for transboundary related issues</p> <p>(b) Reach interagency agreement on (a) and define mandate, role and involvement of other relevant agencies (UNEP, WB, GEF, UNDP, UNESCO, FAO) when addressing transboundary related initiatives in the region</p> <p><i>Cost estimate: US\$ 50,000</i></p> <p>(c) Designate MCSD as the regional Coordinating Body for transboundary related issues and secure the logistical support by MAP structure</p> <p>(d) Reformulate MAP monitoring programme and other RAC's programmes if needed and as appropriate, to meet requirements related to (a), (b), and (c)</p> <p><i>Cost estimate: US\$ 50,000</i></p>	<p>MAP document on its role in transboundary related issues, adopted by Contracting Parties Meeting – by year 1997</p> <p>Interagency agreement and programme on transboundary related activities in the region – adopted by year 1998</p> <p>MAP/MCSD document on role of MCSD addressing transboundary related issues in the region – adopted by year 1997</p> <p>Relevant decisions of the Contracting Parties Meeting – by year 1999</p>

1. L – local; N – national; T – transboundary; I – insignificant; M – medium; H – high

<p>2. Inadequate regional and national legal arrangements regarding transboundary issues</p>	<p>L - I N - H T - H</p>	<p>International and UN agencies (MAP-UNEP, MAP MCSD, UNDP, FAO, UNESCO, WB-METAP, GEF)  Responsible authorities of Mediterranean coastal states  General public, NGOs</p>	<ul style="list-style-type: none"> <li>• Political will of Contracting Parties to adopt Annex to LBS Protocol</li> <li>• Willingness of national authorities to establish national coordinative bodies</li> <li>• Source of funds for the Network Programme</li> <li>• Willingness of individual countries to adopt national legislation</li> </ul>	<p>(a) Prepare and adopt transboundary related annex to LBS Protocol  <i>Cost estimate: US\$ 150,000</i></p> <p>(b) Invite affected and involved countries to establish high level National Coordinative Bodies for transboundary related issues and to nominate National Lead Agency for transboundary related issues</p> <p>(c) Invite countries to adapt/harmonise national legislation with transboundary related international / regional legal documents  <i>Cost estimate: US\$ 100,000</i></p> <p>(d) Establish Regional Network addressing transboundary related issues and provide support for this programme  <i>Cost estimate: US\$ 40,000</i></p>	<p>Transboundary related annex to LBS Protocol – by year 2000</p> <p>National Coordinative Bodies and National Lead Agency – established by 1998</p> <p>National legislation adopted – by year 2002</p> <p>Regional Network established 1998</p>
<p>3. Absence of adequate bilateral and multilateral transboundary related arrangements and programmes</p>	<p>L - M N - H T - H</p>	<p>International and UN agencies (MAP-UNEP, MAP MCSD, UNDP, FAO, UNESCO, WB-METAP, GEF)  Responsible authorities of Mediterranean coastal states  General public, NGOs</p>	<ul style="list-style-type: none"> <li>• Willingness of countries involved/affected to cooperate, conclude agreements and projects</li> <li>• Funds needed for mitigation of transboundary impacts</li> <li>• Source of funds for assistance to developing countries involved</li> </ul>	<p>(a) Prepare and adopt (at MAP and interagency levels) a prioritized list of major transboundary issues and areas affected, resulting from the regional TDA, and identify priority areas needing international support  <i>Cost estimate: US\$ 50,000</i></p> <p>(b) Recommend to countries involved in identified transboundary priority areas to conclude relevant bilateral or multilateral agreements /programmes within MAP framework  <i>Cost estimate: US\$ 300,000</i></p> <p>(c) Introduce in the MAP regular programme relevant training/assistance to transboundary related activities  <i>Cost estimate: US\$ 100,000</i></p>	<p>Adopted prioritized list of transboundary issues and areas, identifying those needing international support – by year 1998</p> <p>Transboundary agreements concluded – by year 1999; two programmes assisted in 2000 – 2003</p> <p>Programme to start – by year 1998</p>

\* For more detailed information see 3.8. and table 3.8.1. and 3.8.3; order number of "problems" in 2.8.1 corresponds to "issue" numbers in Tables 3.8.1 and 3.8.3.

**Table 2.9.1 Public Participation in Environmental Decision-making – Proposed Actions and Associated Costs**

PROBLEMS	IMPACTS*	STAKEHOLDERS	UNCERTAINTIES	PROPOSED ACTIONS AND ASSOCIATED COSTS	PRODUCTS AND MILESTONES
<p>1. Inadequate access to information</p>	<p>L - H N - H T - H</p>	<ul style="list-style-type: none"> <li>• State</li> <li>• Local authority</li> <li>• NGOs</li> <li>• Private sector</li> <li>• Mass media</li> <li>• Other partners</li> </ul>	<ul style="list-style-type: none"> <li>• Lengthy and complex legislative process</li> <li>• Lack of funds for the implementation of activities</li> <li>• Inadequate capacity of NGOs to prepare relevant materials</li> </ul>	<ul style="list-style-type: none"> <li>• Study to be carried out in each country in order to identify which are the needed amendments in the existing legislation in order to secure introduction of provisions for access to information and improved participation <i>Cost estimate: \$ 170,000</i></li> <li>• Introduction of legislation making information related to the environment open to the public <i>Cost estimate: \$ 40,000</i></li> <li>• Preparation of printed material and TV spots to inform the various groups and individual citizens, on their rights and on the most appropriate ways to formulate their requests for information <i>Cost estimate: \$ 90,000</i></li> <li>• Critical review of the existing experience in the EU countries of the introduction of the relevant directive on access to environmental information <i>Cost estimate: \$ 20,000</i></li> </ul>	<ul style="list-style-type: none"> <li>• Public better informed and involved in environmental management process – by year 2000</li> <li>• Effective legislation in Mediterranean countries ensuring easier access to information – by year 2000</li> <li>• Printed materials and TV spots produced and disseminated - by year 1999</li> <li>• Critical review of the existing experience in EU countries – by year 1998</li> </ul>

<p>2. Limited participation of the public in the decision-making process</p>	<p>L - H N - H T - H</p>	<ul style="list-style-type: none"> <li>• State</li> <li>• Local authority</li> <li>• NGOs</li> <li>• Private sector</li> <li>• Mass media</li> <li>• Other partners</li> </ul>	<ul style="list-style-type: none"> <li>• Lengthy and complex legislative process</li> <li>• Lack of funds for activities</li> <li>• Inadequate capacity of NGOs to prepare relevant materials</li> <li>• Local authorities not prepared to take active role in initiating broad consultations</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction of legislation allowing environmental NGOs and other parties to participate in policy-making bodies and in the implementation of relevant policies <i>Cost estimate: \$ 30,000</i></li> <li>• Increase of the ability and expertise of NGOs in order to participate in a constructive and effective way in environmental protection activities <i>Cost estimate: \$ 80,000</i></li> <li>• Preparation of publications promoting communication of ideas and positions among all actors <i>Cost estimate: \$ 20,000</i></li> <li>• Setting up consultation process between local environmental authorities and public about the new development projects <i>Cost estimate: \$ 40,000</i></li> </ul>	<ul style="list-style-type: none"> <li>• Improved prestige and respect for the role of NGOs in the eyes of the public and the government – by year 2000</li> <li>• Effective relevant legislation – by year 2000</li> <li>• Publication and dissemination of relevant materials – by year 1998</li> <li>• Local authorities enhanced in a role of initiation of wide consultation for environmental decisions – by year 1999</li> <li>• Mass media well informed on strategies and concrete actions – by year 1998</li> </ul>
<p>3. Limited access to justice</p>	<p>L - H N - H T - I</p>	<ul style="list-style-type: none"> <li>• State</li> <li>• Local authority</li> <li>• NGOs</li> <li>• Private sector</li> <li>• Mass media</li> <li>• Other partners</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of funds for the implementation of activities</li> <li>• Inadequate capacity of NGOs to prepare relevant materials</li> </ul>	<ul style="list-style-type: none"> <li>• Ensuring of open access of citizens and NGOs to courts of all levels</li> <li>• Inform the public and NGOs on the proper procedure to support their legal rights to appeal to courts against decisions of State and Municipal authorities and establishment of the Mediterranean service for the local advice to citizens and the NGOs <i>Cost estimate: \$ 80,000</i></li> </ul>	<ul style="list-style-type: none"> <li>• Open access of citizens and NGOs to courts – by year 2000</li> <li>• Publication and dissemination of relevant materials – by year 1998</li> <li>• Established Mediterranean service for the local advice to citizens and the NGOs – by year 2000</li> </ul>



4. Inadequate funding	L - H N - H T - H	<ul style="list-style-type: none"> <li>• State</li> <li>• Local authority</li> <li>• NGOs</li> <li>• Private sector</li> <li>• Mass media</li> <li>• Other partners</li> </ul>	<ul style="list-style-type: none"> <li>• Readiness of the establishment to finance public participation in the decision - making process</li> </ul>	<ul style="list-style-type: none"> <li>• Continuous funding at national and local level in order to improve participation and public awareness</li> <li>• Tax exemption of private donations to environmental NGOs</li> <li>• Funding of the work of the MCSD Working Group on Public Participation <i>Cost estimate: \$ 30,000</i></li> </ul>	<ul style="list-style-type: none"> <li>• Enhanced funding of the public participation - by year 2000</li> <li>• Tax exemption of private donations achieved - by year 2000</li> <li>• Funding of the work of the MCSD Working Group on Public Participation - by year 1998</li> </ul>
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\* L - Local; N - National; T - Transboundary; I - Insignificant; M - Medium; H - High

**Table 2.10.1 Summary of estimated investment costs of projects and programmes – Proposed Actions and Associated Costs**

Problem	Impacts*	Stakeholders	Uncertainties	Proposed Actions and Estimated Costs	Products and Milestones
<ul style="list-style-type: none"> <li>Hot spot projects</li> <li>Extreme Environmental Problems: Of the total of 109 environmental Hot Spots identified by the country studies, the most extreme environmental problems caused by municipal and industrial wastewater are reported to occur in 81 Hot Spots which are distinguished by their "extreme effects". These 81 Hot Spots constitute targets for first priority action</li> </ul>	<p>L - H N - H T - M/H</p> <ul style="list-style-type: none"> <li>23 Hot Spots have extreme effects on public health</li> <li>23 on aquatic life</li> <li>21 on economy and welfare</li> <li>7 on recreation</li> <li>5 on other beneficial uses</li> <li>2 on the quality of drinking water</li> </ul> <p>Serious environmental impacts on public health, aquatic life, economy and welfare, recreation and other beneficial uses and the quality of drinking water</p>	<ul style="list-style-type: none"> <li>Local and national population</li> <li>Local and national authorities</li> <li>Tourism industry</li> <li>Low-income communities</li> <li>Environmental resources</li> </ul>	<ul style="list-style-type: none"> <li>Quality and coverage of cost estimates</li> <li>General project identification</li> <li>Action cost-effectiveness</li> <li>Cost/Benefit analysis</li> <li>Financial analysis</li> <li>Cost recovery possibilities</li> <li>Affordability issues</li> </ul>	<p>First Priority Action Project</p> <p>Construction, reconstruction and upgrading of wastewater treatment plants in 81 Hot Spot locations</p> <p><i>Cost estimate:</i> US \$ 2,328,300,000</p>	<ul style="list-style-type: none"> <li>Based on the Investment Portfolio Framework to prepare Investment Portfolio supported by project identification, costing, cost/benefit analysis to determine more detailed action priorities - by end of 1997</li> <li>In the context of the above Investment Portfolio to prepare selected pre-investment appraisal studies including technical and financial analysis - by year 2000</li> <li>To carry out a rapid appraisal of national level public finance and budget constraints to indicate affordability criteria, social impacts from alternative financing options and national co-financing possibilities</li> <li>To establish a "rolling process" for on-going project analysis and annual budget estimates and donor support - by year 2000</li> </ul>
<ul style="list-style-type: none"> <li>Serious environmental problems: The remaining 28 Hot Spots are reported to have various environmental problems, ranging from moderate of severe. These 28 Hot Spots constitute targets for second priority action</li> </ul>	<p>L - H N - H T - I</p>	<ul style="list-style-type: none"> <li>Local and national population</li> <li>Local and national authorities</li> <li>Tourism industry</li> <li>Low-income communities</li> <li>Environmental resources</li> </ul>	<ul style="list-style-type: none"> <li>Quality and coverage of cost estimates</li> <li>General project identification</li> <li>Action cost-effectiveness</li> <li>Cost/Benefit analysis</li> <li>Financial analysis</li> <li>Cost recovery possibilities</li> <li>Affordability issues</li> </ul>	<p>Second Priority Action Project</p> <p>Construction, reconstruction and upgrading of wastewater treatment plants in 23 Hot Spot locations</p> <p><i>Cost estimate:</i> US \$ 1,641,300,000</p>	<ul style="list-style-type: none"> <li>To carry out a rapid appraisal of national level public finance and budget constraints to indicate affordability criteria, social impacts from alternative financing options and national co-financing possibilities</li> <li>To establish a "rolling process" for on-going project analysis and annual budget estimates and donor support - by year 2000</li> </ul>

<p>2. Regional Management Programmes</p> <p>Location-specific, sectorial and discrete wastewater facilities represent "front line" initiatives for addressing risk situations. Pollution control strategies are most effective when they are planned and implemented within an integrated environmental management programme including elements focused on the need to ensure sustainable resource use and management is an important element in strategic action planning. The following programmes proposed in the Investment Portfolio Framework seek to strengthen these links</p>	<p>L - H N - H T - H</p> <p>Lack of linkages between specific environmental risks and sustainable management programmes leading to sectorial responses partial strategies and recurrence of environmental conflicts</p> <p>Inadequate coastal zone management, limited planning, participation capacities undermine pro-active actions and effective approaches</p> <p>Recurrence of pollution risks and resort to belated and costly projects</p>	<ul style="list-style-type: none"> <li>• Local and national population</li> <li>• Local and national authorities</li> <li>• Tourism industry</li> <li>• Low-income communities</li> <li>• Environmental resources</li> </ul>	<ul style="list-style-type: none"> <li>• Quality and coverage of cost estimates</li> <li>• General project identification</li> <li>• Lack of framework for programme design and selection of cost-effectiveness criteria</li> <li>• Cost/benefit analysis</li> <li>• Financial analysis</li> <li>• Specification of cost recovery and affordability issues</li> </ul>	<ul style="list-style-type: none"> <li>• Integrated Coastal Zone Management (ICZM)</li> <li>• Public Participation strengthening</li> <li>• Fisheries management</li> <li>• Capacity building (planning, monitoring, evaluation, audit and implementation)</li> </ul> <p><i>Cost estimate:</i> US\$ 6,548,000,000</p>	<ul style="list-style-type: none"> <li>• Regionally relevant Cost-Benefit Study manual and national guidelines - prepared by 1998</li> <li>• Environmental Public Participation programme - prepared by 1999</li> <li>• Integrated river basin management plan - by 2000</li> <li>• Mediterranean ICZM action framework and regional strategies - to be adopted by 2001</li> <li>• Development of fisheries management programme</li> </ul>
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\* L - Local; N - National; T - Transboundary; I - Insignificant; M - Medium; H - High

**Transboundary Diagnostic Analysis for the Mediterranean  
(TDA MED)**

**Section 3**

**Relevant Data and Information and  
Detailed Analysis of Problems**

Table 3.1.4.4 Nitrogen and P<sub>2</sub>O<sub>5</sub> balance (10<sup>3</sup>)

Country	N-OUT	N-INP	N-DEPL	N/I/O	P-OUT	P-INP	P-DEPL	P/I/O
Albania	64.47	38.6	-25.8	0.60	23.5	8	-15.5	0.34
Algeria	228.4	348.4	120.0	1.53	77.5	62.6	-14.7	0.81
Bosnia	70.73	43.8	-26.9	0.62	24.1	7.7	-16.4	0.32
Herzegovina								
Bulgaria	467.48	417.6	-49.9	0.89	167.83	102.2	-65.7	0.61
Croatia	173.66	247.9	74.2	1.43	59.9	62.4	2.5	1.04
Cyprus	20.53	22.8	2.3	1.11	6.29	11.9	5.6	1.89
Egypt	1324.7	1327.5	2.9	1.00	480.6	247.1	-233.6	0.51
France	4475.42	4040.2	-435.3	0.90	1540.7	1449.5	-91	0.94
Greece	785.11	672.2	-112.9	0.86	340.87	251.3	-89.6	0.74
Israel	111.18	125.9	14.8	1.13	37.22	50.9	13.7	1.37
Italy	2177.67	1779.7	-398	0.82	718.4	764.7	46.3	1.06
Jordan	39.26	33.1	-6.2	0.84	11.86	17.1	5.3	1.44
Lebanon	50.50	37.6	-12.9	0.74	15.46	19.8	4.4	1.28
Libya	41.7	131.2	89.6	3.15	13	76.2	63.2	5.86
Macedonia	53.41	33.4	-20	0.63	18.77	8.4	-10.4	0.45
Morocco	714.0	468.6	-245.4	0.66	255.1	151.7	-103.4	0.59
Portugal	210.21	260.3	50.1	1.24	66.14	102.2	35.8	1.55
Slovenia	41.68	64.6	23	1.55	13.86	22.5	8.6	1.62
Spain	1856.11	1941.1	85	1.05	596.56	725.1	128.6	1.22
Syria	649.43	519.6	-129.8	0.80	241.51	218.3	-23.2	0.90
Tunisia	178.3	157.5	-20.8	0.88	55.6	63.1	7.5	1.13
Turkey	2993.92	2984.2	-9.7	1.00	1076.03	1335.1	259	1.24
Yugoslavia	599.46	362.8	-236.7	0.61	207.92	89.8	-118.1	0.43

## 3.1 Sources of pollution of the Mediterranean Sea

### 3.1.1 Rivers

#### 3.1.1.1 Specific features of Mediterranean rivers

About 80 rivers contributing significantly to pollution inputs to the Mediterranean Sea have been identified, however, not all of them are presently monitored for all water quality determinants. For instance micropollutants are still lacking in many cases. In addition to these uncertainties the specific features of Mediterranean hydrology must be noted: Mediterranean basin hydrology is in fact very heterogeneous, ranging from alpine regime with early summer maximum, to typical Mediterranean regime with winter high flows and summer low flows, to semi-arid regime of the South Coast with gradual increase of summer drought and development of episodic floods. Except for alpine rivers and for the Nile, in its natural condition, the Mediterranean rivers regime are typically characterized by very high variations of day to day and year to year discharges. Sediment discharges occur during few events per year, or even once every 10 years, or more for the Southern Wadis. All metals, some micropollutants, and part of nutrients and organic carbon are attached to the particulates and carried to the Sea in such episodic events.

#### 3.1.1.2 General decrease of river water discharge

Water inputs to the Mediterranean Sea have dramatically decreased over the last 40 years. The most dramatic decrease is noted for the Nile: prior to the construction of the High Asswan Dam the water discharge was estimated to more than  $83\text{km}^3/\text{yr}$  ( $2600\text{m}^3/\text{s}$ ). The construction of the High Asswan Dam led to a decrease of this figure due to the reservoir evaporation. Downstream the High Asswan Dam from Asswan to Cairo, and particularly in the Delta the Nile water is used for industrial and domestic uses but most of it is returning to the river with some losses. In addition to these losses the major water use in Egypt is by far irrigation and water is not returned to the main river branches, the Rosetta and Damietta branches in the Delta, but to canals reaching the Mediterranean Sea or the Delta lakes. As a result the Nile river discharge to the Mediterranean Sea was on the average around  $2\text{km}^3/\text{yr}$  ( $65\text{m}^3/\text{s}$ ) this last decade. New irrigation schemes and the Peace Canal bringing Nile water to the Sinai will reduce the Nile inputs to practically zero. As a result the Nile river is now ranking after the first 50 rivers of the Basin, despite its huge basin area ( $2.87\text{km}^2$ ) (Tables 3.1.1.1 and 3.1.1.2).

Other reductions of water discharge have been observed in many major rivers of the basin such as the Rhone river (diversion of the Durance, one of its main tributaries), and the Spanish rivers (Segura, Jucar, Mijares, Ebro, Llobregat, Turia) (Table 3.1.1.3). Similar decrease are most likely for Southern Italian, Greek, Turkish, and Northern African rivers due to evaporation in reservoirs, diversion, and generalized use of water for irrigation (e.g. in the Ebro Delta).

The present reduction of river water discharge for the whole basin, taking into account the near-complete reduction of the Nile inputs, is estimated between 30 and 40%. South Levantin, Alboran, South West Aegean, Central and North Levantin basins are probably those most affected by this reduction (Table 3.1.1.4).

### 3.1.1.3 Sediment discharges and sedimentation retention behind dams

Sediment discharges in natural conditions are mostly occurring during rare events of catastrophic floods: typically more than 90% of suspended sediments are carried during less than 5% of the time in the Mediterranean regime of sediment load (Table 3.1.1.6).

The occurrence of hundreds of reservoirs in the basin, particularly south of 43°N, has completely changed the natural pattern of sediment discharge in Spain, South and Central Italy, Greece, Turkey, Egypt, Morocco, Algeria, Tunisia. The present-day transport of sediments have been reduced by 100% (Nile), 95% (Ebro), 80% (Rhone) (Tables 3.1.1.5 - 3.1.1.7). As a result the sediment discharge estimated to 620 million tonnes prior the dams construction, 50 years ago, is probably now reduced to less than 200 million tonnes (Table 3.1.1.6). It must be noted that, natural river-borne sediment should not be regarded as pollutants (as industrial and domestic suspended sediment might be), but as an important agent of coastal sedimentary balance: without river inputs the coastal erosion may be quite important as it is observed now in the Nile Delta.

The storage of sediments behind dams has also an important effect on particulate nutrients (P and N) retention and on metal and organic micropollutants storage. The particules retention capacity of dams is commonly exceeding 90%.

### 3.1.1.4 Organic pollution

Although not completely documented in MERRI database, organic pollution is not a major problem in documented Mediterranean rivers. Po and Rhone rivers present a remarkable improvement during the last 15 years, but few small rivers are still heavily contaminated when BOD<sub>5</sub> are considered. Levels of DOC are generally quite low, due to low contribution of humic substances but level of POC may reach 25mg/L and up, during major floods, although this material is derived from natural erosion.

Rivers documented for organic pollution are presented on Table 3.1.1.8. A tentative estimate of total BOD<sub>5</sub> and COD river inputs to the Mediterranean has been made on the basis of documented rivers and of an extrapolation to the remaining part of the basin allocating to 50% of discharge relatively low BOD<sub>5</sub> and COD levels, as for the Rhone river (1.5 and 5mg/L respectively) and to 50% of the discharge higher BOD<sub>5</sub> and COD as for the Llobregat (5 and 15mg/L respectively). (Table 3.1.1.8). The total present inputs are 980 tonnes/yr for BOD<sub>5</sub> and 3.451 tonnes/yr for COD.

Many small rivers can still be considered as highly polluted and their pollutants sources should be controlled as Qued Martil, the Besos and Kishon. Adige, Po, Ceyhan and Seyhan are still somewhat polluted. The Po river is now much less polluted than during the peak of pollution which occurred in 1977-78.

### 3.1.1.5 Nutrients

Nutrient levels for the Mediterranean rivers are about 4 times less than in Western Europe rivers (Table 3.1.1.4). Some rare pristine levels can still be found on the Dalmatian coast and some islands, but most rivers are now impacted. Nitrate is increasing in all documented cases. Phosphate may increase dramatically (Greece), or steadily (France). In Italy a marked decrease is observed as the result of efficient P restriction measures (P ban in detergent). Although some local coastal eutrophication may occur, the main body of the Mediterranean as a whole is not yet seriously threatened with eutrophication over the last decades (Vollenweider, 1996). Ammonia levels have been decreased as a result of domestic and industrial waste collection and treatment. Rivers documented for nutrients are listed on Table 3.1.1.9. The concentration range is enormous, over an

order of magnitude for  $\text{NO}_3$  and more for  $\text{NH}_4$  and  $\text{PO}_4$ : nutrients are water quality determinants most sensitive to human impacts. Ammonia is still very high in some rivers (Llobregat, Ter, Tet, Tevete) and levels in the Besos are extremely high, i.e. similar to those found in sewage effluent. Nitrate levels are much less (2 to 10 times) than those commonly found in Western European rivers.

A tentative budget of nutrients inputs to the Sea can be made (Table 3.1.1.10) on the basis of documented rivers and of an extrapolation assuming that 1/3 of remaining undocumented rivers were similar to the Neretva (levels close to pristine values), 1/3 similar to the Ebro (major agricultural basin) and 1/3 similar to the Tevere (highly populated basin). As for the  $\text{BOD}_5$  and COD, this tentative budget is based on water discharges for the last decade, i.e. the Nile discharge is assumed to be negligible and other rivers has been reduced by 10 to 60%. The estimated inputs to the Sea are 446.000t for N- $\text{NO}_3$  (expressed in nitrogen), 99.000 for N- $\text{NH}_4$ , and 66.000t for total phosphorus. Another recent estimate published by Vollenweider et al (1996) is proposing higher values of 810.000t for total N and 110.000t for total P (corrected budget for a most likely decimal point error for the Alboran and South West basins) on the basis of population density and land use. Discrepancies between these two estimates reflects the difficulties of such budgets realized with different approaches and the possible retention of nutrients in many reservoirs, a process probably underestimated by Vollenweider and his colleagues. It must be noted that nitrate trend is still positive in all documented rivers, ammonia trend is variable depending on the sewage collection and treatment. Phosphate trend is very positive in Greece and Spain, but is markedly decreasing in Italy since 1982 as for the Po river.

#### 3.1.1.6 Heavy metals

Mediterranean rivers are also less contaminated with heavy metals than most other Western European rivers. But this may be the result of dilution of urban and industrial sources by high levels of suspended solids in highly erosive environment. Metals are very much linked with particulates which constitute the proper medium to be investigated. When considering the growing storage of particulates in reservoirs it can be said that net metal fluxes to the Sea are actually decreasing even if trends of contamination of river basins (not properly documented here) are steady or deteriorating.

Pollution of heavy metals can be appreciate either by the analysis of filtered particulate matter (Table 3.1.1.11) or by the analysis of dissolved metals (Table 3.1.1.12), provided that background natural levels of each metal are known in both dissolved and particulate forms. Such estimate of background levels are presented in Tables 3.1.1.11 and 3.1.1.12, on the basis of pristine river analysis in the Mediterranean Basin and from various places in similar geological conditions. Analyses of particulates are the most reliable ones since they are less sensitive to contamination during sampling and analysis and it must be noted that 80 to 99% of heavy metals are carried by rivers in association with the particulate phase (Table 3.1.1.13). Natural variations can sometimes account for a doubling of levels with regards to the reference values, but above this rate of change a pollution is likely. This is the case for Pb in many rivers (Rhône, Tevere, Herault, Brenta, Martil), for Zn (Adige, Herault, Martil, Po, Tevere), for Hg (Po, Rhône), for Cu (Ebro, Herault, Orb, Rhône, Tevere), for As (Orb, Herault). The exact origins of these contamination remain to be set up and if systematic studies were carried on deposited sediments or on filtered particulates, much more pollutant sites would probably be found, particularly downstream major metal industries, and mining sites. Few rivers, as Var and Argens, are still in pristine state.

Budgets of heavy metal inputs from rivers to the Mediterranean are quite difficult to be set up: (i) many rivers are still unmonitored for particulate metals, or not adequately monitored (total concentration, questionable dissolved concentration), (ii) water inputs have been changed, sometimes drastically as for the Nile, (iii) river sediments including their attached load of metals are now



retained behind reservoirs. The three budgets presented here (Tables 3.1.1.11-3.1.1.13) are only tentative ones and should be confirmed.

They have been set up on the basis of our best present knowledge of natural background levels for both dissolved and particulate metals in pristine rivers of the Mediterranean basin, combined with pre-damming estimate of water and sediments budgets. For the present day conditions typical polluted river concentrations have been attributed on the basis of existing measurements (Ebro, Rhone, Po, Adige, etc.) as follows: 1.8mg.g<sup>-1</sup> for Cd, 125 for Cr, 100 for Cu, 0.5 for Hg, 100 for Pb and 200 for Zn, compared to 0.4mg.g<sup>-1</sup> for Cd, 40 for Cr, 20 for Cu, 0.03 for Hg, 25 for Pb and 100 for Zn in pristine conditions.

Some major points can be made: (i) most metal fluxes are still associated with particulate matter. (ii) reservoirs are probably storing much of the metals originating from human activities. (iii) due to this retention the net inputs to the Sea are stable for the cadmium, or may decrease (copper, lead, zinc). However the mercury inputs are increasing due to a major contamination of particulates for this metal.

### **3.1.1.7 Organic micropollutants**

Organic micropollutants discharged by rivers are not correctly monitored in order to assess loads, even within orders of magnitude. This type of finding is not specific to the Mediterranean Basin. Contamination by industrial products is documented on great rivers (Po, Ebro, Rhone) for Polychlorinated Biphenyls, Poly Aromatic Hydrocarbons, and solvents. Evidence of pesticide high concentrations (concentrations > 1mg/L) has been found in some specific studies, as in Greece, and is believed to occur in many small rivers with intensive agriculture but was not found during the Rhone pilot study. Type of pesticides found in rivers may greatly vary from one country to another and probably from one river to the next. The new pesticides generation (atrazine and others) are not much transported by rivers: only 0.2 to 3 % of the products applied to cultivated land are exported. Examples of detection of organic micropollutants are presented in Tables 3.1.1.14 and 3.1.1.15.

### **3.1.1.8 Bacterial contamination**

Although little documented for the whole Basin, bacterial contamination ranges from none in few basins sparsely populated, to dramatic in some Southern rivers. In major Greek and Italian rivers the contamination is real although generally not severe. If the improvement noted for the Po river, which has variable levels of contamination along its course, is extrapolated to other Northern rivers, where sewage collection and treatment is known to have occurred in the last two decades, the bacterial contamination should not be any more a major problem in the Northern part of the Basin; but in the Southern part its actual status should be set up. Example of bacterial counts in Mediterranean rivers are presented in Table 3.1.1.16.

### **3.1.1.9 Pristine Mediterranean rivers**

Few Mediterranean rivers still exist in pristine conditions: their levels of nutrients, fecal coli, or metals are practically those found in river of other continents without any human activities. This is due to the very low population density, limited agriculture and absence of industries. Krka and Neretva (Croatia), Var, Argents and Tavignano (France) are examples of such conditions. It must be remarked that such basins have also none or little number of existing dams and have also a high ecological values for this reason. Examples of pristine Mediterranean rivers are given on Table 3.1.1.17 on the basis of nutrient levels and of bacterial counts, both very sensitive to anthropogenic impacts. Such precious environments for biodiversity and water resources should be looked for, listed, and urgently protected.

Table 3.1.1.1 Development of dams and reservoirs; some key examples.

Italy	Among the 221 reservoirs registered 12 exceed a volume of 100Mm <sup>3</sup> and 18 are between 50 and 100 Mm <sup>3</sup>
Spain	For the whole Spanish territory 1,000 reservoirs exceeding 8 km <sup>2</sup> have been constructed, 25 reservoirs are found on the Ebro. 30 on the Ter
Turkey	2 major dams are found on the Seyhan
Algeria	In 1985, 30 dams were in exploitation or being built
Egypt	The High Asswan Dam and Lake Nasser are among the largest of the world, with an average water residence time of about 2 years

Table 3.1.1.2 Major Mediterranean rivers in decreasing order of present water discharge to the sea.

Rivers	Qact Km <sup>3</sup> /yr	Area 10 <sup>3</sup> km <sup>2</sup>	Sub Basin	Country
PO	48.90	70.00	ADR7	Italy
RHONE	48.07	95.60	NWE13	France
DRINI	11.39	14.17	ADR14	Albania
NERETVA	11.01	10.02	ADR13	Croatia
BUNA	10.09	5.19	ADR X	Albania
EBRO	9.24	84.00	NWE 4	Spain
TEVERE	7.38	16.55	TYR3	Italy
ADIGE	7.29	11.95	ADR 8	Italy
SEYHAN	7.20	20.00	NLE3	Turkey
CEYHAN	7.10	20.50	NLE4	Turkey
EVROS	6.80	55.00	AEG 6	Greece/Turkey
VIJOSE	6.15	6.71	ADR17	Albania
ISSER	6.12	31.60	SWE9	Algeria
AKHELOOS	5.67	5.54	ION5	Greece
MANAVGAT	4.99	1.32	NLE1	Turkey
AXIOS	4.90	24.70	AEG 3	Greece
BUYUK MENDERES	4.70	19.60	AEG9	Turkey
MATI	3.25	2.44	ADR22	Albania
VOLTURNO	3.10	5.50	TYR5	Italy
SEMANI	3.02	5.65	ADR16	Albania
NAHRELASI	2.70	22.60	NLE5	Turkey
STRYMON	2.59	16.50	AEG 5	Greece
GOKSU	2.50	10.10	NLE2	Turkey
BRENTA	2.32	1.56	ADR 9	Italy
LAMAS	2.20		NLE6	Turkey
ARNO	2.10	8.228	NWE16	Italy
SHKUMBINI	1.94	2.45	ADR15	Albania
GEDIZ	1.87	15.62	AEG 9	Turkey
PESCARA	1.70	3.10	ADR 2	Italy
KRKA	1.61	1.98	ADR12	Croatia
MOULOUYA	1.58	51.00	ALB1	Morocco
VAR	1.57	1.83	NWE15	France
RENO	1.40	3.40	ADR 6	Italy
AUDE	1.31	1.794	NWE10	France
CHELIF	1.26	43.70	SWE4	Algeria
JUCAR	1.26	21.60	NWE 1	Spain
ALIAKMON	1.17	9.50	AEG 2	Greece
NESTOS	1.03	5.74	AEG 5	Greece
NILE	0.30*	28.70	SLE1	Egypt

\* Estimate of actual discharge from Rosetta and Dannietta Branches

Table 3.1.1.3 River water discharge: % of reduction of long term natural inputs to the Sea

% reduction	Nile 99 % (1)	Segura 63 %	Jucar 25 %	Mijares 16 %
% reduction	Ebro 38 %	Llobregat 7 %	Turia 34 %	Rhône 13 %

(1) present direct discharge of Nile Branches assumed to be < 50 m<sup>3</sup>/s.

Table 3.1.1.4 Water and nutrients inputs from rivers to the Mediterranean subbasins

	Terrestr. watershed area (1)  10 <sup>3</sup> km <sup>2</sup>	Total river discharge (1)  km <sup>3</sup> / yr	Total load estimates N (2)  10 <sup>3</sup> t/yr	Total load estimates P (2)  10 <sup>3</sup> t/yr	Average Concentrations N  mg/L	Average concentrations P (3)  mg/L
1. Alboran	56.40	3.8	(122) ?	(16.5) ?	(32.1) ?	(4.3) ?
2. North West	229	85.9	298	40.5	3.5	0.47
3. South West	79.40	3.4	(99) ?	(13.5) ?	(29.1) ?	(4.0) ?
4. Tyrrhenian	46.4	12.2	59	8.0	4.8	0.65
5. Adriatic	146	106	182	25	1.7	0.23
6. Ionian	1.4	5.7	29.5	4.0	5.2	0.70
7. Central		= 0	= 0	= 0	/	/
8. Aegean	80.7	32.2	169	23	5.25	0.7
9. North Levantin	41.3	13.6	52	7	3.8	0.5
10. South Levantin	2.961	15.8	1.5	0.2	0.10	0.012

(1) Water balance from UNEP 1984

(3) Combination of (2) and (1)

(2) Nutrient balance from Vollenweider et al 1996

(?) Questioned values

Table 3.1.1.5 Ranked natural sediments loads to the Mediterranean (million tonnes per year)

Rivers	Msnatural Mt/yr	Area 10 <sup>3</sup> km <sup>2</sup>	Sub Basin	Country	Ts t km <sup>-2</sup> yr <sup>-1</sup>
NILE	120.00	2870	SLE1	Egypt	41.8
RHONE	31.00	95.60	NWE13	France	324.3
MEDJERDA	21.00	21.80	TYR6	Tunisia	963.3
EBRO	18.00	84.00	NWE 4	Spain	214.3
DRINI	16.63	14.17	ADR14	Albania	1,173.4
PO	15.20	70.00	ADR 7	Italy	217.1
SEMANI	11.30	5.65	ADR16	Albania	2,000.0
VIOSE	8.39	6.71	ADR17	Albania	1,251.1
STRYMON	8.00	16.50	AEG 5	Greece	484.8
TEVERE	7.50	16.55	TYR3	Italy	453.3
VAR	7.50	1.83	NWE15	France	4,093.9
ERZENI	7.24	0.76	ADR19	Albania	9,526.3
MOULOUYA	6.60	51.00	ALB1	Morocco	129.4
ISSER	6.10	31.60	SWE9	Algeria	193.0
AKHELOOS	6.04	5.54	ION5	Greece	1,090.3
OSUMI	5.70	2.042	ADR11	Albania	2,789.9
SHKUMBINI	4.67	2.45	ADR15	Albania	1,910.0
VOLTURNO	4.20	5.50	TYR5	Italy	763.6
SOUMMAM	4.10	8.00	SWE3	Algeria	512.5

ISHMI	3.97	0.67	ADR21	Albania	5,899.0
SIMETO	3.59	1.83	ION1	Italy	1,960.2
CHELIFF	3.40	43.70	SWE4	Algeria	77.8
BRADANO	2.80	2.74	ION4	Italy	1,020.4
RENO	2.71	3.40	ADR 6	Italy	798.2
MARTI	2.53	2.44	ADR22	Albania	1,036.5
BUNA	2.52	5.19	ADR X	Albania	485.8
GOKSU	2.50	10.10	NLE2	Turkey	247.5
BIFERNO	2.23	1.29	ADR18	Italy	1,730.0
ARNO	2.20	8.228	NWE16	Italy	267.6
SEYBOUSSE	2.00	6.00	SWE1	Algeria	333.3
OMBRONE	1.90	2.60	TYR2	Italy	730.8
OFANTO	1.81	2.72	ADR 1	Italy	665.7
ADIGE	1.60	12.00	ADR8	Italy	133.3
VOLTURNO	1.53	5.00	TYR5	Italy	306.0
CRATI	1.20	1.33	ION2	Italy	900.9
METAURO	1.20	1.40	ADR 4	Italy	857.1
TAFNA	1.00	6.90	SWE5	Algeria	144.9
PESCARA	0.92	3.10	ADR 2	Italy	297.4
ALIAKMON	0.83	9.50	AEG 2	Greece	87.4
AXIOS	0.83	24.70	AEG 3	Greece	33.6
KEBIR	0.22	1.10	SWE2	Algeria	200.0

Ts – specific transport rate

Table 3.1.1.6 Riverine particulates transport in the Mediterranean basin: example of exceptional floods

<u>Oued Zeroud</u> 8,950km <sup>2</sup> (Tunisia)	In "normal year" O. Zeroud does not flow most of the year and does not reach the sea. In 1969 the exceptional flood during September and October discharged 2.4 km <sup>3</sup> / 2 months of water and 240 millions tonnes of sediments corresponding to a transport of 40,000t/km <sup>2</sup> during this period. The maximum water discharge reached 17,000 m <sup>3</sup> /s and river velocity was up to 10m/s. The occurrence of such event is once every 20 years (Colombani and Olivry 1984).
<u>Oued Medjerdah</u> 23,300km <sup>2</sup> (Tunisia)	In March 1973, before major dam construction, the river discharged 80 to 100 millions tonnes of sediments during 8 days corresponding to 3,400 to 4,250 t/km <sup>2</sup> . The TSS content reached 35 g/l and, if bed load is included this figure, is up to 100 g/l for a maximum Q of 3150m <sup>3</sup> /s. The occurrence of the event is once every 200 to 300 years. (Claude, Francillon, Loyer 1977).
<u>Rhone river</u> 96,500 km <sup>2</sup> (France)	In November 1994 the Rhône reached 9,760m <sup>3</sup> /s (#5th flood since 1856) during 77 days of floods (Q> 3,000m <sup>3</sup> /s) the TSS discharge was 11.3Mt. i.e. 81% of the annual load for 22% of the time. The maximum TSS content measured was 5,200mg/L compared to 683mg/L for the discharge weighted TSS load of this hydrologic year (Pont and Bombled 1995) and only 41.5mg/L for the arithmetic average of the national French river survey (RNB) over 10 years.
<u>Ebro river</u> 85,550 km <sup>2</sup>	In 1907 (23 October) the maximum discharge at Tortosa, last gauging station, was 23 484m <sup>3</sup> /s with an estimated TSS content of 10g/L, corresponding to a flux of 720,000t of particulates in one hour, i.e. about 5 times the present day annual load estimated from 0.12 to 0.15 million tonnes per year compared to 3 million, before the major dams construction started in the 60's (Ibanez, Prat, Crricio 1996).

Table 3.1.1.7 Ranked actual sediment loads to the Mediterranean

Rivers	Msnat Mt/yr	Msactual Mt/yr	Area 10 <sup>3</sup> km <sup>2</sup>	Sub Basin	Country
CEYHAN		5.50	20.50	NLE4	Turkey
SEYHAN		5.20	20.00	NLE3	Turkey
RHONE	31	5.00	95.60	NWE13	France
ARNO		2.21	8.228	NWE16	Italy
ADIGE		1.65	11.95	ADR 8	Italy
EBRO	3-18	0.15	84.00	NWE 4	Spain
AXIOS		0.80	24.70	AEG 3	Greece
TEVERE	7.5	0.33	16.55	TYR3	Italy
JUCAR		0.08	21.60	NWE 1	Spain
LLOBREGAT		0.04	4.90	NWE 5	Spain
NILE (1)	120	2.00	2.87	SLE1	Egypt

Msnat = natural load

Msact = present day load

(1) upstream the Nile Delta

Table 3.1.1.8 Documented Mediterranean rivers for organic pollution

Rivers	Qact km <sup>3</sup> /yr	BOD <sub>5</sub> mg/L	COD mg/L	DOC mg/L	POC mg/L	*DOC+POC mg/L	TOC mg/L
ADIGE	7.29	5.68	11.43				2.7
AKHELOOS	5.67			1.12	0.29	1.41	1.46
ALIAKMON	1.168			1.22	0.65	1.87	1.78
ARGENS	0.38	3.5	10	2.4			
ARNO	2.10	2.36	12.55				6.1
AUDE	1.31	3.1	15	3.3			
AXIOS	4.90			1.42	0.43	1.85	1.86
BESOS	0.130	19.2	38.0				
BUYUK MENDERES	4.70		3.1				
CEYHAN	7.10	4.6	24.4				
EBRO	9.24	4.01	3.83	4.8	1.37	6.17	
EVROS	6.80			2.95	1.78	4.73	4.72
FLUVIA	0.36	1.24	3.7				
GOKSU	2.50	1.45	22.18				
HERAULT	0.92	2.5		2.5			
KISHON	0.063	275	1.700				
KRKA	1.61	2.48	9.7				
LLOBREGAT	0.466	5.3	15.3				
MANAVGAT	4.99	1.3	9.16				
METAURO	0.43	0.0	2.83				
NERETVA	11.01	1.958	10				
NESTOS	1.03	3.6	7.96	1.70	0.66	2.36	2.35
NILE	0.3			3.5	4.4	7.90	
ORB	0.86	3.1		2.7			
PINIOS	0.672	4.02	3.83				
PO	48.90	6.99	18.1	2.40			4.7
RHONE	48.07	1.5	5	2.61	5.20	7.81	
SEMANI	3.02	3.44	3.32				
SEYHAN	7.20	6.9	48				
SHKUMBINI	1.94	5.18	3.69				
STRYMON	2.59			2.05			
TAVIGNANO	0.06	1		2.3			
TER	0.84	2.64	7.9				

TET	0.40	5.6		3.5		
TEVERE	7.38	4.49	5.76			5.4
VAR	1.57	2.5	8	1.6		

Table 3.1.1.9 MERRI documented rivers for dissolved nutrients

Rivers	Qact Km <sup>3</sup> /yr	N - NO <sub>3</sub> <sup>-</sup> mg/L	N - NO <sub>2</sub> <sup>-</sup> mg/L	N - NH <sub>4</sub> <sup>+</sup> mg/L	Nk mg/L	P - PO <sub>4</sub> <sup>-3</sup>	Tot P mg/L
ADIGE	7.29	1.25		0.111		0.03	0.1126
AKHELOOS	5.67	0.60		0.035		0.02	0.0151
ALIAKMON	1.168	0.395		0.05		0.10	0.0168
ARGENS	0.38	0.74	0.02	0.09	0.5	0.11	0.22
ARNO	2.10	0.912		0.042		0.500	0.01
AUDE	1.31	1.42	0.03	0.09	1.2	0.09	0.49
AXIOS	4.90	1.584		0.0658		0.48	0.48
BESOS	0.130	1.9	0.3	31			12.7
BUYUK MENDERES	4.70	1.44				0.55	
CEYHAN	7.10						8.68
EBRO	9.24	2.3		0.1672		0.029	0.243
EVROS	6.80	1.9		0.05		0.36	
FLUVIA	0.36			0.054			0.35
GEDIZ	1.87	1.65		0.05		0.19	
GOKSU	2.50						8.87
HERAULT	0.92	0.61	0.012	0.06		0.045	0.22
KISHON	0.063						20
KRKA	1.61	0.45	0.001	0.031		0.029	
LLOBREGAT	0.466	1.9	0.5	3.2		1.2	1.53
METAURO	0.43	1.366		0.0		0.005	0.119
NERETVA	11.01	0.269		0.029			0.050
NESTOS	1.03	1.24		0.071			0.127
ORB	0.86	0.67	0.045	0.44	0.9	0.14	0.45
PINIOS	0.672	2.323		0.167			0.2431
PO	48.90	2.03		0.21		0.084	0.2393
RHONE	48.07	1.48	0.033	0.124	0.80	0.101	0.14
SEMANI	3.02	0.24					0.002
SEYHAN	7.20	0.59		0.31	0.27	0.01	
SHKUMBINI	1.94	0.73					0.01
STRYMON	2.59	1.236		0.053		0.11	0.125
TAVIGNANO	0.06	0.34	0.045	[0.003]		[0.005]	
TER	0.84			1.2			2.15
TET	0.40	1.8	0.18	1.5	2.7	0.47	0.8
TEVERE	7.38	1.37		1.04		0.26	0.355
VAR	1.57	0.18	0.003	0.031	1.5	0.006	0.13

Table 3.1.1.10 Proportions of specific forms of nutrients in selected Mediterranean

	Nitrogen						Phosphorus				Organic carbon		
	TN mg/L	NO <sub>3</sub> %	NO <sub>2</sub> %	NH <sub>4</sub> %	DON %	PN %	P-PO <sub>4</sub> %	DOP %	PP %	TP mg/L	DOC %	POC %	TOC mg/L
Po (1)	3.13	<--	71	-->	17	12	49	6	45	0.170			
Rhône (2)	1.7	78.2	1.2	5.4	8.4	6.9	36	18.5	45.5	0.120	33	67	7.8
Ebro (3)	2.6	75.5	1.1	4.2	11.5	7.7	58	/	42	0.200	78	22	6.2

DON = Dissolved Organic Nitrogen. PP = Particular Phosphorus etc.

Table 3.1.1.11 Documented rivers for particulate metal contents

Rivers	As mg/g	Cd mg/g	Cr mg/g	Cu mg/g	Hg mg/g	Ni mg/g	Pb mg/g	Zn mg/g
ADIGE		1.63		50		32	49	270
ARGENS	4.2	0.1	15.6	3.2	<0.03	9.7	19.6	38.1
ARNO			159					
BRADANO		2.55						
BRENTA							145	
CEYHAN				<10		<20		
EBRO	6.1	1.8	215	71		19	60	
GOKSU		0.5	270	16.8			5	27.4
HERAULT	26.4	0.7	33.6	57.2	0.137	24.3	129	279
MARTI			91				517	438
ORB	28.7	0.1	37.5	132	0.29	30.2	68.4	138
PO	7.45	1.74	124	73	1.54	112	75	342
RHONE	13.2	1.80	155	125	0.47	60	120	108
SEYHAN				<10		<20		
TEVERE		2.0		100			130	280
VAR	7.7	0.42	19.8	25	0.0	14.2	5.6	68
REFERENCE BACKGROUND (1)		0.4		20	0.03		25	100

(1) Estimated.

Table 3.1.1.12 Documented rivers for dissolved metal contents

Rivers	As Dis Mg/L	Cd Dis mg/L	Cr Dis mg/L	Cu Dis mg/L	Hg Dis mg/L	Ni Dis mg/L	Pb Dis mg/L	Zn Dis mg/L
ADIGE		0.032		2.39			0.74	
ARNO		0.020		2.00	0.07		1.0	
BRADANO		0.076						
BRENTA				2.54			0.50	
EBRO		0.061		1.8		1.5	0.030	0.60
KRKA		0.005		0.1	0.0004	0.1	0.01	
NILE		0.008		0.95			0.034	
PO		0.064	1.1	1.50	0.0093	3.3	0.148	7
RHONE	1.89	0.028	0.274	2.200	0.0018	1.4	0.083	1.3
TEVERE		0.080		0.9	0.02		0.4	5.3
REFERENCE BACKGROUND (1)		0.005		1.0	0.001		0.05	0.2

(1) Estimated.

Table 3.1.1.13 Proportion of heavy metal loads associated to river particulate matter (in % of total load)

	Al	As	Cd	Co	Cr	Cu	Hg	Ni	Pb	Zn
Po (1)	98.4	23	41	94.7	88.2	73	88	78.4	93.1	71.1
Rhône (2)	/	/	90	/	99	87.4	99	93.5	99	94.0

(1) Pettine and Camusso 1991. (2) Pont et al 1996.

Table 3.1.1.14 Pesticides detection in Mediterranean rivers (% of analyses)

	Pô (1)	Louros (2) Arachtos	Seyhan Ceyhan (3)
Alachlor	31	0.9	
Atrazine	87	3.1	
BHC = lindane			3
Bromacil			33
Bromad			3
Brompropylate			3
Carbofuran	6		
Chlopyrifos	19		30
Diazinone	31		
Dichlorobenil	24		
Dicofol	6		17
Dieldrin			3
Dimethoate	6		
Diuron		1.9	
Heptachlor	6		
Lindane	24	0.3	
Metholachlor	12		
Molinate	12		
Pendimethaline	24		
Phorate	12	0.3	
Propazine	31		
Simazine	37	1.7	
Terbutilazine	6		
Terbutrine	6		
Tetradifon			27
Triadimefon	31		
Trifluralin	56	0.6	
Vindozolin			6

(1) Italy, Marchetti 1991 at Zibello (Parma) (n=16).

(2) Small Greek rivers, Albanis et al 1995.

(3) Turkey, Erbatur 1994.

Table 3.1.1.15 Solvent detection in the river Pô at mouth (Marchetti) in % of samples (n=28 samples)

Methylene chloride	11%	Bromo-dichloromethane	11%
Trichlorofluoromethane	43%	Tetrachloroethylene	25%
Chloroform	96%	Trichloroethylene	39%
1.1.1.trichloroethane	61%	Dibromochloromethane	18%
Carbon tetrachloride	50%		



Table 3.1.1.16 Bacterial counts (n/100ml) in Northern Mediterranean river waters between 1982 and 1992 (data from Europe Environmental Agency courtesy of Kristensen 1997)

Rivers	Coli-Fae Average	Coli-Fae Min.	Coli-Fae Max.	Coli-tot Average	Coli-tot Min.	Stre-Fae n/100ml Average	Stre-Fae n/100ml Min.	Stre-Fae n/100ml Max.	Coli-tot Max.
ADIGE	2,335.4	0	36,300	14,007	200	408.96	0	4,200	90,200
AKHELOOS	133.01	0	4,600	301.24	0	31.984	0	266	4,600
ALIAKMON	3,520	0	240,000	12,423	6	764.72	0	24,500	1,000,000
ARNO	2,752.1	50	9,180	7,354.8	200	393.48	20	2,300	24,000
AXIOS	5,320	240	46,000	10,740	450	1,891.5	0	11,000	46,000
EBRO	11,790	7	456,000	106,756	38	138.3	0	2,500	810,000
METAURO	5,549.4	10	36,000	6,146.1	30	782.56	0	9,180	100,000
NESTOS	1,696	0	11,000	3,105.6	23	904.95	0	8,000	24,000
PINIOS	1,158.8	0	11,000	2,676.7	0	77.542	0	700	37,000
PO	26,636	1,000	330,000	57,203	1,000	10,133	700	302,000	1,000,000
STRYMON	14,830	43	1,000,000	20,395	110	2,882.7	0	30,000	1,000,000
TEVERE	188,454	4,300	2,000,000	284,024	7,500				4,000,000

Table 3.1.1.17 Examples of Pristine Mediterranean rivers

	Area Km <sup>2</sup>	BOD <sub>5</sub> mg/L	COD mg/L	N-NO <sub>3</sub> mg/L	N-NH <sub>4</sub> mg/L	P-PO <sub>4</sub> mg/L	Tot P	Coliform n/100ml
Krka - Croatia (1)	1,980	2.78		0.45	0.031	0.029		56
Neretva (Croatia) (1)	10,042	2.06		0.49	0.0017		0.023	1,800
Var	1,830	2.5	8.0	0.18	0.034	0.006	0.13	/
Tavignano		1.0	/	0.34	<0.01	<0.006	/	/

(1) N. Hak (pers. com. 1997), average of 12 samples.

## 3.1.2 Ports and 3.1.3 Maritime Transport

### 3.1.2.1 Introduction

Pollution from Maritime Transport activity occurs not only in open sea but also, and even more, near the coastline in ports, outside anchorage areas, access channels, estuaries and seaways. Therefore, densely populated coastal areas surrounding the major Mediterranean ports are places where both maritime transport-generated and land-based pollution take place and mix to build-up so-called "hot spots".

Maritime Transport is a world-wide activity, mostly transboundary by its origin and organization. However, within this global activity, international sea-borne trade flows are mingled, mainly in coastal waters but also in open sea, with national traffics between ports of the same countries. In the Mediterranean Sea, these domestic traffics are particularly important in Italy, Greece and Turkey. Of course, many of these national traffics are directly or indirectly linked with international ones. Domestic feeding of containers from and to a hub served by international lines is directly related to a transboundary activity. A very important example of indirect link is provided by the domestic coastal distribution of various oil products processed in local refineries from imported crude.

However, the enforcement of these measures has to be considered at the national and regional level. Therefore, a maritime country is concerned by Maritime Transport derived pollution under three complementary points of view: the first is the one of *flag-state* regulating the ships placed under its own register; the second is the one of *port-state* controlling the foreign ships calling in its harbours; the third is the one of *coastal-state*, monitoring the compliance of all ships passing along its coast with navigation safety and pollution control regulations.

In the Mediterranean region, all countries are signatories to the Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its related Protocols. Among these protocols one is directly related with the Maritime Transport general impact upon the marine environment and it concerns Cooperation in Combating Pollution of the Mediterranean Sea by Oil and other Harmful Substances in case of Emergency.

This "Emergency Protocol" as, it is known for short, is dealing with the regional cooperation required in taking necessary curatives measures in cases of imminent marine pollution danger resulting from sea accidents. Therefore, it is mainly in their capacity of coastal-states that the parties to the Barcelona Convention deals with Maritime Transport-generated pollution. This position is fully opposite as their rights and duties as flag-states and port-states are amply established by the relevant IMO Conventions, Protocols and Codes.

The present chapter will, at first, analyze the risks which Maritime Transport activities present for the Mediterranean marine and coastal environment and, afterwards, will evaluate the impact in the Region of the preventive and curative measures adopted at the international level to fight marine pollution, some suggestions will also be presented to improve their implementation and increase their efficiency within the Mediterranean Region.

It was originally planned to discuss, in two separate chapters of the present TDA, the pollution risks, problems and perceived issues for Maritime Transport, on one hand, and Ports, in the other. However, when ports provide the interface of maritime transport between their inner-

land and the open sea, they belong to the marine world and their pollution risks are ship-related, whilst the solution of most of their environment problems are linked with safer and cleaner shipping operations.

### **3.1.2.2 Maritime Transport**

With the specific chemical and physical character of the various commodities and manufactured goods carried by a ship, their respective handling, storing and containment methods are to be taken into consideration when assessing the pollution risk she presents for the Marine Environment.

A preliminary distinction is to be made between operational and accidental pollution causes. Operational pollution causes shall be reduced as far as possible, accidental one are to be prevented by all means.

Apart cargo and passengers carrying vessels, other merchant ships such as off-shore and port service craft may be the source of operational or accidental pollution. Dredges constitutes a very special case of operational pollution as the material dredged in the port basins and access channels are generally heavily polluted by shipping and coastal industries wastes. These materials are often dumped at sea and the selection of dumping sites to mitigate damages to the marine Environment is a very complicated matter. By chance, most of the Mediterranean Sea ports are located in areas where, silting being minimal, depth maintenance dredging has not to be performed according a continuous program.

Fishing and pleasure craft are also source of operational pollution and the latter are particularly numerous in the Northern shores of the Mediterranean sea. A possible, but practically not documented, pollution source derives from warships operations in the Mediterranean sea. In fact, the NATO navies units are well equipped and their crews well trained to avoid operational pollution not primarily to protect the environment but rather for a tactical discretion purpose.

Most operational pollution causes are common to all types of merchant ships (and to many of non-merchant ones). Some are related to propulsion plant: oily water and wastes collected in machinery space bilge tanks, nitrogen acid and other pollutants in machinery exhaust fumes, others to the crew and passengers: garbage and sewage, others to the ship's maintenance and operation: cleaning of tanks and piping before repairs, anti-fouling organotin paints, unwanted aquatic organism and pathogens found in ship's ballast water and sediment discharges.

Severe accidental pollution is usually related to oil tanker major casualties, such as foundering, grounding, fire and explosion, collision at sea with an other vessel, contact in a port with a quay, a pier or a bridge. These cargo oil spills, often involving large quantities of hydrocarbons, attract the attention of the public through their wide coverage by the media, showing terrific pictures of blackened beaches and of dead or deceasing oily birds, otters or seals.

The risk of occurrence of shipping casualties in the Mediterranean Sea, is very important. For an "INTERNATIONAL SALVAGE INDUSTRY SURVEY", prepared in 1991/1992 a special extract of LLOYD'S MARITIME INFORMATION SERVICE major marine casualties data base was provided, for the period 1981-1990. Out of World total of 8,395

registered events, 1,246 have taken place in a geographical area covering the Mediterranean and Black Seas as well as the Suez Canal. The corresponding percentage - 14.8- is only exceeded by the North-western European area -21%- and the very extensive Far-east and Australo-Asia area: 18.4%.

From the same major casualties statistical analysis it appears that, among the "Fire/explosion" events recorded all over the world during the period, 21.7% have taken place in the Mediterranean / Black Seas area. The corresponding percentage for "Foundered vessel" events was 16.9 when the one for "Collisions" was 16.3.

A detailed cargoes analysis and forecast of the Mediterranean international sea-borne trade flows was prepared in the framework of the Blue Plan in 1990 / 1991 and presented in an ECOMAR report entitled "Maritime Transport in the Mediterranean sea and its consequences on the Environment".

This Mediterranean Sea-borne trade analysis was carried-out for each of the following main cargo categories:

- |                                    |   |                         |
|------------------------------------|---|-------------------------|
| - Crude oil                        | < |                         |
| - Petroleum refined products       | > | Liquid bulk cargo group |
| - Liquefied gasses (LPG and LNG)   | < |                         |
| - Liquid chemicals                 | < |                         |
|                                    |   |                         |
| - Iron ore                         | < |                         |
| - Coal                             | < |                         |
| - Grains                           | > | Dry bulk cargo group    |
| - Minor and other dry bulk cargoes | < |                         |
|                                    |   |                         |
| - Refrigerated and frozen goods    | < |                         |
| - Containerisable cargoes          | > | General cargo group     |
| - Other general cargoes            | < |                         |

### 3.1.2.3 Intra-Mediterranean Cargo flows

During 1985, 172 million tonnes of international sea-borne cargoes were shipped between Mediterranean countries. Out of this total, *crude oil and refined petroleum products* amounted to 123 million tonnes (71.5%) when liquefied gasses and bulk chemical liquids together represented 10 million tonnes (5.8%). Consequently, tanker trades represented more than three quarter to these inter-Mediterranean international shipments.

Among other cargo categories, it is interesting to point out the relative importance of *other dry bulk* with 27 million tonnes (15.7%).

### 3.1.2.4 Cargoes loaded in Mediterranean ports

Here again, "liquid bulk cargoes" play the major part: out of a total of 177 million tonnes in 1985, they reached nearly 100 million or 56.5%. This total volume was distributed between 90 million tonnes for crude oil and oil products and about 10 million for liquefied gasses and chemical liquids. This relative weigh of the "minor bulk cargo" category - 47 million tonnes -

reaches 26.6%. Out of a total of 25.5 million tonnes for General cargo, the "Containerizable" segment is accounting for more than 16 millions tonnes.

### **3.1.2.5 Cargoes unloaded in Mediterranean ports**

The total volume of these shipments from other parts of the world, at about 305 million tonnes, exceeds by far the one of the sea-borne "exports" of the Mediterranean area.

From this overall analysis of the 1985 Mediterranean generated Maritime Transport flows the main findings can be summarized as follows:

Out of a total volume of 375 million tonnes of liquid bulk cargoes, 204 (54.4%) originated from the countries of the South and East area when 242 million tonnes (64.5%) were destined to the North-west area. The comparison of these figures shows the importance of the rest of the World in the Mediterranean liquid bulk cargo flows: it is the origin of 37.9% and the destination of 26.7% of their volumes.

In the dry bulk cargoes group, the part played by the rest of the world as origin of the Mediterranean traffic flows is clearly predominating: about 142 millions tonnes out of a total of 223, i.e. more than 60%.

The general cargoes group represents a total exceeding 55 million tonnes. Essentially, this group comprises manufactured goods, therefore it is logical that nearly half of this total is loaded in the ports of the industrialized North-West area. An other important share -37%- originates from the rest of the world whilst only 12.8% is provided by the developing countries of the South and East area. Conversely the same countries receive 28.8% of general cargoes unloaded in Mediterranean Maritime Transport, a little more than the North-West area (26.8%) but far less than the rest of the world (45.6%).

The total Mediterranean generated cargo flows reached about 654 million tonnes in 1985 of which 99 (15.1%) were loaded in the North-West area and 242 (37%) in the South and East area. The remaining volume 304 million tonnes (46.6%) originated from the rest of the world, a fact underlining the relative weakness of the inter-Mediterranean trade.

The resulting estimates for the Mediterranean transit cargo flows, in 1985, totals 215 million tonnes or which 54.5 million tonnes (25.3%) are liquid bulk cargoes. It is noteworthy that crude oil and petroleum refined products volumes are practically equal with about 21 million tonnes for each category. Chemical liquids, mostly loaded east of Suez, with nearly 12 million tonnes, form a relatively important part (5.5%) of these transit traffics. Among the major dry bulk cargoes transit flows totaling 127 million tonnes, grains, with more than 32 million tonnes, mainly imports of the former USSR and other Black Sea countries, as well as coal, with about 30 million tonnes, are the predominant commodities.

Within the 33.5 million tonnes of transit flows in the general cargo group, the respective volumes of "containairizable" ones and "others cargoes" nearly appear equal at about 15 million tonnes, each. Due to the progress of the containerization process in the meantime in the liner trades linking North-Western Europe and US East Coast on one side of Gibraltar with the Middle East, Southern Asia, Australasia and Far East on the other side of Suez, the present

distribution differs from the 1985 one and the share of containerized among containerizable cargoes is probably nearing 90%.

The result of the Drewry analysis tends to confirm the validity of the low hypothesis of ECOMAR forecast: the volume of the Mediterranean crude oil sea-borne trade, as computed by Drewry for 1994, stands at 284.4 million tonnes. Thus, it was only 8% higher than the corresponding figure for 1985. Surprisingly enough, the volume of products - 70.5 million tonnes - was lower by 14% than the one recorded in 1985. The combined volume of the two categories reaches 355 million tonnes and can be compared with an interpolation to the year 1994 of the low and high hypothesis for the target-year 2000. The resulting forecast range is 350 / 370 million tonnes and the actual volume is only slightly exceeding the lower figure.

Therefore, the comparison of the 1985 and 1994 regional traffic and transit flows for crude and products shows that the total Mediterranean oil sea borne trade has remain more or less stagnant during this 9 years period: its volume was nearing 388 million tonnes in 1985, it was only about 377 million tonnes in 1994.

It confirms that the fast growth of the world oil shipping traffics recorded during the last decade (53% from 1985 to 1994 according the Fearnley yearly statistical Review) was mainly due to the rapid development of the economies of the new industrialized nations in the South and East parts of Asia.

As regards the evolution of oil spill risks in the Mediterranean Sea and ports, this recent stagnation of regional crude and products flows is a favorable development. However, this situation is not likely to last for ever: the embargo on Iraqi oil exports has been partially lifted and the North Sea reserves are diminishing. It is also obvious that aiming at higher GNP growth rates shall become a political priority for the coming years in the unemployment-plagued European Union Countries.

#### **3.1.2.6 Oil and Chemical Spills**

The most accident-prone areas of the Mediterranean Sea are the approaches of Gibraltar, Messina and Sicily straits, several Mediterranean ports and their accesses, particularly Genoa, Leghorn, Civitavecchia, Venice / Trieste, Piraeus, Limassol / Larnaca, Beirut and Alexandria. The geographical distribution of these marine pollution hot-spots is clearly related with the density of shipping traffics on the various Mediterranean routes.

Among the most recent accidents registered in 1994 and 1995, 53% occurred in the open sea and 47% in ports or in their vicinity. The fact that many accidents are located in port areas is not surprising taken into consideration the high number of daily shipping movements that has to be carried-out in these much restricted waters. However, for some of the harbours, the absence, or the poor quality, of the local vessel traffic system (VTS) may also be a contributing factor.

Out of 268 accidents listed by REMPEC for the 1977 / 1995 period, more of three quarter were involving oil. Out of 180 of them, occurring between 1981 and 1995, 55% resulted in oil spillage.

Among casualty categories Fire / Explosions (25%) and Grounding (24%) were the more frequent ones during the eighties. In the nineties their relative share was reduced by the big increase of the number of Collisions. The percentage of this last category was 9% for the period 1981 / 1990 but doubled for the 1991/ 1995 one. This increase is rather disquieting as regards the compliance of the seafarers in charge of watch-keeping on board of the involved ships with the international and local safety of navigation regulations.

A collision is the most likely casualty to cause a cargo spillage: out of 17 collisions involving tankers reported from 1981 to 1995, 12 resulted in oil spills. The corresponding percentage reaches 71%, when only 27% on the tanker grounding events and 20% of the tanker fires and explosions have the same pollution consequence. However, when considering the quantities of spilled oil, more than half of the total results from fires and explosions whilst 38% are the consequence of collisions.

During the fifteen years period 1981 / 1995, the total quantity of oil entered in the Mediterranean sea as the result of shipping accidents reads 54,622 tonnes, a yearly average of about 3,641 tonnes. During 1995, only 12 tonnes of oil were reported as spilled by accident. The distribution of spilled quantities between persistent and non-persistent oils shows that persistent ones represented 47% during the eighties but 100% since 1991. This trend may appear disquieting. However, when comparing the involved quantities with the volume of 377 millions tonnes of oil transported in the Mediterranean Sea in transboundary trade during 1994 (to which should be added about 60 millions tonnes of oil in domestic Maritime Transport) one cannot fail to conclude that ship-generated oil accidental pollution only has marginally contributed to the overall ecological risk represented by hydrocarbons for the Mediterranean marine and coastal environment.

However, three single locally severe pollution cases have resulted in the past of the uneven distribution in space, time and volume of the individual accidental spills. These three accidents alone were responsible for 74% of the total volume of oil spilled in the considered period. This underline the fact that the precise geographical distribution of oil spilled quantities is unpredictable in a large region as the Mediterranean Sea.

The recorded bunker oil spillage - 1,555 tonnes for whole period- seems negligible. Nevertheless, a severe casualty may happen in the future to a very large container vessel and causes an important pollution.

Indeed, the probability of a major oil pollution accident remains high in the region and preventative actions as well as preparedness efforts should be sustained and even increased.

Accidents involving other hazardous substances, the number of which reads 66, were only reported to REMPEC since 1988 when the ones involving oil are listed since 1977. Accordingly their percentage of about 25% in the REMPEC list is somewhat misleading. When taking into consideration, for the sake of homogeneity, only the oil-involving events that have occurred since 1988, the percentage of accidents involving other hazardous substances reaches 37% out to the total registered during this eight years period.

The frequency of fires and explosions appears similar for the involved vessels than for oil tankers when the ones of grounding and collision is lower. Conversely, sinking are far more frequent among accidents involving hazardous substances. This finding can be probably

related to the size of the concerned vessels: as an average, chemical and LPG tankers and most dry cargo vessels, operations on the Mediterranean short-sea routes are far smaller than the crude oil and even petroleum products tankers, operating in cross-Mediterranean trades. Therefore, they are most likely to suffer from heavy sea conditions.

The normal operation of ships of any type produce a large range of contaminants which are becoming the source of multifarious pollution risks for the Marine and Coastal Environment, unless opposite preventative measures and procedures are applied, for each case, in order to eliminate, or reduce to a sustainable level, the consecutive discharge into the sea, or in the atmosphere, of polluting effluents.

Many of these measures and procedures have been provided by rules and regulations adopted in the framework of IMO international Conventions covering most operational ship-generated pollution causes.

Nevertheless, the incomplete and discontinuous implementation of the IMO regulations by several flag-states -including some Mediterranean ones- remains a global problem, specially in the fields of maintenance, manning and operation of their respective merchant fleets. The control of the actual compliance of individual vessels, operating in the Mediterranean Sea under various flags, with these internationally agreed pollution-abatement measures and navigation safety procedures are not seriously enough carried-out by national authorities of several countries of the Region in their twin capacities of Port and Coastal State.

On the basis of the ECOMAR analysis of the Mediterranean traffic flows in 1985, a very theoretical estimating exercise has resulted in a daily average of about 490 cargo carrying vessels in operation.

At the world level the major marine source of hydrocarbon pollution results mainly from the discharge of oily water and residues resulting from the washing and de-ballasting at sea of the cargo tanks of oil tankers and O/B/O carriers. A similar tank washing problems exists for chemical tankers carrying hazardous substances. The operational discharge of oil comprises also effluents of oily bilge water and residues from the machinery space of all ships.

According IMO MARPOL Convention, the Mediterranean Sea has been designated as a "Special Area" in which no harmful discharge of hydrocarbons is permitted. Therefore, no problem of operational oil pollution should exist in the Region. But the reality certainly differs from this ideal situation. Curiously enough, MARPOL doesn't consider the Mediterranean Sea as a "Special Area" for chemical tankers; thus these ships shall observe the general regulations for monitoring and controlling their discharge at sea.

Nevertheless, for lack of recent data, the actual state of implementation of MARPOL discharge regulations for the Mediterranean Sea appears questionable. There are two sources of oily wastes from oil tankers: tank washing (and pipe rinsing) before gas-frying or cargo changing and oil contaminated ballast water from tanks used alternatively for cargo or ballast according the weather conditions.

In a report by the World Bank and the European Investment Bank the "Tanker operations (especially de-ballasting)" were considered, by far, as the major Mediterranean source of



pollution with 450,000 tonnes, whilst discharge of "oily bilge waters, sludge and used luboils from ships" were supposed to represents a further 60,000 tonnes.

Therefore, the total quantity of oil entering the Mediterranean Sea as a consequence of ship operations was estimated to exceed, at the time, half-million tonnes. This huge volume contrasts with the modest annual quantities of oil spilled by shipping accidents as listed by REMPEC. In this respect, it is interesting to underline that, in the same "Maritime Sector Assessment", the volume for the oil accidentally spilled in the Mediterranean Sea also appears enormous with an annual average of 65,000 tonnes.

As regards contaminated ballast water, the problem is resolved for most of the recent tankers: every crude-oil tanker of 20,000 tdw., and above and every product carrier of 30,000 tdw., and above, delivered after 31 December 1979, shall be provided with ballast tank segregated from cargo tanks. However, many old tankers are still operated in the inter-Mediterranean oil trade and the domestic distribution of refined products is generally done by coastal tankers, the deadweight tonnage of which is well below the 30,000 tonnes limit.

Nevertheless, the above estimated annual 450,000 tonnes of oil discharged in the Mediterranean from tanker de-ballasting operations, which was probably derived from ancient data, nowadays appears completely out of proportion as compared with the current level and present regulation of tanker operations in the Region.

If, as a preliminary tentative hypothesis, one considers that, despite the fact that the Mediterranean Sea is classified as "Special Area" and due to insufficient terminal oily-wastes reception facilities (a problem discussed later), the tankers are still discharging into it, during their ballast voyages, 1/15,000 of the total annual regional flows of crude oil and refined products shipped during 1994, the resulting overall released volume would have not exceed 19,000 tonnes. This estimate is probably too pessimistic as the majority of the present world crude oil carrying tanker fleet was built after 1980, and therefore is fitted with segregated ballast tanks, and practices the COW washing system.

Sewage discharge is regulated by ANNEX IV of MARPOL Convention but this text is not yet in force and, consequently, only few recent ships, particularly cruise passenger vessels and large car-ferries, are fitted with the required treatment and holding equipment.

For Garbage, the relevant ANNEX 5 of MARPOL is totally in force since April 1993. In this respect, Mediterranean Sea is considered as a "Special Area" where disposal at sea of all types of garbage, but food waste, is prohibited. Food waste can neither be dumped within 12 miles from the land. The implementation of these regulations also supposes a strict control in open sea and coastal waters by Navy, Coast Guard or Customs patrol boats.

In order to get an idea of the size of the problem of disposal posed by these two pollutants, an estimate of the quantities produced can be undertaken on the basis of the previously computed number of ships operating in the Mediterranean Sea on a given day. If the 129 tankers and 232 bulk carriers are, as an average, manned by a crew of 13 persons, the corresponding total number of seafarers aboard ships in the Mediterranean waters and ports reaches 8,916.

Passengers ships cater for a far more important seafaring population. Passengers travelling on the Italian and Greek domestic routes were numbering 74 million during the year 1995 or a

daily average of 202,740 persons. When this figure is divided by the number of Greek and Italian flags passenger vessels –550– we obtain an average daily transport capacity per unit of 368 passengers. If we consider a crew of 50 per vessel the average daily number of persons living aboard a passenger vessel reaches 418.

Thus, when applying this human transport capacity, considered as a representative average for the whole Region, to the total estimated number of passenger vessels sailing in Mediterranean waters, the results reads 376,200 persons. To sum up, the average number of persons at sea, per day, aboard merchant vessels in the Mediterranean Sea exceeds 385,000 people.

The above calculations result in a total garbage output by merchant ships calling at Mediterranean ports of about 206,000 tonnes of which only 1.3% of food waste can be dumped in the sea at more than 12 miles from land.

### **3.1.2.7 The relevant IMO Conventions**

The transboundary nature of the Maritime Transport implies that the same basic preventive and curative measures, dealing with the Marine and Coastal pollution generated by its activities, shall be in force all over the World. The discussion and the adoption of these measures by the international community are carried-out within the framework of a United-Nations Institution, the London-based International Maritime Organization (IMO). The corresponding rules and regulations are enacted by many International Conventions, the signatories of which should be all the maritime Nations.

These conventions provide a complex legal network, several parts of which are at any time, undergoing revision or addition processes. A comprehensive analysis of the relevant IMO rules would exceed, by far, the limits of the current analysis. The main subjects covered by IMO rules and regulations are:

- Preventive Navigation and Ship safety measures;
- Marine Environment protection technical measures in Ship design, construction equipment and operation;
- Emergency measures to prevent, minimize and fight accidental Marine Pollution; and
- Pollution civil liability and financial compensation rules.

A special test inspection programme covering 4,193 cargo units – containers and road vehicles – was carried out in two Swedish ports during the period from March 1994 to September 1996. Among these units, 885, or 21% were carrying dangerous goods. Out of these 885 cargo units, 43.3% have presented deficiencies as regards the IMDG code regulations. About a third of the faults were found in the stowage/securing arrangements inside the units, more than 25% were concerning mis-declaration, labeling, certification and documentation.

### 3.1.2.8 Some special shipping issues and problems

Similar exercises have been done in 1995 and 1996 in some Japanese and Canadian Ports and the percentage of deficient cargo units reached 45 in Japan and 75 in Canada. Up to now, no systematic test programme has been undertaken in the Mediterranean Region. Such action should be urgently considered under the GEF SAP Programme. It seems highly probable that the situation in the South and East parts of the Region as regards the compliance with IMDG Code regulations is far worst than the one observed in very developed industrialized and pollution-minded countries such as Sweden, Japan and Canada.

Ship's routing includes various internationally agreed measures and recommendations concerning areas to be avoided, recommended deep water routs and traffic separation schemes. When many of these provisions concern Northern and Western European waters, such as the well known English Channel entrance and Dover Strait traffic separation schemes non has yet been enacted for the Mediterranean Sea.

When considering the important number of collision and grounding casualties in this area, it would be advisable within the framework of MAP Phase II to initiate a survey of the Mediterranean traffic flows in order to determine the most urgent ships' routing regional projects to be implemented in the coming years.

The consequences of the current decline of salvage capability in the Mediterranean Sea should be more completely reviewed in the light of a comprehensive assessment of the possible evolution during the coming years of the risk of casualties in the categories implying oil or chemicals accidental pollution and likely to be prevented or minimized by rescue towing or other salvage actions.

The conclusion of such a cost / benefit analysis, which should be undertaken within the framework of MAP Phase II, will probably indicate that Salvage availability should be increased in the some areas of the Mediterranean Sea. This requirement will be all the more pressing when the parties to the Mediterranean Action Plan will take into consideration not only the aim of safeguarding private properties but, even more, the public duty of preventing or minimizing Marine and Coastal pollution. To reach this objective it appears that, beyond the existing means, several dedicated salvage tugs, each manned by a well experienced and trained crew, should be stationed permanently in most casualty-prone Mediterranean areas. As the cost of such stationing will exceed by far the benefit that a private salvor may expect to get from it, this cost should be supported jointly by the countries, on a regional or sub-regional geographical basis, proportionally to the value of hydrocarbons and chemicals loaded and unloaded in its Mediterranean ports.

The choice of the areas where these tugs should be kept in station will be difficult as it is impossible to forecast the timing and location of the next tanker casualties involving major spill risks in the Mediterranean. To obtain a good cover of these risks up to five tugs could be required to be stationed near the straits of Gibraltar and Sicily, also in Tyrrhenian, Adriatic and Aegean Sea (the two Suez Canal Authority's tugs offering a suitable cover for this seaway and its Mediterranean approaches). However, the implementation of such an ambitious program will have to be spread over some years and priorities should be established. As for a first unit, it seems that a station in Malta covering the highly trafficked straits of Sicily, Messina and even Otrant as well as a long part of the dangerous North African Coast, could be an obvious choice for both geographical and political motives. This location may also permit to place this major

regional pollution prevention means under the international aegis of REMPEC in its capacity of joint Agency of IMO and UNEP in charge of organizing the regional and sub-regional co-operation for pollution prevention and fighting among the parties to the Barcelona Convention.

### **3.1.2.9 The state of preparedness in the Mediterranean area**

When preventive measures have proved unsuccessful and a major spill has taken place near the land, the ability of country to effectively respond to the unavoidable pollution of its coastal waters and shores depends of its state of preparedness concerning such a catastrophic event.

The International Tanker Owners Pollution Federation Ltd. (ITOPF) report has considered 13 UNEP Regional Seas Area, among which is the Mediterranean. For this area it is reported that, out of the 20 countries, 10 have enacted a National Contingency plan and 6 more are in course of preparing one.

#### *Preventing Marine Pollution occurring during port operations*

Port activities appear directly or indirectly linked with Maritime Transport. For instance, oil spills occurring in port as a consequence of overflowing during a bunkering operation can be related to the operation of the receiving ship and considered as entering the sea from Maritime Transport, or related to the delivering barge which ranks among the harbour craft performing a land-based service. Most of the categories of operational and accidental ship-generated pollution, indifferently, happens in port or at sea and the same range of preventative measures are to be observed in both locations. Contrarily, the preventive and curative measures are different in a very restricted area like a port and its approaches, from the ones intended for deep-sea intervention.

To promote the adoption of emergency plans by the concerned ports in the Mediterranean Region, REMPEC has recently suggested the implementation of two pilot-projects: the first concerns the development of an emergency plan for the Moroccan Port of Tanger, the second is a risk analysis for the Turkish port of Mersin which will also include the development of emergency means and procedures for fighting the designated categories of possible pollution.

The financing of these two pilot-projects should be provided, for an important part, by international donors. The generalization of Port Emergency Plans to all Mediterranean harbours loading and / or unloading large quantities of noxious or dangerous substances constitutes an important issue which should be given due consideration in the GEF project.

Some other categories of Maritime Transport-derived pollution take place or originate only, or mainly, in ports and their approaches. Among them figure the release of organotin biocidal pollutants by anti-fouling paints on the submerged part of ship's hulls, the introduction in the sea of unwanted aquatic organisms and pathogens from the ships' de-ballasting operations, the pollution of the air by ship exhaust fumes (this ship's pollution happens also and even more in the open sea but it is so dispersed that no direct consequences can be observed). In the current circumstances, none of these problems seems sufficiently important in the Mediterranean ports to be perceived as a major pollution issue. However, the adoption of regulations in these various fields are considered at IMO level and it is likely that their future implementation will provoke some difficulties which should be addressed in due time.

### *The provision of adequate Port receptions facilities*

Various categories of Port receptions facilities should be provided by parties to IMIO MARPOL 73/78 Convention according the regulations included in Annex I for oily wastes, in Annex II for noxious liquid substances, in Annex IV for sewage, and in Annex V for garbage. Governments of maritime countries should ensure the availability of such facilities adequate to meet the need of ships using their ports. These ships' needs are the ones resulting of the relevant MARPOL annex as regards the quantities of pollutants to be retained on board to avoid their release or dumping at sea.

The Mediterranean Sea being classified, in MARPOL Convention Annexes I and V as a "Special Area" respectively for oily wastes and garbage, it seems obvious that, when these Annexes came into force respectively in 1983 and 1990, the provision of relevant Port Reception facilities in the harbours of the Region should have been given a high priority. It was particularly important to ensure the disposal ashore of these pollutants since the release or dumping of them in the Mediterranean Sea was totally prohibited.

Unfortunately, the actual situation was far to be considered as satisfactory when a meeting of National Experts on Port Reception Facilities in the Mediterranean was held in Cairo under the aegis of REMPEC in December 1991. Since this time, the availability of suitable Reception facilities in the Mediterranean ports has certainly improved.

### 3.1.4 Agricultural Runoff In The Mediterranean

In most countries, all types of agricultural practices and land use, which include animal feedlots, irrigation, cultivation, pastures, dairy farming, orchards and aquaculture, are treated as non-point sources of water pollution. The main characteristics of non-point sources are that they respond to hydrological conditions, are not easily measured or controlled directly (and therefore difficult to regulate), and focus on land and related management practices. Agriculture is only one of a variety of causes of non-point sources of pollution, through runoff water and sediment, and leaching carrying phosphorus, nitrogen, metals, pathogens, salts and trace elements; however it is often regarded as the largest contributor of pollutants. These pollutants ultimately find their way into groundwater, wetlands, rivers and lakes and, finally, to ocean in the form of sediment and chemical loads carried by rivers. The range and relative complexity of agricultural non-point source pollution are shown in Figure 3.1.4.1.

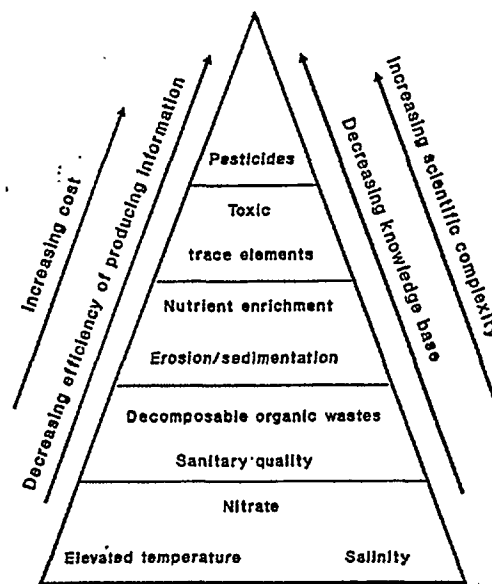


Figure 3.1.4.1 Hierarchical complexity of agriculturally-related water quality problems (Rickert, 1993).

The impacts of agriculture on surface waters are as follows:

Agricultural activity	Impact
Tillage/ploughing	sediment/turbidity: sediments carry P and pesticides adsorbed to sediment particles
Fertilising	runoff of nutrients, especially P, leading to eutrophication of waters
Manure spreading	spreading of high amounts leads to contamination by pathogens and pollution from P, nitrogen and metals
Pesticides	runoff of pesticides leads to pollution of surface waters; pesticides are also carried as dust by wind over very long distances and contaminate aquatic systems
Animal feedlots	contamination by nutrients, pathogens and metals contained in urine and/or faeces
Irrigation	runoff of salts, fertilisers, pesticides and trace elements (e.g. selenium)
Clear cutting	erosion of land, high levels of turbidity in rivers, siltation of bottom habitats, disruption and change of hydrologic regime
Silviculture	pesticide runoff, erosion and sedimentation problems
Aquaculture	release of pesticides and high levels of nutrients to surface waters through feed and faeces

Pollution by sedimentation has two major dimensions. One is the physical dimension: top soil loss and land degradation by gullying and sheet erosion, which leads both to excessive levels of turbidity in receiving waters, and to off-site ecological and physical impacts from deposition in river and lake beds. The other is a chemical dimension: the silt and clay fraction is a primary carrier of adsorbed chemicals, especially P, chlorinated pesticides and most metals, which are transported by sediment into the aquatic systems. Moreover, erosion is also a net cost to agriculture insofar as losses of top soil represent an economic loss, through loss of productive land by erosion of top soil, and a loss of nutrients and organic matter that must be replaced by fertiliser at considerable cost to the farmer in order to maintain soil productivity.

Non point pollution from agriculture is related to that part of the Mediterranean basin which drains into the Mediterranean sea. The basins draining into the Mediterranean cover a total of about 1.9 million km<sup>2</sup>, not counting the Upper Nile basin, and include 24 countries: Albania, Algeria, Bosnia-Herzegovina, Bulgaria, Cyprus, Croatia, Egypt, France, Greece, Israel, Italy, Jordan, Lebanon, Macedonia, Morocco, Palestine, Portugal, Slovenia, Spain, Syria, Tunisia, Turkey, Yugoslavia.

The Mediterranean Hydrological Cycle Observing System (MED-HYCOS), a regional component of the World Hydrological Cycle Observing System (WHYCOS) includes the Black Sea, considering the important exchange of water between the two seas, the dynamic of pollution fluxes and the existence of similar water-related problems of the region. The Black Sea includes five countries: Georgia, Moldova, Romania, Russia and Ukraine, whilst its drainage basin (2.4 million km<sup>2</sup>) is far larger than the one of the Mediterranean Sea, and is drained by three international rivers (Danube, Dniepr and Don) covering almost 79 % of the area. The comparison of the input of Black Sea to the Mediterranean with the fluvial input in the Mediterranean Sea (210 km<sup>3</sup>/year against 477 km<sup>3</sup>/year, i.e. 4 times the input of the Rhone river, proves the importance of the water exchange between these seas, not to say anything about the related transfer of pollution.

The pollution from the Black Sea considerably affects the quality of the water of the eastern part of the Mediterranean Sea (Aegean Sea). It has been estimated that the Black Sea water receives each year 20 ton/m<sup>3</sup> of pollutants, which stay in the upper volume of the sea for a long time (40 to 140 years). The origin of pollution from nutrients (N and P) has been ascribed to different sources, and among them the contribution from soils and agriculture ranges from 25 to 40 % for nitrogen, and from 10 to 20 % for phosphates.

All factors relevant to land based pollution of the Mediterranean have a wide qualitative and quantitative variability.

The Mediterranean climate, a transition between the desert and arid climates of the North African regions and the temperate climate of the European regions, is one of the planet's major recognised types. Its main characteristics are:

1. two rainy seasons (autumn and spring);
2. hot, dry summers;
3. irregular, sometimes violent rainfall causing destructive floods, following long periods of low water and often the drying up of a large majority of coastal rivers.

These characteristics are more pronounced in the south and east of the basin. The northern countries receive an average of 600 to 1000 mm of rainfall annually, while the eastern ones only receive 400 to 600 mm, and the southern ones often much less than 400 mm. The number of dry months is often higher than seven, and potential evapotranspiration is about 1200 mm per year. As a direct consequence of the Mediterranean climate, the streams regimes are an alternation of brief, flash floods and severe low waters. The exceptions are the large rivers whose drainage basins are partly outside the Mediterranean region, such as the Rhone and the Po.

Parallel with the variation in climatic conditions is the change in natural vegetation, while geomorphology and geology are still more complicated, and almost all parent rocks and soil types occur in the area.

Extremely high spatial variability of natural conditions has caused a great variability of land use, so different land use areas are mostly interlaced in a small area. The favourable climatic and geographic conditions in the Mediterranean area caused it to be populated from very early times, and because of oversettlement on farm lands the area has been subjected to exhaustive farming, uncontrolled grazing by sheep and goats and destruction of forest vegetation. The result has been intensive erosion which has brought about drastic changes, even to the extent of forming deserts in the Middle East and North Africa.

Considering soil as a source of eutrophication of the Mediterranean, attention must be focused on N, P and organic C in soil sediments. In studying the problem two points are very important: the source of pollutants and nutrients, i.e. the humic horizon of soils, and their mode of transport into the sea. N, P and organic C are transported into streams and the sea mainly by runoff water, either in a dissolved form (particularly N) or bound to a solid load.

Numerous investigations have found that the four basic factors affecting runoff and erosion are: (i) climate, especially rainfall intensity and quantity, and the time of year that rainfall occurs; (ii) kind of soil; (iii) length and percent of slope; and (iv) cover. In addition, soil and water management practices also affect losses and strongly modify the action of these four factors.

Climatic influence is expressed through energy and duration of rainfall. Very high correlation coefficients do exist between rainfall intensity and surface runoff, whilst the total amount of rainfall does not always correlate with the intensity of erosion.

Soil erodibility is the function of complex interactions between different physical and chemical properties, resulting in surface seal and crust formation or reduction of soil permeability beneath the surface. Generally speaking, soils that are high in silt, low in clay and low in organic matter are the most erodible. Permeability of the least permeable layer and its location in the soil profile is the second important parameter.

The length of slope affects the flow concentration, and together with the slope percent increases the velocity of runoff. The capacity of runoff to transport soil particles increases approximately as the fifth power of its velocity, and its detachment capacity as the square of its velocity.

All investigations show a high dependence of erosion intensity on soil cover. Forest cover and permanent meadows protect soil almost completely, and agricultural crops can reduce soil loss by erosion (in relation to non-tilled fallow taken as 100) from 57 % (continuous corn, conventional plant and till, harvest for silage) to 7 % (corn without cultivation).

In the Mediterranean Basin, agricultural land is one of the resources where the pressures of development are the strongest (Table 3.1.4.1), particularly on a narrow coastal strip bordered by desertic regions on the Southern coast. Moreover, urbanisation and infrastructures absorb an increasing part of arable land, and agricultural pressure is strong on ever more vulnerable soils. In the North Mediterranean highly yielding specialised monocultures have appeared, inducing gradual abandonment of marginal lands. In the Southern and Eastern Mediterranean, where demographic pressures are intense and constantly increasing, cultivated surfaces continue to progress at the expense of forests and grazing land, increasing the risk of soil degradation. In the North of the Basin, abandonment of terrace cultivation land, without reforestation or erosion control policies, as well as intensive agricultural cropping systems can have the same effect.

The most widely equation used to evaluate the transport of sediment by runoff water is the Universal Soil Loss Equation proposed by Wischmeier (1969). Data presented in this report have been calculated using the equation developed by Gavrilovic (1962), which is simpler and allows the calculation of sediment yield by input data available by the interpretation of maps (FAO, 1977). The



amount of N, P and organic carbon in the soil sediment were calculated by applying an estimated Enrichment Ratio considering natural fertility of soils, land use, length of drainage area and the intensity of erosion.

The geographic distribution of soil sediments and nutrients originating from agricultural and forest lands discharged into the Mediterranean is rather uneven. About 3000 km of Mediterranean coastline are not exposed at all to any effect from agricultural sources, i.e. the arid part of North Africa where the low rainfall (300 mm) excludes the possibility of runoff, or where there is no runoff owing to the plain topography (several great plains in Italy, Turkey and Albania).

A not significant amount of nutrients come from soils over hard karstic limestone covered by forest vegetation. Such regions are particularly widespread in France, Albania and parts of Yugoslavia, but in the Mediterranean basin they are generally not suitable for agricultural production, are converted into pastures and in these cases rather high erosion occurs. On the other hand, areas under well preserved forests produce low amounts of nutrients, regardless of other factors.

The highest degree of erosion and transport of nutrients is connected with agricultural regions. Soils in these regions are, as a rule, friable and have a B horizon, which make them susceptible to erosion. The rather low level of land cultivation, predominant in the Southern and Eastern part of the Mediterranean basin, does not take into enough consideration erosion control measures, whilst in regions with more advanced agriculture the input of nutrients is higher. Therefore, agricultural regions in all countries produce relatively high discharge of nutrients into the Mediterranean.

Considering the estimated annual soil loss, a tentative classification can be made as follows (FAO, 1977):

I.	0 - 50 t ha <sup>-1</sup> year <sup>-1</sup>	none or slight
II.	11 - 50 t ha <sup>-1</sup> year <sup>-1</sup>	weak to moderate
III.	51 - 100 t ha <sup>-1</sup> year <sup>-1</sup>	moderate to high
IV.	101 - 200 t ha <sup>-1</sup> year <sup>-1</sup>	high
V.	> 200 t ha <sup>-1</sup> year <sup>-1</sup>	very high

Basing on this classification figures for agricultural runoff shown in table 3.1.4.2 can be derived. The exam country by country is as follows.

In Albania the degree of soil erosion is none or slight.

In Algeria 8.5 % of drainage area (2 basins on 13) has a weak to moderate risk.

In Cyprus, two basins representing 64.8 % of total draining area have a weak to moderate risk.

In France, excluding Corsica and the Rhone, only one basin of the seven discharging in the Mediterranean (11.9 % of draining area) has a weak to moderate risk; in Corsica 46 % of the draining area (2 basins on 4) has a moderate to high risk of erosion; the Rhone basin present a risk none or slight.

Continental Greece, with 23 draining basins, has 57.6 % of weak to moderate risk (15 basins), and 4 % of moderate to high (1 basin). In Crete all the 4 basins have a weak to moderate risk.

The 4 basins of Israel present a non or slight risk.

The Italian peninsula, excluding the Po river, has 31 draining basins of which 17 (45.9 % of the area) have a weak to moderate risk, and 2 (3.5 % of the area) a moderate to high risk. In the Po basin the risk is none or slight, whilst all the seven basins of Sardinia have a weak to moderate risk. In Sicily, with 10 basins, 87.3 % of the drainage area (8 basins) has a weak to moderate risk.

In Lebanon one basin has a weak to moderate risk (61.5 % of the drainage area).

In Morocco, with 5 basin, 2 basin have a weak to moderate risk (6.2 % of the area), one basin a moderate to high (6.7 %).

Spain has 16 basins, of which 7 (16.4 % of the drainage area) have a weak to moderate risk.

Syria has only 1 basin with a moderate to high risk.

Tunisia, with a total of 5 basins, has a weak to moderate risk in 3 of them (26.5 % of the drainage area), and a moderate to high in 1 basin (3.8 % of the drainage area).

Turkey has 10 basins. Six have a weak to moderate risk (66 % of the drainage area) and one a moderate to high risk (1 %).

Finally Yugoslavia, including Croatia, Slovenia, Bosnia-Herzegovina and Macedonia, has 7 basins, and two of them have a moderate to high risk (17.6 % of the area).

Table 3.1.4.3 shows a tentative of ranking the risk of soil erosion and nutrient losses. When these are referred to the area of the drainage regions in hectares, Syria, Sicily, Corsica and Crete are always ranked among the first five; Sardinia and Greece join this group when the first ten are considered. The bottom of the ranking is occupied from regions where runoff cannot take place, such as the basins of the Rhone and the Po, confirming their lack of contribution to the pollution of the Mediterranean from agricultural sources.

Considering figures from Table 3.1.4.4, nitrogen balance is close to be met in most Mediterranean countries (FAO, 1996b), but attention should be made since a ratio I/O much lower than the unit does not mean that N inputs must be increased as a general rule, and this is particularly true for those countries where climatic conditions are unfavourable (e.g. Morocco).

On the opposite lies the situation of some countries where N inputs are much higher than the outputs; in this case inputs should be decreased as a general rule, particularly if climatic conditions are unfavourable (e.g. Libya, Algeria).

Concerning the  $P_2O_5$  balance, there is a strong evidence of misuse of phosphatic fertilisers, again particularly where the climate is unfavourable (e.g. Turkey, Libya).

Potential increase in pollutants transported to the Mediterranean from agricultural ecosystems may be caused by inadequate management practices which would concurrently lead to decreasing soil productivity and economic efficiency of agriculture.

Control measures depend very much on the economic situation of the farmer, the degree of importance placed on sediment erosion by environmental authorities, availability of capital, and the state of development of the country (FAO, 1996a). The following control measures are those classified and recommended by the US-EPA (1993), and are used in many parts of the world, including developing countries. These techniques also have beneficial effects for conservation of nitrogen and phosphorus in the soil.

#### CONSERVATION COVER

establish and maintain perennial vegetative cover to protect soil and water resources on land retired from agricultural production

#### CONSERVATION CROPPING

a sequence of crops, including grasses and legumes planted in rotation, designed to provide adequate organic residue for maintenance of soil tilth. These practice reduces erosion by increasing organic matter, and may also disrupt disease, insect and weed reproduction cycles thereby reducing the need for pesticides.

#### CONSERVATION TILLAGE

also known as reduced tillage, this is a planting system that maintains at least 30 % of the soil surface covered by residues after planting. Erosion is reduced by providing a soil cover, runoff is reduced and infiltration into groundwater is increased. No-till also is a conservation tillage practice.

#### CONTOUR FARMING

ploughing, planting and other management practices that are carried out along land contours, thereby reducing erosion and runoff.

**COVER AND GREEN MANURE CROPS**

a crop of close-growing grasses, legumes, or small grains grown primarily for seasonal protection and soil improvement, for 1 year or less.

**CRITICAL AREA PLANTING**

planting vegetation, such as trees, shrubs, vines, grasses or legumes, on highly erodible or eroding areas.

**CROP RESIDUE USE**

using plant residues to protect cultivated fields during critical erosion periods.

**DELAYED SEEDBED PREPARATION**

any cropping system in which all crop residue is maintained on the soil surface until shortly before the succeeding crop is planted. This reduces the period that the soil is susceptible to erosion.

**DIVERSIONS**

channels constructed across the slope with a supporting ridge on the lower side. By controlling downslope runoff, erosion is reduced and infiltration into the groundwater is enhanced.

**FIELD BORDERS AND FILTER STRIPS**

a strip of perennial herbaceous vegetation along the edge of fields. This slows runoff and traps coarser sediment, being however not generally effective for fine sediment and associated pollutants.

**GRASSED WATERWAYS**

a natural or constructed channel that is vegetated and is graded and shaped so as to inhibit channel erosion. The vegetation will also serve to trap sediment that is washed in from adjacent fields.

**SEDIMENT BASINS**

basins constructed to collect and store sediment during runoff events. Also known as detention ponds. Sediment is deposited from runoff during impoundment in the sediment basin.

**STRIP CROPPING**

growing crops in a systematic arrangement of strips or bands across the general slope (not on the contour) to reduce water erosion. Crops are arranged so that a strip of grass or close-growing crop is alternated with a clean-tilled crop or fallow.

**TERRACING**

terraces are earthen embankments that retard runoff and reduce erosion by breaking the slope into numerous flat surfaces separated by slopes that are protected with permanent vegetation or which are constructed from stone, etc. Terracing is carried out on very steep slopes, and on long gentle slopes where terraces are very broad.

Data from Chesapeake Bay (USA) installations indicate the following ranking of costs of erosion control measures:

Practice	Rank
grassed filter strips	1 (least cost)
cover crops	2
strip-cropping	3
conservation tillage	4
reforestation of crop and pasture lands	5
diversions	6
permanent vegetation on critical areas	7
terraces	8
sediment ponds and structures	9 (most cost)

Poor land management practices such as overgrazing, especially on hilly lands, always leads to serious erosion problems which are difficult or impossible to remedy due to the scale of damage and cost of reconstructing hill-sides. While recommendations to control these abuses are self-evident, the fundamental causes lie often in national economic goals that are incompatible with environmental and water quality objectives, and in social policies that do little to contain destructive marginal agricultural practices.

For phosphorus, which tends to be associated with the sediment, runoff losses are directly linked to erosion, therefore the economics of nutrient control tend to be closely tied to the cost of controlling runoff and erosion.

In any location where intensive agriculture and/or livestock farming produces serious risk of nitrogen pollution, Ignazi (1993) recommended the following essential steps to be taken at the farm level:

1. rational nitrogen application: to avoid over-fertilisation, the rate of N to be applied needs to be calculated on the basis on the "crop nitrogen balance". This takes into account plant needs and amount of N available through the soil;
2. vegetation cover: as far as possible, keep the soil covered with vegetation. This inhibits build-up of soluble nitrogen by adsorbing mineralised N, also preventing its discharge during runoff events;
3. manage the period between crops: organic residues produced by harvesting are easily mineralised. Steps include planting of "green manure" crops, and delaying ploughing of straw, roots and leaves into the soil;
4. rational irrigation: poor irrigation has one of the worst impacts on water quality, whereas precision irrigation is one of the least polluting practices;
5. optimise other cultivation techniques: highest yields with minimum water quality impacts require optimisation of practices such as weed, pest and disease control, liming, balanced mineral fertilisers including trace elements, etc.;
6. agricultural planning: implement erosion control techniques that complement topographic and soil conditions.

FAO/ECE (1991) have summarised the type of voluntary and mandatory measures to limit the impact of organic fertilisers:

1. maximum number of animals per hectare based on the amount of manure that can be safely applied per hectare of land;
2. maximum quantities of manure that can be applied on the land is fixed, based on the N and P content of the manure;
3. the periods to apply manure to the land must be limited, and the incorporation into the ground must be carried out immediately;
4. establish fertilisation plans;
5. levies (taxes) on surplus manure;
6. areas under autumn/winter green cover to be extended, and green fallowing promoted;
7. change in composition of feed to reduce amount of nutrients and heavy metals.

In recognition of pesticide abuse and of environmental and public health impacts the European countries have adopted a variety of measures that include the following (FAO/ECE, 1991):

1. reduction in use of pesticides
2. bans of certain active ingredients

3. revised pesticide registration criteria
4. training and licensing of individuals that apply pesticides
5. reduction of dose and improved scheduling of pesticide application to more effectively meet crop needs and to reduce preventative spreading
6. testing and approval of spraying apparatus
7. limitations of aerial spraying
8. environmental tax on pesticides
9. promote the use of mechanical and biological alternatives to pesticides, and adoption of integrated pesticide management programmes.

The link between erosion, increasing fertiliser application, and loss of soil productivity is very direct in many countries. In the Brazilian state of Paraná (Andreoli 1993) erosion has led to extensive loss of top soil, large-scale gullyng, and silting of ditches and rivers. The use of fertilisers has risen as a consequence, up 575 % over the period 1970-86, and without any gain in crop yields. Loss of N-P-K from an average erosion of 20 t/ha/yr represents an annual economic loss of US\$ 242 million in nutrients.

Estimates of phosphorus loss by erosion in the Republic of South Africa (Du Plessis 1985) are US\$ 10.5 million. The World Bank (1992) reported that extrapolations from test-plots of impacts of soil loss on agricultural productivity, indicates some 0.5-1.5 % loss of GDP annually for countries such as Costa Rica, Malawi, Mali and Mexico. These losses do not include offsite costs as reservoir infilling, river sedimentation, damage to irrigation systems, etc.

In a study of 17 agricultural sub-watersheds in the Lake Balaton district of Hungary, Jolankai (1986) measured and modelled N and P runoff from a variety of agricultural land uses. He calculated that a selection of control measures (mainly erosion control) would reduce P loss by 52.8 % at a cost of US\$ 2500 per ha in remediation measures (in 1986).

Ultimately, any strategy to reduce agricultural impacts on water quality will only be successful if it is implemented at the farm level. Therefore, implementation of control measures at the farm level will only be successful and sustainable if the farmer can determine that it is in his economic interest to undertake such measures. As a consequence, the economic benefits from such factors as implementation of erosion control measures to maintain soil fertility, capital costs associated with improved manure handling and distribution, etc., must be clearly seen to be offset by reduced energy consumption in minimum till situations, improvement in soil fertility by improved manure handling and erosion control, reduced fertiliser costs, etc.. This implies that agricultural agencies must use a holistic approach to the economics of farming practices, and there are abundant examples from both developed and developing countries indicating that this approach is equally applicable to all farmers who have a long term interest in their land.

In cases where serious pollution of surface water creates conflicts over water rights and beneficial uses, mitigation is often addressed by a mixture of regulatory and mandatory measures. These measures may involve change in agricultural use or land management practice, or may take land entirely out of production. Where the cost-benefit is not in the farmer's favour, compensation becomes an important issue. While compensation is a well established legal recourse in developed countries, appropriate compensation for land owners in cash or kind should be considered as a part of pollution mitigation programmes in developing countries.

Because water pollution from agricultural is of a non point source nature, the quantification of pollutants and their impacts is more difficult than for point sources. However, the world's ever-increasing demand for a cleaner environment, requires that countries adopt a holistic approach to water resource management. Pollution control is now so expensive that decisions on resource

management priorities should be guided by the knowledge of the cost of water pollution to the various economic sectors. That cost is in two parts: the first is the direct cost (e.g. treatment) of meeting minimum water quality standards required for various uses; the second is the cost of any lost economic opportunity because of inadequate water quality. It is only by knowing both direct and indirect costs, and by assigning these costs to the various economic sectors (including agriculture) that the true cost both caused by and adsorbed by agriculture, can be evaluated relatively to other sectors.

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Table 3.1.4.1 Land use

Country	arable %	Permanent crops %	meadows pastures %	forests woodland %	others %	irrigated lands ha	land area ha	irrigated/land area %	AGR/GDP %	Population growth %
Albania	21	4	15	38	22	4230	27400	15.4	55	1.19
Algeria	3	0	13	2	82	3360	2381740	0.1	12.8	2.29
Bosnia Herzegovina	20	2	25	36	17	na	51233		9	0.69
Bulgaria	34	3	18	35	10	10	110910	0.0	na	-0.32
Croatia	32	20	18	15	15	na	56538		na	0.07
Cyprus	40	7	10	18	25	350	9240	3.8	7	0.91
Egypt	3	2	0	0	95	25850	995450	2.6	20	1.95
France	32	2	23	27	16	11600	545630	2.1	4	0.47
Greece	23	8	40	20	9	11900	130800	9.1	15	0.84
Israel	17	5	40	6	32	2140	20330	10.5	7	2.22
Italy	32	10	17	22	19	31000	294020	10.5	4	0.21
Jordan	4	0.5	1	0.5	94	570	88884	0.6	10	3.5
Lebanon	21	9	1	8	61	860	10230	8.4	33	1.98
Libya	2	0	8	0	90	2420	1759540	0.1	5	3.72
Macedonia	5	5	20	30	40	na	24856		12	0.89
Morocco	18	1	28	12	41	12650	446300	2.8	14	2.12
Portugal	32	6	6	40	16	6340	91640	6.9	61	0.36
Slovenia	10	2	20	45	23	na	20296		5	0.23
Spain	31	10	21	31	7	33600	499400	6.7	5	0.25
Syria	28	3	46	3	20	6700	184050	3.6	30	3.74
Tunisia	20	10	19	4	47	2750	155360	1.8	16	1.76
Turkey	30	4	12	26	28	22200	770760	2.9	16	2.02

source CIA World Factbook 1994

Table 3.1.4.2 Discharge to Mediterranean from agricultural land

Country	Area Km <sup>2</sup>	Soil 10 <sup>6</sup> t	P 10 <sup>3</sup> t			N 10 <sup>3</sup> t			Org C 10 <sup>3</sup> t			Soil t ha <sup>-1</sup>			P kg ha <sup>-1</sup>			N kg ha <sup>-1</sup>			Org. C kg ha <sup>-1</sup>			Erosion class		
			Tot	Max	Min	Tot	Max	Min	Tot	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min
Albania	30400	6.8	3.7	1.4	0.08	6.7	2.5	0.2	74.1	23.0	2.3	2.24	5.93	0.74	1.22	5.32	0.28	2.21	9.21	0.61	24.4	70.4	8.5	I	I	I
Algeria	99100	55.8	15.9	4.8	0.23	41.4	5.8	0.8	387.6	58.8	4.8	5.63	40.77	1.55	1.61	18.46	0.27	4.18	22.31	0.95	39.1	106.6	5.3	I	I	I
Cyprus	9100	14.1	6.9	3.4	0.15	20.3	9.0	0.6	161.1	90.8	6.1	15.49	23.79	2.40	7.55	11.33	1.19	22.26	30.00	8.71	177.0	302.7	39.9	II	II	I
France	26800	10.8	7.5	2.0	0.29	19.2	6.7	0.4	240.0	84.0	10.0	4.03	14.38	1.00	2.81	7.11	0.70	7.16	20.94	1.00	89.6	262.5	23.8	I	II	I
Corsica	7600	22.9	15.3	8.2	0.70	26.9	14.2	1.5	269.0	142.0	15.0	30.13	57.14	6.84	20.13	39.05	3.68	35.39	67.62	7.89	353.9	676.2	78.9	II	III	I
Rhone	95600	4.5	2.8			5.6			56.0		0.47	0.29						0.59			5.9			I		
T.France	130000	38.2	25.6			51.7			565.0		2.94	1.97						3.98			43.5			I		
Greece	98000	183.3	129.9	16.8	0.6	240.0	34.6	1.5	2205.3	331.0	14.3	18.70	55.00	3.09	13.26	42.00	0.72	24.49	86.50	3.95	225.0	827.5	26.3	II	III	I
Crete	8100	24.2	16.7	6.2	3.0	28.7	1.5	5.2	287.0	105.0	52.0	29.88	50.00	22.82	20.62	34.44	15.90	35.43	60.00	26.92	354.3	600.0	269.2	II	II	II
T.Greece	106100	207.5	146.7			268.7			2492.3		19.56	13.82						25.33			234.9			II		
Israel	10300	3.8	1.3	0.4	0.11	3.2	1.1	0.5	33.0	11.6	4.6	3.69	8.12	2.68	1.26	2.79	0.63	3.10	6.75	1.62	32.1	72.4	16.0	I	I	I
Italy pen.	156300	226.1	170.3	29.2	0.30	325.5	46.7	0.8	3557.0	367.0	8.0	14.47	59.20	2.67	10.90	58.40	2.00	20.83	93.40	4.30	227.6	951.7	43.7	II	III	I
Po	70000	12.0	14.0			21.0			210.0		1.71	2.00						3.00			30.0			I		
Sardinia	20700	61.8	64.7	22.0	4.4	105.1	34.3	7.5	1041.6	360.0	75.6	29.86	45.00	15.00	31.26	61.11	17.07	50.77	95.28	21.55	503.2	1000	251.7	II	II	II
Sicily	32300	110.1	92.7	31.0	0.8	167.8	55.0	2.1	1765.8	546.0	21.0	34.09	44.90	7.04	28.69	80.00	4.44	51.95	90.00	13.33	546.7	1000	125.9	II	II	I
T.Italy	279300	410.0	341.7			619.4			6574.4		14.68	12.23						22.18			235.4			II		
Lebanon	7800	25.7	6.5	4.8	1.7	17.4	14.4	3.0	196.4	165.7	30.7	32.95	49.79	6.00	8.33	10.00	5.67	22.33	30.00	10.07	251.7	345.2	102.2	II	II	I
Morocco	62800	43.7	9.1	4.3	0.24	29.7	15.3	0.8	502.0	285.0	8.8	6.96	51.90	1.75	1.45	10.24	0.37	4.72	36.43	0.95	79.9	678.6	13.5	I	III	I
Spain	180300	116.1	103.1	51.6	0.45	177.3	86.3	0.9	1801.1	932.0	8.2	6.44	37.78	2.09	5.72	27.72	2.07	9.84	47.72	3.00	99.9	237.6	36.8	I	II	I
Syria	5700	34	14.8			27.4			267.9		59.65	26.00						48.00			470.0			III		
Tunisia	34400	54.9	28.7	15.5	0.9	56.5	31.3	2.3	571.0	314.1	30.0	15.96	56.15	9.71	8.34	28.46	4.09	16.42	52.31	10.45	166.0	521.5	130.9	II	III	I
Turkey	153700	296.9	129.0	31.0	2.6	250.9	55.0	4.7	3315.0	780.0	40.0	19.32	52.67	8.89	8.39	23.33	3.88	16.32	53.33	5.92	215.7	766.7	59.7	II	III	I
Yugosl.	49900	43.9	30.9	13.0	0.76	72.0	26.0	3.0	723.5	214.0	21.5	8.80	45.45	1.88	6.20	39.39	1.58	14.44	78.79	5.52	145.0	648.5	44.8	I	II	I



Table 3.1.4.3 Ranking of soil erosion and nutrient losses

Country	Soil $10^6$ t	Country	Tot P $10^3$ t	Country	Tot N $10^3$ t	Country	Tot C $10^3$ t	Country	Soil t ha <sup>-1</sup>	Country	P kg ha <sup>-1</sup>	Country	N kg ha <sup>-1</sup>	Country	C kg ha <sup>-1</sup>
Turkey	296.9	Italy pen.	170.3	Italy pen.	325.5	Italy pen.	3557.0	Syria	59.65	Sardinia	31.26	Sicily	51.95	Sicily	546.7
Italy pen.	226.1	Greece	129.9	Turkey	250.9	Turkey	3315.0	Sicily	34.09	Sicily	28.69	Sardinia	50.77	Sardinia	503.2
Greece	183.3	Turkey	129.0	Greece	240.0	Greece	2205.3	Lebanon	32.95	Syria	26.00	Syria	48.00	Syria	470.0
Spain	116.1	Spain	103.1	Spain	177.3	Spain	1801.1	Corsica	30.13	Crete	20.62	Crete	35.43	Crete	354.3
Sicily	110.1	Sicily	92.7	Sicily	167.8	Sicily	1765.8	Crete	29.88	Corsica	20.13	Corsica	35.39	Corsica	353.9
Sardinia	61.8	Sardinia	64.7	Sardinia	105.1	Sardinia	1041.6	Sardinia	29.86	Greece	13.26	Greece	24.49	Lebanon	251.7
Algeria	55.8	Yugosl.	30.9	Yugosl.	72.0	Yugosl.	723.5	Turkey	19.32	Italy pen.	10.90	Lebanon	22.33	Italy pen.	227.6
Tunisia	54.9	Tunisia	28.7	Tunisia	56.5	Tunisia	571.0	Greece	18.70	Turkey	8.39	Cyprus	22.26	Greece	225.0
Yugosl.	43.9	Crete	16.7	Algeria	41.4	Morocco	502.0	Tunisia	15.96	Tunisia	8.34	Italy pen.	20.83	Turkey	215.7
Morocco	43.7	Algeria	15.9	Morocco	29.7	Algeria	387.6	Cyprus	15.49	Lebanon	8.33	Tunisia	16.42	Cyprus	177.0
Syria	34	Corsica	15.3	Crete	28.7	Crete	287.0	Italy pen.	14.47	Cyprus	7.55	Turkey	16.32	Tunisia	166.0
Lebanon	25.7	Syria	14.8	Syria	27.4	Corsica	269.0	Yugosl.	8.80	Yugosl.	6.20	Yugosl.	14.44	Yugosl.	145.0
Crete	24.2	Po	14.0	Corsica	26.9	Syria	267.9	Morocco	6.96	Spain	5.72	Spain	9.84	Spain	99.9
Corsica	22.9	Morocco	9.1	Po	21.0	France	240.0	Spain	6.44	France	2.81	France	7.16	France	89.6
Cyprus	14.1	France	7.5	Cyprus	20.3	Po	210.0	Algeria	5.63	Po	2.00	Morocco	4.72	Morocco	79.9
Po	12.0	Cyprus	6.9	France	19.2	Lebanon	196.4	France	4.03	Algeria	1.61	Algeria	4.18	Algeria	39.1
France	10.8	Lebanon	6.5	Lebanon	17.4	Cyprus	161.1	Israel	3.69	Morocco	1.45	Israel	3.10	Israel	32.1
Albania	6.8	Albania	3.7	Albania	6.7	Albania	74.1	Albania	2.24	Israel	1.26	Po	3.00	Po	30.0
Rhone	4.5	Rhone	2.8	Rhone	5.6	Rhone	56.0	Po	1.71	Albania	1.22	Albania	2.21	Albania	24.4
Israel	3.8	Israel	1.3	Israel	3.2	Israel	33.0	Rhone	0.47	Rhone	0.29	Rhone	0.59	Rhone	5.9

### 3.1.5 Airborne Pollution

#### 3.1.5.1 Nitrogen

The aerosol in the Mediterranean atmosphere consists of a mixture of components emitted from various sources.

This text is focused on identifying sources of air pollution that contribute significantly to deposition on the Mediterranean Sea.

Nitrogen oxides (NO<sub>x</sub>) include two main pollutants - nitrogen dioxide (NO<sub>2</sub>) and nitric oxide (NO). The NO<sub>x</sub> emissions are strongly dependent on fossil fuel combustion. The CORINAIR inventory indicates that 93% of the total NO<sub>x</sub> emissions results from fuel combustion, including 54% from road transport, 24% from power plants and 6 % from non-industrial combustion. An estimated 2% result from oil refineries and 5% from production processes and these are also dependent on the use of fuel to some extent (Erdman et al, 1994)

According to the CORINAIR inventory, 80% of the atmospheric ammonia (NH<sub>3</sub>) emissions are produced by the microbiological decomposition of wastes from domestic animals. About 10% of NH<sub>3</sub> atmospheric input is related to application of nitric fertilizers. The remaining 10% of NH<sub>3</sub> emissions originates from other sources, including the industrial production of nitric fertilizers.

An estimate of the emissions of nitrogen ( NO<sub>x</sub> and NH<sub>3</sub> ) into the atmosphere from the Mediterranean countries for 1991 is given in Table 3.1.5.1.

Table 3.1.5.1 Emissions of nitrogen ( NO<sub>x</sub>, NH<sub>3</sub> and N<sub>tot</sub>) into the atmosphere from the territories of the Mediterranean countries in kt of N / year in 1991 (Erdman et al, 1994)

Country	NO <sub>x</sub> kt of N/yr	NH <sub>3</sub> kt of N/yr	N <sub>total</sub> kt of N/yr
Albania	(12)	[ 25]	37
France	551	[ 636]	1,187
Greece	227	[ 64]	291
Italy	536	[ 338]	874
Spain	255	[ 282]	537
Turkey	(61)	(395)	456
Yugoslavia *	128	[ 174]	302
Algeria	[ 15]	(82)	97
Egypt	(15)	(33)	48
Israel	(24)	(16)	40
Libya	[ 7]	(34)	41
Morocco	(2)	[ 3]	5
Tunisia	[ 6]	(38)	44
Cyprus	(2)	(2)	4
Lebanon	(3)	(9)	12
Malta	(1)	(1)	2
Syria	(9)	(58)	67
<b>Total</b>	<b>1.854</b>	<b>2.190</b>	<b>4.044</b>

\* all countries on the territory of the former SFR of Yugoslavia  
 ( ) EMEP MSC-E estimate; [ ] EMEP MSC-W estimate

Deposition on the Mediterranean Sea of airborne nitrogen ( $\text{NO}_x$ ,  $\text{NH}_3$  and  $\text{N}_{\text{tot}}$ ) originated from individual Mediterranean countries have been estimated (Erdman et al, 1994) and are given in Table 3.1.5.2. The major contributors to the airborne pollution are Italy (29.22%), Greece (11.43%), France (10.9%) and Spain (10.15%). Only 77.3% of the total deposition results from emissions in the Mediterranean countries. The remaining nitrogen comes from Germany (4.9%), Romania (2.2%), Bulgaria (2.1%), Ukraine (1.6%) and other countries.

Table 3.1.5.2 Deposition of oxidized and reduced nitrogen on the Mediterranean Sea emitted from individual Mediterranean countries. For each country the total deposition of oxidized and reduced nitrogen ( $\text{kt N yr}^{-1}$ ) attributable to it and the fraction this represents from the total national emissions are given. The last column indicates the relative contribution of each country to the total deposition. Based on (Erdman et al, 1994)

Country	$\text{NO}_x$		$\text{NH}_3$		$\text{N}_{\text{tot}}$		$\text{N}_{\text{tot}} \%$
	kt N / yr	% of national emission	kt N / yr	% of national emission	kt N / yr	% of national emission	% of total deposition
Albania	3.7	30.8	6.3	25.2	10.0	27.0	0.94
France	76.8	13.9	39.5	6.2	116.3	9.8	10.9
Greece	98.5	43.4	23.5	36.7	122.0	41.9	11.43
Italy	199.6	37.0	112.3	33.2	311.9	35.7	29.22
Spain	59.7	23.4	48.6	17.2	108.3	20.2	10.15
Turkey	12.5	20.5	42.1	10.7	54.6	12.0	5.12
Yugoslavia*	22.2	17.3	20.4	11.7	42.6	14.1	3.99
Algeria	3.0	20.0	21.6	26.0	24.6	25.4	2.30
Egypt	1.5	10.0	3.1	9.4	4.6	9.6	0.43
Israel	1.5	6.3	1.7	10.6	3.2	8.0	0.3
Libya	1.5	21.4	9.3	27.4	10.8	26.3	1.01
Morocco	0.3	15.0	-	-	0.3	6.0	0.03
Tunisia	2.1	35.0	13.2	34.7	15.3	34.8	1.43
Total from Med. countries	482.9	26.0	341.6	15.6	824.5	20.4	77.3
Total from all countries	648.0		419.3		1.067.3		100

\* all countries on the territory of the former SFR of Yugoslavia

Comparison of riverine and atmospheric inputs of nitrogen to the Mediterranean sub-regions presented in Table 3.1.5.3 show that for the Tyrrhenian, Adriatic, Southeast and Central parts of the Mediterranean, that represent about 75% of the total area, the direct atmospheric deposition represents from 72.6 to 100% of the total nitrogen input. It should be noted that about 6% of nitrogen deposited to the Mediterranean watershed enter the sea from rivers thus making the input of airborne nitrogen to the sea more significant.

Disposition, inputs and runoffs for the Mediterranean Sea and its watersheds are presented in Tables 3.1.5.4 and 3.1.5.5.

Table 5.1.5.3 Comparison of inputs of nitrogen to the Mediterranean Sea subbasins through riverine contributions and by atmospheric deposition. The atmospheric deposition for the south and southeastern subbasins (4,6,7 and 10) which represent about one third of the total surface is 87% of the total nitrogen input (Erdman et al, 1994)

Mediterranean Sea subbasins	Input through rivers kt N / year	Atmospheric input kt N / year	% Input resulting from Atmospheric deposition
1 Alboran	121.7	16.0	11.6
2 Northwest	297.6	174.8	37.0
3 Southwest	99.3	112.8	53.2
4 Tyrrhenian	58.6	155.2	72.6
5 Adriatic	182.2	122.4	40.2
6 Ionian	29.5	103.5	77.8
7 Central	0	120.1	100
8 Aegean	169.5	122.2	41.9
9 Northeast	51.7	44.5	46.3
10 Southeast	1.5	95.8	98.5
<b>Total Mediterranean</b>	<b>1,011.5</b>	<b>1,067.3</b>	<b>51.3</b>

Table 3.1.5.4 Deposition and inputs of N for the Mediterranean Sea and its watershed (UNEP, 1984)

	kt /yr	% of $I_t$ or $D_{wsh}$
Deposition on the sea surface	1,084	52
Deposition on the watershed: $D_{wsh}$	1,660+/-2,000	
- without Nile basin	1,097	
- on the Nile basin	560+/-200	
Total runoff from the watershed	1,000+/-200	48
- with rivers	800+/-200	38.4
- coastal runoff	200	9.6
Total input to the sea: $I_t$	2,084	
Airborne N runoff from the watershed	105+/-4	5 (6.3)
- riverine runoff	99	4.8 (6.0)
- underground runoff	6+/-4	
Total input of airborne N to the sea	1,189	57

Table 3.1.5.5 Nitrogen depositions, inputs and runoffs, in the Mediterranean (UNEP, 1984)

	Adriatic Sea	Mediterranean Sea	Baltic Sea
Deposition on the sea surface kt/yr (D)	122	1,084	300
Airborne N runoff from the watershed in kt/yr ( $R_{at}$ )	30	105	120
Riverine input in kt/yr ( $R_r$ )	182	1,000	750
Total input in kt/y $I_t = R_r + D$	304	2,084	1,050
$R_{at}/I_t$ in %	9.8	5	11.5
$R_{at}/D$ in %	24.5	9.7	40
$D+R_{at}/I_t$ in %	50	57	40

Several studies have pointed out the potential importance of the increase in atmospheric nitrogen deposition in recent decades in explaining the increased frequency of toxic algal blooms in the sea surface (Paerl, 1993).

### 3.1.5.2 Phosphorus

An estimate of atmospheric deposition of P onto the North-Western Mediterranean (GESAMP, 1989) suggests that it could be about 16 kt year with the riverine input of P to this region being 40.5 kt / year (FAO 1996).

### 3.1.5.3 Heavy metals

Atmospheric long range transport seems to be a major factor to explain the Mediterranean surface sea waters enrichment in Pb, Cd, Zn, Al, Fe, Mn and Co (Guieu 1992).

Emission of heavy metals into the atmosphere from the territories of the Mediterranean countries are presented in Table 3.1.5.6.

Table 3.1.5.6 Emissions of heavy metals into the atmosphere from the territories of the Mediterranean countries in 1982 (Mg/yr). All estimates in brackets are from Erdman et al, 1994, the other values are derived from Axenfeld et al, 1992 Van den Hout et a, 1994

Country	As	Cd	Cu	Hg	Pb	Zn
Albania	16.5	1.10	6	0.60	170	37.0
France	147.0	36.20	194	16.72	8,654	3,311.5
Greece	14.0	3.60	27	1.50	1,104	175.5
Italy	96.5	35.85	160	10.80	8,576	1,949.0
Spain	268.0	134.85	148	9.3	4,215	3,982.5
Turkey	(39.6)	(12.32)	80		(2,220)	(611.6)
Yugoslavia*	271.5	85.60	73	6.45	1950	1,804.5
Algeria	(15.7)	(3.95)			(1,149)	(204.0)
Egipt	(17.5)	(4.37)			(832)	(144.8)
Israel	(4.0)	(1.00)			(440)	(62.0)
Libya	(3.9)	(0.79)			(399)	(47.0)
Morocco	(2.0)	(0.50)			(80)	(27.2)
Tunisia	(7.1)	(1.80)			(338)	(90.6)
Cyprus	(0.7)	(0.20)			(26)	(9.0)
Lebanon	(3.0)	(0.70)			(325)	(35.0)
Syria	(11.3)	(2.70)			(565)	(136.0)
<b>Total Mg/yr</b>	<b>918.3</b>	<b>325.53</b>			<b>31,043</b>	<b>12,627.2</b>

\* all countries on the territory of the former SFR of Yugoslavia

Depositions to the Mediterranean Sea of Pb, Cd, Zn and As from individual Mediterranean countries in 1991 are given in Table 3.1.5.3 derived from Erdman et al, 1994. For each element estimates are given of the total deposition to the sea in 1991 for each country, the fraction of the total emissions that are deposited in the Mediterranean Sea and the relative contribution that it makes to the total deposition.

Table 3.1.5.7 Total deposition of Pb, Cd, Zn and As to the Mediterranean Sea in 1991 for each country, the fraction of the total emissions that is deposited in the Mediterranean Sea and the relative contribution that this makes to the total deposition. From (Erdman et al 1994)

Country	Pb			Cd		
	Total dep. to the sea t/yr	% of total em. Deposited in the M. Sea	% of total dep to M.Sea	Total dep. to the sea 0.1t/yr	% of total em. Deposited in the M. Sea	% of total dep to M.Sea
Albania	57	33.5	0.77	0.9	8.2	0.12
France	791	9.1	10.68	36.6	10.1	4.93
Greece	374	33.9	5.05	6.6	18.3	0.89
Italy	2,980	34.7	40.25	132.8	37.0	17.87
Spain	806	19.1	10.89	153.5	11.4	20.66
Turkey	405	18.2	5.47	17.3	14.0	2.33
Yugoslavia*	255	13.1	3.44	104.5	12.2	14.06
Algeria	223	19.4	3.01	5.5	13.9	0.74
Egypt	70	8.4	0.95	3.5	8.0	0.47
Israel	37	8.4	0.50	0.7	7.0	0.09
Libya	86	21.6	1.16	0	0	0
Morocco	15	18.8	0.20	0	0	0
Tunisia	131	38.8	1.77	5.0	27.8	0.67
Lebanon	25	7.7	0.34	0.5	7.2	0.07
Cyprus	6	23.1	0.08	0	0	0
Syria	17	3.0	0.23	0.8	3.0	0.11
Total from Mediterranean countries	6,278	20.2	84.8	468.2	14.4	63.0
Total from all countries	7,404		100	743.1		100

Country	Zn			As		
	Total deposition to the Sea t/year	% of total emission deposited in the M. Sea	% of total dep to M.Sea	Total deposition to the Sea t/year	% of total emission deposited in the M. Sea	% of total dep to M.Sea
Albania	11	29.7	0.44	4.2	25.5	2.09
France	136.5	4.1	5.41	9.6	6.5	4.78
Greece	43.1	24.6	1.71	5.3	37.9	2.64
Italy	753.0	38.6	29.85	37.7	39.1	18.77
Spain	521.0	13.1	20.65	36.4	13.6	18.13
Turkey	101.7	16.6	4.03	6.5	16.4	3.24
Yugoslavia*	221.7	12.3	8.79	29.8	11.0	14.84
Algeria	36.4	17.8	1.44	2.9	18.5	1.44
Egypt	13.2	9.1	0.52	1.5	8.6	0.75
Israel	5.0	8.1	0.2	0.3	7.5	0.15
Libya	10.3	21.9	0.41	0.7	17.9	0.35
Morocco	5.0	18.4	0.20	0.4	20.00	0.20
Tunisia	34.7	38.3	1.38	2.7	38.0	1.34
Lebanon	2.7	7.7	0.11	0.2	6.7	0.10
Cyprus	2.3	25.6	0.09	0.1	14.3	0.05
Syria	4.4	3.2	0.17	0.4	3.5	0.20
Total from Mediterranean countries	1,902	15.1	75.4	137.7	15.0	68.6
Total from all countries	2,523		100	200.8		100

\* all countries on the territory of the former SFR of Yugoslavia

From 63% (Cd) to 84.8% (Pb) of the atmospheric depositions of heavy metals to the sea came from the Mediterranean countries. The rest is from Bulgaria, Germany, Poland, Ukraine, Romania and some other countries. The highest atmospheric deposition flows of Pb, Cd, Zn and As ( $\text{g}/\text{m}^2/\text{yr}$ ) are in the Adriatic, Aegean, South-western, Tyrrhenian and North-western regions. Rough estimates of atmospheric deposition on the Mediterranean Sea have been proposed for mercury of 100 t/yr, and copper of 2,100 t/yr, that is 11% of the total European emission to the atmosphere Van den Hout, 1994. GESAMP (1989) reports 12,500 t/yr deposition of vanadium V representing 4% of the European emissions.

In table 3.1.5.8 an attempt is made using data from Erdman et al, 1994 to identify the main areas of impact of different atmospheric pollutants on the Mediterranean Sea. The deposition flux values have been used to rank the 10 subbasins.

Table 3.1.5.8 Summary table of deposition fluxes on the 10 Mediterranean subbasins in 1991. For each compound the subbasins are ranked and an overall score obtained by adding the respective scores is displayed in the last column and has been used to order the subbasins in the table

	NOx Mg/m <sup>2</sup>	rank	NHy mg/m <sup>2</sup>	rank	Pb mg/m <sup>2</sup>	rank	Zn mg/m <sup>2</sup>	rank	Cd mg/m <sup>2</sup>	rank	As mg/m <sup>2</sup>	rank	Total Score
MT5	527.54	1	393.58	1	6.55	1	1.85	1	0.05	2	0.14	2	8
MT8	401.92	2	249.47	2	3.57	6	1.61	3	0.06	1	0.16	1	15
MT2	391.30	3	232.78	3	3.57	5	1.20	4	0.04	4	0.08	6	25
MT3	238.93	6	185.50	5	3.57	4	1.62	2	0.04	3	0.10	5	25
MT6	356.68	5	172.97	7	4.21	2	1.19	5	0.03	5	0.10	4	28
MT4	375.15	4	208.83	4	3.72	3	1.18	6	0.03	6	0.08	7	30
MT1	110.68	10	174.94	6	2.41	7	0.80	7	0.03	7	0.11	3	40
MT7	146.53	7	74.55	10	1.90	8	0.61	8	0.02	8	0.05	9	50
MT9	122.30	9	167.18	8	1.78	9	0.57	9	0.02	9	0.05	8	52
MT10	132.07	8	96.31	9	0.15	10	0.48	10	0.02	10	0.05	10	57

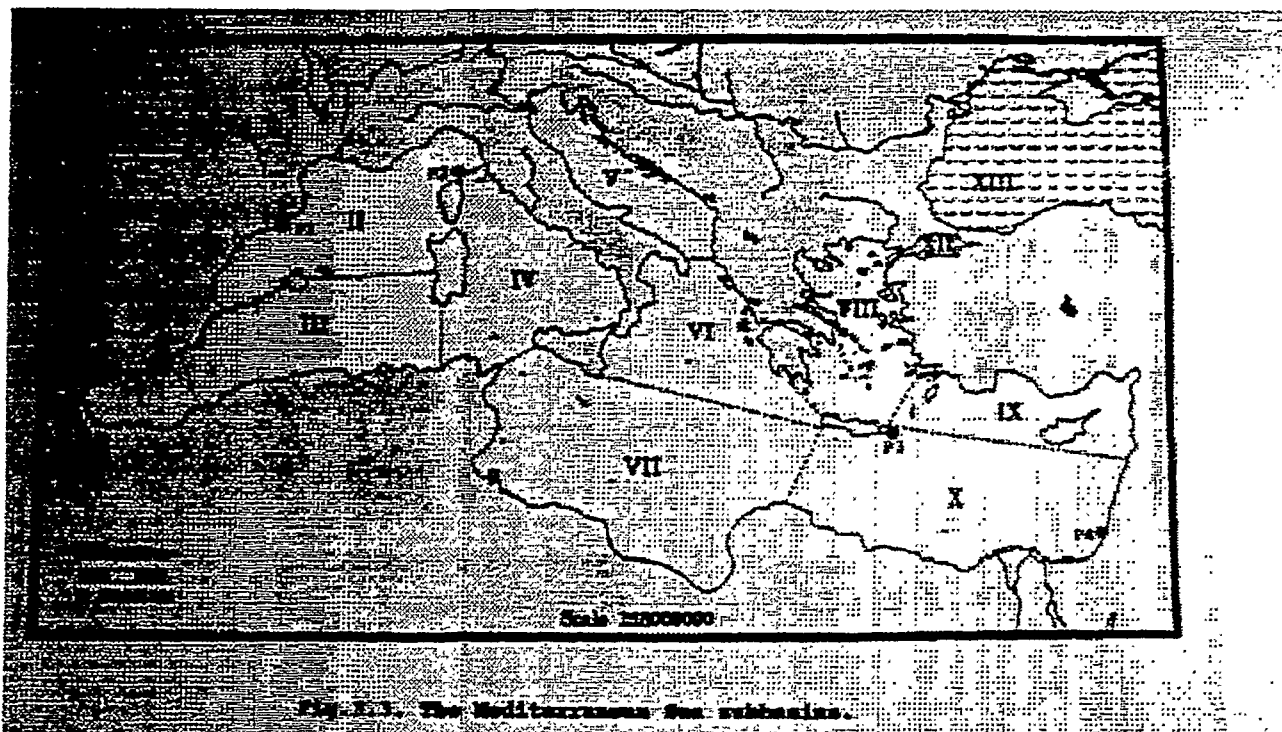


Figure 3.1.5.1 The Mediterranean subbasins as used by UNEP, 1984 and Erdman et al, 1994 (from Erdman et al, 1994).

Relative importance of direct atmosphere deposition in 10 Mediterranean subbasins is presented in Figure 3.1.5.2.

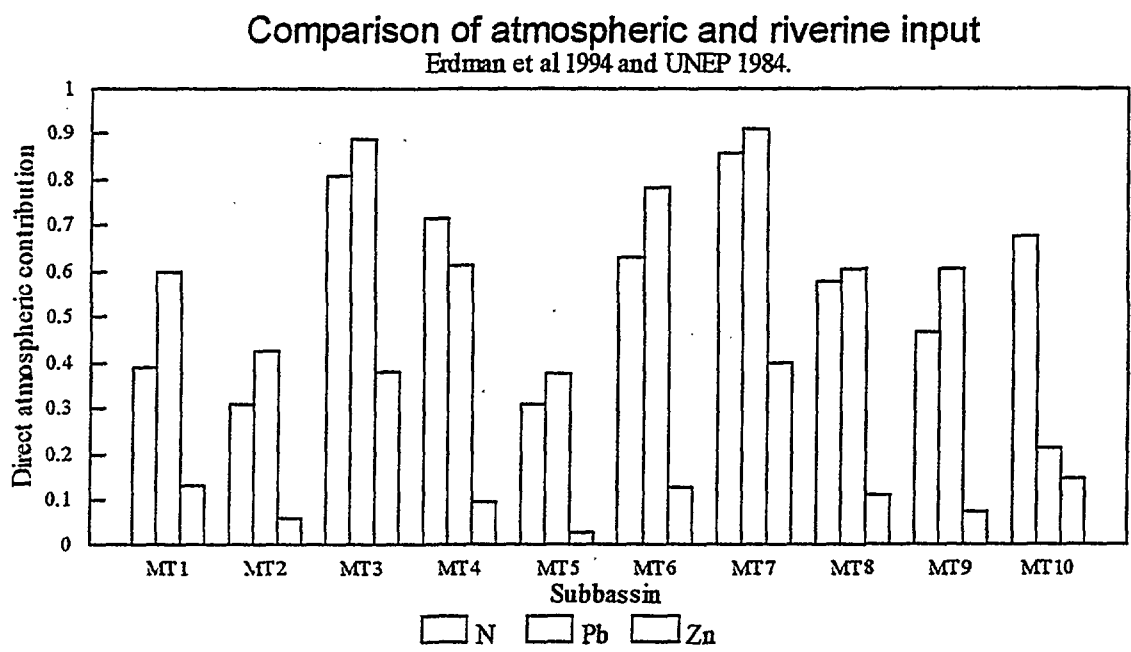


Figure 3.1.5.2 Relative importance of direct atmospheric deposition on the 10 subbasins. The data for the riverine inputs are from UNEP, 1984 and for the atmospheric deposition the values in tables 3.1.5.7 and 3.1.5.8 derived from Erdman et al, 1994 have been used.



### 3.1.5.4 Persistent Organic Pollutants

Major sources of anthropogenically released POPs from stationary sources are thermal processes involving organic matter in the case of uncomplete combustion or chemical reaction.

The major sources of POP emission from motor vehicles occur as particle bound PAHs emitted by spark-ignition engines.

The emission estimates of POPs are rather uncertain ( by a factor of 2-5 ) because the activity and application data are incomplete and unreliable (Van den Hout 1994). Estimates of emissions of lindane, benzo(a) pyrene, HCB, PCB and PAH for some mediterranean countries are given in Table 3.1.5.9 (Axenfeld et al 1992, Van den Hout 1994).

Table 3.1.5.9 POPs emissions (tons per year) in some Mediteranean countries and totals for Europe. (\*) estimates for 1990 from ; (\*\*) estimates for 1983 from Axenfeld et al, 1992

Country	Lindane (t/y) *	B(a)P (t/y) *	HCB (t/y) **	PCB (t/y) **	PAH <sub>tot</sub> (t/y) **
Albania	0.9	5	0.11	5.7	114
France	56.3	54	3.97	109.0	1,238
Greece	5.2	5	0.54	19.6	208
Italy	12.0	20	3.48	113.3	498
Spain	26.5	22	3.21	75.9	572
Turkey		59			
Yugoslavia ^	10.1	36	1.12	45.3	549
Europe Total	387	1,409	51.13	1,325.6	25,421

^ all countries on the territory of the former SFR of Yugoslavia

The estimates of atmospheric deposition of POPs in Europe, and especially over the Mediterranean Sea, are very scarce.

According to GESAMP (1989) the atmospheric input of POPs to the global marine environment constitutes 99% of HCH<sub>tot</sub>, 95% of HCB, 91% of dieldrin, 98% of DDT, 85% of Chlordane and 80% of PCB total input.

### 3.1.5.5 Radionuclides

Radionuclides are present in trace amounts in the Mediterranean from natural (<sup>210</sup>Po, <sup>210</sup>Pb) and anthropogenic sources (<sup>137</sup>Cs, <sup>239,240</sup>Pu, <sup>214</sup>Am).

According to Aarkrog, 1988 atmospheric nuclear tests have produced 13PBq <sup>239,240</sup>Pu and 0.33 PBq of <sup>238</sup>Pu. These are the source terms for global fallout. In the northern hemisphere the integrated deposition density of <sup>239,240</sup>Pu is 39 Bq m<sup>-2</sup> and in the southern it is found to be 9.7 Bq m<sup>-2</sup>. For <sup>90</sup>Sr the correspondig figures are 1,804 and 565 Bqm<sup>-2</sup>

Table 3.1.5.10 Estimates of total atmospheric POPs deposition on the Mediterranean Sea (tons per year)

	Tons per year	Area	Reference
B(a)P	20	North of 36° only	Van den Hout 1994
PCBs	1.7 =<6.8	NW Mediterranean Mediterranean Sea in total	GESAMP, 1989 Villeneuve, 1986
HCB	0.2	NW Mediterranean	GESAMP, 1989
DDT	0.3 =<1.3	NW Mediterranean Mediterranean Sea in total	GESAMP, 1989 Villeneuve, 1986
Dieldrin	0.6	NW Mediterranean	GESAMP, 1989
HCH <sub>tot</sub>	9.9	NW Mediterranean	GESAMP, 1989
Lindane	29 5.6	North of 36° only NW Mediterranean	Van den Hout, 1994 GESAMP, 1989
Chlordane	0.05	NW Mediterranean	GESAMP, 1989

The global inputs of <sup>137</sup>Cs and <sup>239,240</sup>Pu to the Mediterranean Sea are estimated to be 15 and 0.19 PBq respectively, up to 1996. The most important sources are atmospheric fallout from nuclear weapon tests and the 1986 accident. (Papucci, 1996).

More than 90% of <sup>137</sup>Cs deposited onto the surface of the Mediterranean Sea is still present in the water column, while the remaining 10% is deposited in the upper layers of the sediments. Present concentrations in surface waters are about 1/3 of those measured 20 years ago, while an increase of about 30% is observed in the Mediterranean deep waters (Papucci, 1996).

Radionuclide levels in the living organisms reflect the low concentrations in seawater. The enhanced levels observed in biota after 1986, are now reduced to pre 1986 concentrations, except in few areas that are still receiving radionuclide inputs either from rivers (Adriatic Sea) or from contaminated basins (Aegean Sea-Black Sea) (Papucci, 1996).

### 3.1.5.6 Emission reduction cost

Table 3.1.5.11 Cost (10<sup>6</sup> Ecu) estimates for the currently agreed emission reduction plans as calculated by LRTAP/TFIAM in January 1997 (EB.AIR/WG.5/R.69)

	SO <sub>2</sub>				NO <sub>x</sub>			
	1990 kt	2010 kt	Change %	Cost MEcu/yr	1990 kt	2010 kt	Change %	Cost MEcu/y
Albania	120	54	-55	0	30	30	0	0
Bosnia-Herzegovina	480	410	-15	0	80	48	-40	48
Croatia	180	69	-62	62	83	64	-23	45
France	1,298	691	-47	1,344	1,585	895	-44	4,797
Greece	510	361	-29	220	306	282	-8	382
Italy	1678	847	-50	1,625	2047	1,160	-43	5,223
Slovenia	195	37	-81	57	57	31	-46	60
Spain	2,266	1,035	-54	226	1,178	851	-28	3,337
The FYR of Macedonia	106	81	-24	0	39	22	-43	0
Yugoslavia	581	262	-55	88	211	118	-44	36

In table 3.1.5.11 some values for emission reduction costs for mediterranean countries are given for illustrative purposes. The values have been obtained from the preliminar calculations under consideration in the negotiations of the new protocol on acidification, eutrophication and photochemical oxidants under the ECE/LRTAP convention.

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### 3.1.6 Exploitation of seabed and its subsoils

#### 3.1.6.1 Introduction

Exploitation of the seabed and its subsoils is limited to two key activities, mineral extraction and oil and gas production.

To date, offshore mineral extraction has primarily concentrated on aggregate (sand and gravel) for the construction industry and metals (primarily tin) from sediments known as placer deposits. Neither of these are found in significant quantities in the Mediterranean although there are large sand deposits in the Gulf of Lion and chromium rich placer deposits to the east of Cyprus. In addition, there are known deposits of calcareous products off southwest Italy, the south of France and south of Sicily and concentrated metalliferous deposits off southwest Italy. In general, marine mineral extraction is very limited in the Mediterranean.

In contrast, the oil and gas industry in the Mediterranean is much more extensive. Over 350 wells have been drilled (Figure 3.1.6.1) and offshore production is taking place in Italy, Egypt, Greece, Libya, Tunisia and Spain (Table 3.1.6.1). In addition, concessions for offshore exploration have been identified off Turkey, Malta, Israel, Lebanon, Algeria and the former Yugoslavia (Oilfield Publications Ltd, 1997). To date the number of wells and number of producing fields are small in comparison to the more highly developed areas in the Middle East, North Sea or Gulf of Mexico and the overall production modest.

Reserve estimates for the Mediterranean Basin are currently set at over 400 million tons of oil and 1000 billion cubic metres of gas, with the remaining potential located in deep offshore waters (Isoard, 1997). Mediterranean countries produce a little over 1.7 million barrels of oil equivalent per day and consume just under 2.4 million barrel of oil equivalents per day, leaving a considerable deficit in the energy balance of the region, and setting the scene for further development of hydrocarbon reserves. Forecasters expect offshore production of oil in the region to increase by 42% between 1994 and 1999 and gas by 171% (El Badri, 1997).

Table 3.1.6.1 Offshore fields, wells and production (Oil and Gas Journal December 96)

	No. of offshore fields	No. of producing wells	Average oil production (barrels/day)
Libya	1	46	57.192
Tunisia	4	33	41.923
Italy	6	58	15.547
Spain	2	36	12.702
Greece	1	12	9.000
Egypt*	41	13	640.393

\* INCLUDES RED SEA PRODUCTION FACILITIES

### 3.1.6.2 Sources, magnitude and scale effects

The activities on the exploitation of seabed and subsoils can result in environmental impacts. The magnitude and extent of any impacts is generally dependent on the activity together with the physical regime (i.e. wind, currents, water depth, mixing etc.) and the environmental sensitivities of the area. The key sources of potential impacts are: acoustic emissions, drilling mud, cuttings, produced water and decommissioning.

The main concerns associated with acoustic emissions from seismic surveys are potential impacts on fish, fisheries and marine mammals. If there are military exercise areas in the vicinity, they may also interfere with certain sound sensitive military equipment.

The scale of effects is dependent on the sensitivity of organisms to the sound source and varies from metres to kilometres. Generally, the magnitude of impacts is small, affecting individuals rather than populations, unless activities impact areas where species congregate to breed or feed or interfere with migration routes. The most sensitive animals are marine mammals which may show behavioural responses up to 10 km or more from the source.

Water based muds (WBM) are used in most wells drilled in the Mediterranean. The main water based mud components are generally classified as non-toxic (i.e. 96h LC50 > 10,000 ppm), although some of the smaller volume products may be classified as slightly toxic (i.e. LC50 > 1000-10,000 ppm). Typically, the toxicity of the whole mud is very low, with an LC50 of > 50,000 ppm (Jones et al, 1986; Leutermaun et al, 1989).

The major waste product of a drilling operation is the generation of rock cuttings. Cuttings are inert solids, and their composition reflects the well geology.

Field studies indicate that biological effects, following the discharge of water based mud cuttings, rarely show an impact beyond that of the immediate vicinity of the rig, in which smothering by the cuttings pile appears to be the most important factor (Bakke et al, 1986; Neff, 1987). Although the benthic communities present will be affected by the discharged cuttings, the area will be relatively small.

The fluids retrieved from a well contain a range of components including hydrocarbons and water. This 'produced water' is separated from the hydrocarbons on the production facility and is generally discharged. Generally, the water is treated to reduce the oil content to less than 40 ppm prior to discharge to sea although it is common practice in the Mediterranean to re-inject produced water into the producing formation to maintain reservoir pressure and reduce any environmental effects.

The environmental impacts of disposal of the non-hazardous material of structures will primarily revolve around the physical effects of moving or leaving a structure in a certain place. These will be small localised effects.

The environmental effects of the decommissioning and disposal of installations, in terms of both the hazardous and non hazardous materials that they contain, if carried out according to the IMO guidelines, will be small and limited to the immediate area.

Atmospheric emissions associated with oil and gas exploration and production contribute to global and regional problems attributed to global warming and acid rain.

Rough estimates of total emissions from production operations in the Mediterranean have been made using estimates of emissions from UK production operations (UKOOA, 1993) and assuming a direct relationship between emissions and oil production (Table 3.1.6.2). These estimates suggest that the contribution of atmospheric emissions from E&P operations in the Mediterranean is very small compared to total regional emissions.

Table 3.1.6.2 Estimated total emissions from E&P operations in the Mediterranean

Emissions	Estimated total from E&P operations in the Mediterranean (k tonnes)	Contribution (%) relative to total emissions from available Mediterranean coastal countries*
CO <sub>2</sub>	5440	0.4
CO	12	0.04
NO <sub>x</sub>	36	0.7
SO <sub>2</sub>	1.8	0.03
CH <sub>4</sub>	28	0.2
THC	90	na

\* (France, Greece, Italy, Malta, Spain) Source: EC, 1995

na = not available

Estimates of the total inputs of petrogenic hydrocarbons to the marine environment show that the major inputs are the result of discharges from land (i.e. mainly through rivers), spills and discharges from ships, and smaller but significant input from natural sources (such as seeps or sediment erosion).

In the Mediterranean shipping operations are the primary source of oil entering the sea. It is estimated that c.30% of the world's oil is transported through the area. An estimated 635,000 tonnes of oil enter the Mediterranean each year from all sources (Table 3.1.6.3). Accidental spills reported from vessels for the period 1981 to 1996 amount to c.56,000 tonnes (REMPEC, 1996) whilst the input by the exploration and production industry has been estimated at c.400t per year (Read, 1986).

Table 3.1.6.3 Inputs of petroleum hydrocarbons into the Mediterranean (Jeftic et al, 1990)

Source	Estimate (tonnes)
Tanker operations (spills, ballasting, tank washings)	330,000
Land run off municipal	160,000
industrial	110,000
Atmospheric deposition	35,000
Total	635,000

There have been no large oil spills reported from exploration and production in the Mediterranean. All of the spills reported to REMPEC have resulted from tanker operations (REMPEC, 1996).

### 3.1.6.3 Regional issues and transboundary impacts

The potential environmental impacts from oil and gas exploration and production can be grouped into four types with similar geographic zones of impact (Table 3.1.6.4). The following sections discuss the importance of these impacts in a regional context and the possibility for cumulative effects resulting in regional problems.

Table 3.1.6.4 Type and scale of impacts from E&P activities

Type	Key inputs	Source	Scale of impact
Acoustic Effects	noise	seismic surveys	up to 10 km
Operational Inputs	metals, hydrocarbons, other chemicals	drilling muds drill cuttings drilling chemicals	<0.5 km
Atmospheric Emissions	CO <sub>2</sub> , NO <sub>x</sub> , SO <sub>x</sub> , CO	power generation flaring	regional/global
Oil Spills	oil	fuel, reservoir	regional (up to 1000 km for large spill)

Lethal effects of acoustic emissions as part of seismic surveys are highly localised. There is the potential to impact the behaviour of marine mammals at distances up to 10 km from the source. This can result in transboundary or regional impacts on these scales.

The current scale of E&P activities in the Mediterranean indicates that the potential for regional problems as a result of accumulation of these discharges appears to be small.

The local impacts from atmospheric emissions are relatively small. Emissions generally reach background levels within a few hundred metres of the source.

Impacts from accidental spills can range from hundreds of metres as a result of a fuel spill to 1,000 km or more from a large spill. Although the probability of a large spill from E&P activities is low, spills are an important issue when considering impacts on anything greater than a local scale.

#### 3.1.6.4 Financial implications

The identified impacts from offshore oil and gas exploration and production have few direct cost implications. Exploration activities (seismic and drilling) have relatively short term impacts with rapid recovery times. Offshore production facilities can limit fishing activity but this is generally limited to a small area. The most significant costs are associated with oil spill clean up and remediation.

The costs of responding to small oil spills from rigs and platforms is not well documented. Most small spills are dealt with on-site using equipment held on the platform or on support vessels. Equipment capable of dealing with 50 tonnes of oil per hour can cost of the order of \$1,500 per day. An additional dispersant package suitable for small spills would cost of the order of \$10,000.

The costs of a large spill have been relatively well documented for spills involving oil tankers. Actual costs are not easily predicted and will be affected by many factors. The amount of oil spilt, *per se*, is not necessarily reflected in the final cost of the spill. The timing, the type of oil and the location of the spill may have more impact upon the cost than the volume. Thus the cost of a spill in terms of the costs of cleaning up the oil have been seen to vary between \$70 and \$21,000 per tonne spilt (Etkin, 1994) or even higher (Table 3.1.6.5).

Table 3.1.6.5 Examples of oil spills and associated clean-up costs (HMSO, 1994)

Accident	Cleanup costs	Size of spill (t)	Cost per tonne
Torrey Canyon	\$83,000,000 (1994 prices)	117,000	\$700
Phillips Oklahoma	\$290,000	800	\$366
Rosebay	\$1,300,000	1,100	\$1200
Exxon Valdez	\$2,000,000,000	37,000	\$54,000
Braer	\$3,200,000	84,700	\$40

A study of clean up operations in North America found the costs of clean-up higher than those reported for tankers (Harper et al., 1995). In open water, oil spill clean up ranged from \$75 to \$45,000 per tonne. Shoreline clean up operations were significantly more expensive averaging approximately \$60,000 per tonne.



### **3.1.6.5 Intervention measures**

#### **General measures**

General guidelines on waste inputs from E&P operations have been established as part of the Offshore Protocol to the Barcelona Convention. However, in order to assess the scope of the problem associated with exploitation of the seabed and the long term potential for possible transboundary effects, more detail is required on the total waste loads discharged to the Mediterranean. Currently, the Mediterranean Action Plan keeps a register of all authorised installations in the Protocol Area but this needs to be expanded to include details on discharges.

*Possible Intervention Measures: Implement a data collection programme to provide details of pollutant loadings from oil and gas exploration and production activities. This could involve two courses of action depending on the detail of data required in the short or long term. A rough estimate of loads could be made by a desk study using typical discharges from exploration and production activities. More detailed data on loads would require agreement on a standard reporting structure by all member countries and establishing a database for discharges.*

#### **Acoustic effects**

Acoustic effects from seismic operations can be reduced by timing operations to avoid sensitive periods and adopting appropriate procedures to minimise the potential for severe impacts (e.g. low frequency acoustic sources, slow start-up).

*Possible Intervention Measures: Develop guidelines for undertaking acoustic operations to minimise environmental impacts and incorporate these new guidelines as an additional Annex to the existing Offshore Protocol.*

#### **Operational inputs**

Guidelines have been provided for parameters to be assessed when considering an application to permit discharges of materials listed in Annex 2 to the Offshore Protocol. However, these guidelines do not include criteria against which the assessment should be made.

*Possible Intervention Measures: Establish criteria for acceptance of substances listed in Annex 2 of the Offshore Protocol. These criteria do not have to specify discharge limits but could include consideration of the dispersive capabilities of the local environment.*

#### **Atmospheric emissions**

The issues involved with atmospheric emissions are similar to those being examined on a global scale for all human activities. There are few additional measures specific to offshore oil and gas exploration and production.

*Possible Intervention Measures: Contribute to the larger debate on atmospheric emissions from all human activities. Encourage the use of low sulphur fuels and maximising the efficiency of all power generation equipment and flares.*

## **Oil spills**

The Barcelona Convention has already established a spill response capability for the Mediterranean. Under the Convention, all countries are to establish local oil spill response plans and ensure that resources are available to implement the plans. In addition, a regional response plan has been developed as specified in the Protocol for Co-operation in Combating Pollution of the Mediterranean Sea by Oil and other harmful Substances in Cases of Emergency. This function was extended to dealing with other hazardous substances and is maintained by the Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea (REMPEC).

*Possible Intervention Measures: Review the current response strategies of all signatories to the Barcelona Convention.*

It is not possible to establish the cumulative effects of spills from offshore operations because there does not appear to be regional records kept of all spills. All the spills recorded by REMPEC have been from shipping rather than E&P operations.

*Possible Intervention Measures: Establish a reporting structure for the inclusions of all spills from exploration and production activities into the records currently maintained by REMPEC.*

Prevention of spills is more important than response. Oil recovery systems are not 100% efficient and significant impacts can result from spills with the most rapid response.

*Possible Intervention Measures: Agree regional guidelines for operating using best industry practice to minimise the risks of oil spills. Particular attention should be paid to preventing small spills which may result from operational activities such as fuel transfer.*

## **Costs**

The recommended intervention measures are primarily centred on establishing agreed criteria and reporting requirements for discharges from offshore oil and gas operations among Mediterranean countries. This is mostly a political activity that could be run under the auspices of the Barcelona Convention.

The development of guidelines and background studies for each of the intervention measures could involve some input from external organisations with resultant cost implications.

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## **3.2 Pollution Hot Spots in the Mediterranean Sea Region**

### **3.2.1 Introduction**

The aim of this chapter was:

- to identify potential Mediterranean pollution hot spots, based on collected data and information;
- prepare a list of "Regional Priority Hot Spots" which should have regional priority for intervention in order to control or eliminate pollution in such spots;
- identify, where possible, geographic sites of impact; and
- assess relative importance of each of the listed pollution hot spots.

This chapter summarizes the results of consolidating and analyzing country reports prepared by national teams headed by the government-designated national coordinators for the Strategic Action Programme in the country. The national teams were supported by consultants nominated by Coordinating Unit for MAP (WHO). For this purpose, the Coordinating Unit prepared questionnaires dealing with municipal and industrial discharges into the sea from cities of 100,000 inhabitants or more, as well as from rivers and water courses discharging into the sea. Detailed guidelines were also provided, outlining procedures for:

- identification of hot spots and prioritization;
- evaluation of the impacts of priority hot spots (focusing on transboundary effects);
- remedial actions proposed and estimates of investments needed.

### **3.2.2 Methodology**

Following methodology was applied for the analysis:

The priority hot spots identified for each country were graded (on a scale of "1" (no effects) to "6" (extreme effects) according to the relative importance of their impacts on six aspects:

- public health;
- drinking water quality;
- recreation;
- other beneficial uses;
- aquatic life (including biodiversity); and
- economy and welfare (including marine resources of economic value).

The risks associated with them were also evaluated, as a weighted total, using a multiplier applied to the previous grading. This reflects the importance of the effect on each of the six issues considered. The multipliers were:

- 1.0 for public health;
- 0.9 for drinking water quality;
- 0.8 for recreation;
- 0.8 for other beneficial uses;
- 0.7 for aquatic life (including biodiversity); and
- 0.7 for economy and welfare (including marine resources of economic value).

As a first attempt at identifying the transboundary effects of the priority hot spots, the impacts on each of the following considerations were to be listed in a separate column in the tables:

- Fisheries (F);
- Biodiversity (B);
- Reduction of regional value of Mediterranean tourism (L);
- Public health (P); and
- Habitats (H).

Finally, available estimates of the costs of selected remedial actions were listed.

The questionnaires and the guidelines were discussed in a preliminary meeting to brief the consultants on the project, the proposed methodology, and the time schedule for implementation of the project. The questionnaires and guidelines were sent to the national focal points and the national coordinators were asked to start collecting as much as possible of the data required, drawing on the help and support of the national inter-ministry working groups, to be established whenever possible to ensure that the views of all relevant government structures are taken into account<sup>(1)</sup>. The nominated consultants visited the different countries and worked with national teams on finalizing the country reports.

The country reports were next discussed at length and edited during a meeting attended by the national coordinators and the consultants and finally a consultant consolidated the country reports. This has been reviewed in the coordinating Unit to produce the present report.

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<sup>(1)</sup> In fact, only one country referred to the establishment of an inter-ministry working group

### 3.2.3 Analysis of Results

The results of the country analyses are given in the report on hot spots for each of the 16 countries that prepared country reports. Each table of hot spots was followed by brief notes highlighting the more important comments made in the country reports addressing the main constraints, gaps and the particular methods used in compiling some data in the tables.

109 priority hot spots have been identified as impacting public health, drinking water quality, recreation and other beneficial uses, aquatic life (including biodiversity), as well as economy and welfare (including marine resources of economic value). Some idea of the distribution of their weighted total impacts can be gleaned from Table 3.2.1.

Table 3.2.1 Hot Spots distribution of weighted total impacts

	Number of Hot Spots	% of Total
Hot Spots scoring > 25	2	1.8 %
Hot Spots scoring 25-20	25	23.9 %
Hot Spots scoring 20-15	52	47.7 %
Hot Spots scoring 15-10	27	24.8 %
Hot Spots scoring < 10	3	2.8 %
Total	109	100%

Only two hot spots (Lake Manzala in Egypt and Izmir in Turkey) scored a total weighted impact greater than 25. A little over one fifth was in the 25-20 bracket, while about one fourth are in the 15-10 bracket. Almost one half of the hot spots are in the 20-15 bracket.

Almost all hot spots are considered, in the national reports, as having transboundary impacts on the six issues considered in the analysis.

Table 3.2.2 groups the hot spots according to the sources of pollution (domestic, industrial, mixed). For more than half the number, the sources are mixed. For just under one quarter, the sources are industrial, and the same for domestic sources.

Table 3.2.2 Hot Spots by sources of pollution

Source of the pollution	Domestic	Industrial	Mixed
No. of Hot Spots	26	26	57
% of total	23.9 %	23.9 %	52.2 %

It is worth noting that a limited number of hot spots are responsible for the bulk of pollution loads:

- BOD loads: of the total reported BOD load (865,214 t/yr) four hot spots contribute more than 50,000 t/yr each. They account for no less than (488,553 t/yr) or 56.5 % of the total. Table 3.2.3 lists these four hot spots in descending order of BOD loads. Of these four hot spots, two are in the greater Alexandria area (Abu-Qir Bay to the east and El-Mex Bay to the west). They account for 36.1 % of the total BOD load for all 109 hot spots.

Table 3.2.3 Major Hot Spots by BOD load

Hot Spot	BOD load (t/yr)	% of total BOD load
1- El-Mex Bay (Egypt)	219,498	25.4 %
2- Weid Ghammieq (Malta)	117,968	13.6 %
3- Abu-Qir Bay (Egypt)	91,701	10.6 %
4- Inner Saronic Bay (Greece)	59,386	6.9 %
<b>Totals</b>	<b>448,553</b>	<b>56.5 %</b>

- COD loads: Seven hot spots are responsible for COD loads of more than 100,000 t/yr. Together they account for 69.9 % of the total COD loads (2,198,802 t/yr) as shown in table 3.2.4.

Table 3.2.4 Major Hot Spots by COD load

Hot spot	COD load (t/yr)	% of total COD load
1- Abu-Qir Bay (Egypt)	575,490	26.2%
2- Iskendrun (Turkey)	222,080	10.1%
3- Haifa Bay (Israel)	183,770	8.4%
4- El-Mex Bay (Egypt)	175,654s	8.0%
5-Weid Ghammeiq (Malta)	153,556	7.0%
6- Inner Saronic Bay (Greece)	118,735	5.4%
7- Silifke (Turkey)	100,290	4.6%
Total	1,529,575	69.6%

- One hot spot (Abu Qir Bay) is responsible for slightly more than one quarter of the total COD load.
- Two hot spots in Alexandria account for 34.2% of the total COD loads. They are the same two hot spots responsible for 36.1% of the total BOD load.
- Once more, Weid Ghammeiq in Malta appears as a not insignificant source of total pollution load (7.0% of COD, 13.6% of BOD).

Within the limitations of the considerable gaps in the data collected, eight hot spots, were prominent as main sources of pollution. Table 3.2.5 summarizes their contributions to the different pollutants for which data were compiled in the national reports, and the percentages of their combined shares of the total discharges of pollutants.

The concentration of population in and around the hot spots identified reveals some significant aspects (Table 3.2.6).



Table 3.2.5 Contribution to pollution load by eight major hot spots

Pollutant (Kg/yr) Hot Spots	Hg	Cd	Pb	Cr	Cu	Zn	Ni	POPs	Others (t/yr) mainly hydro- carbons
(3) Abu Qir Bay (Egypt)		31+	193+	362+	2,669+	3,394+	859		1906 (oil)
4) Haifa Bay (Israel)		2,600			3,250	58,500			50,000* (oil)
(7) Tartous (Syria)		54	2,703	1,784	5,406	5,163	2,649		
(10) Lattakia (Syria)		85.4	4,271	2,135	4,271	7,686	2,562		
(35) El-Mex Bay (Egypt)	1278 <sup>(*)</sup>	1,562		530	25,430	46,524			1,319 (oil)
(40) Gush Dan (Israel)	60	430	1,670	11,400	19,000	54,000	2,500		
(46) Sfax South (Tunisia)					3,456	17,000			
(100) Larymna Bay (Greece)						313,170			
<b>Totals</b>	<b>1338</b>	<b>4762.4+</b>	<b>8837+</b>	<b>16211+</b>	<b>63,482+</b>	<b>505,737+</b>	<b>8570</b>		<b>53,225</b>
<b>% of total pollutant discharges</b>	<b>93.0%</b>	<b>81.4%</b>	<b>48.2%</b>	<b>70.1%</b>	<b>96.3%</b>	<b>82.15</b>	<b>75.1%</b>		<b>97.2%</b>

- As can be seen from the table, these eight hot spots are responsible for:
  - more than 90% of the discharges of mercury, copper and oil.
  - more than 80% of cadmium and zinc.
  - more than 70% of chromium and nickel.
  - and just under 50% of lead.

<sup>(\*)</sup> A caustic soda plant at this location, using mercury cells, has been dismantled and is buried in a secure land fill south of Alexandria in the desert.

Table 3.2.6 Population around Hot Spots

Population	> 1,000,000	1,000,000 - 500,000	500,000 - 250,000
No. of cities	9	8	15
Total population for the group	17,963,503	5,875,966	4,959,722
% of total	57.3%	18.7%	15.8%

Although the number of urban concentrations around hot spots of populations of one million and more is only nine, they account for just under 60% of the total population in and around hot spots:

- **Greater Alexandria** with a population of over 4 million, and responsible for around 40% of Egypt's total industrial production, is prominent as a major source of pollution. As indicated earlier on (Tables 3.2.3 and 3.2.4), it is responsible for 36.1% of total BOD load, 34.2% of COD load, 89.3% of mercury discharges, 27.2% of cadmium and 42.6% of copper (Table 3.2.5); and
- **Inner Saronic Gulf** in Greece, with a population of over 3 million is also a significant source of BOD (6.9% of total) and COD (5.4%).

There are **eight cities** with populations between one million and half a million. They house just under 6 million people and thus account for a little less than one fifth of total population around hot spots. None of these cities is particularly prominent as a significant source of pollution.

**Fifteen cities** have populations between 500,000 and 250,000. Their total population is about one million less than that of the previous group.

- Of these 15 cities, **Weid Ghammeiq** in Malta figures as a noticeable source of pollution (13.6% of total BOD load, 7.0% of total COD load), While **Tarsus**, in Syria, also appears on the list of major sources of TPBs (Table 3.2.5).

Table 3.2.7 shows the total number of hot spots for each source of pollution (domestic, industrial, mixed) as well as the share of each group of the total BOD and COD loads of all hot spots.

Table 3.2.7 Total number of Hot Spots for each source of pollution

Source of pollution		Domestic	Industrial	Mixed	Totals
No. of Hot Spots		26	26	57	109
% of total number		23.9%	23.9%	52.2%	100%
BOD load	t/yr	119,881	18,994	740,839	878,914
	% of total	13.6%	2.2%	84.3%	100%
COD load	t/yr	505,496	79,307	1,638,799	2,223,602
	% of total	22.7%	3.6%	73.7%	100%

The fifty-seven hot spots having mixed sources of pollution account for 84% of total BOD load and about three-quarters of COD load. Six of them appear in Table 3.2.6 as main sources of pollution.

- All four hot spots identified as main sources of total BOD load (Table 3.2.3) have mixed sources of pollution.
- Four of the six hot spots identified as main sources of total COD load (Table 3.2.4) have mixed sources of pollution.

Table 3.2.8 lists the 109 priority hot spots identified in the country reports ranked in descending order of their weighted total impact. For each hot spot, the table lists the source of pollution (domestic, industrial or mixed), and the estimated cost for proposed remedial actions.

Of the 109 priority Hot Spots those with the weighted factor of 20 or more were selected (29 hot spots) for the list of "Regional Priority Pollution Hot Spots" (Table 3.2.9).

In Table 3.2.10 the population and pollution loads (BOD, COD, Total-N, Total-P and TSS) are given for each hot spot listed in Tables 3.2.8 and 3.2.9.

Table 3.2.11 compiles the data in the national reports on pollutants ( Hg, Cd, Pb, Cr, Cu, Zn, Ni, POPs, and others - mainly hydrocarbons).

### 3.2.4 Remarks

Time constraints and the tight schedule for preparing and reviewing the country reports meant that the results are based on existing data. There was no time available for further measurements or verification of existing information. Had it not been for the previous efforts of MEDPOL focal points and the data they accumulated, it would not have been possible to prepare a more or less coherent picture of the situation in the Mediterranean coastal zones in such short time.

It is particularly worthwhile to note that all the Mediterranean countries eligible for GEF or donor funding have prepared national reports that provide useful information.

Most country reports underscore important gaps and constraints that are worth highlighting here. Most important among these are:

- scarcity of information on quality of receiving waters;
- difficulty of obtaining sufficient information on industrial effluents and estimates of remedial actions to reduce their undesirable impacts; and
- the need under the new orientations of MAP and the Barcelona Convention and LBS Protocol to establish good working relations between the, so far, predominantly scientific nature of the MEDPOL national focal points and other socio-economic institutions involved in environmental protection (government, business, academia and NGOs).

It is clear that while most hot spots were considered as having all embracing transboundary impacts, no consideration of location, prevailing currents, etc. seem to have been involved in characterizing these impacts as transboundary.

The majority of remedial actions proposed are of the wastewater treatment type. While appropriate in the case of domestic waste waters, this is highly undesirable for industrial effluents, where pollution prevention/ cleaner production, pollution prevention, approaches are more rational and efficient than "end of pipe" treatment of effluents.

There are notable gaps in cost estimates for remedial actions. The total cost of the available estimates is about US\$ 2.5 billion. The total for all hot spots identified could be more than twice this amount.

Some estimates are given for necessary feasibility studies or capacity building projects.

Estimates for new plant and systems, or the upgrading of existing ones, cover only procurement, construction and start-up costs. No costs are given for operating and maintenance costs.

Table 3.2.8 Regional Priority Hot Spots (ranked in descending order of their weighted total impacts)

No.	Country	Hot Spot	Source of Pollution	Weighted Total Impact	Economic Costs for Remedial Actions (MIn Dollars)
1	<i>Egypt</i>	El-Manzala	m	26.1	NA
2	<i>Turkey</i>	Izmir	m	25.8	78.5+
3	<i>Egypt</i>	Abu-Qir Bay	m	24.9	101.2+
4	<i>Israel</i>	Haifa Bay (River)	m	24.9	80
5	<i>Turkey</i>	Icel City	d	24.6	97
6	<i>Turkey</i>	Antalya	d	23.8	136
7	<i>Syria</i>	Tartous	m	23.6	41
8	<i>Turkey</i>	Hatay	i	23.6	NA
9	<i>Turkey</i>	Adana	d	23.1	99.8
10	<i>Syria</i>	Lattakia	m	22.5	73
11	<i>Tunisia</i>	Gabes	m	22.2	132.5
12	<i>Italy</i>	Porto Marghera (VE)	m	21.9	NA
13	<i>Malta</i>	Weid Ghammieq	m	21.9	36
14	<i>Croatia</i>	Kastela Bay	m	21.7	<i>See Split</i>
15	<i>Israel</i>	Nahariya	d	21.4	18
16	<i>Israel</i>	Akko	m	21.4	10
17	<i>Turkey</i>	Tarsus	d	21.3	76.4
18	<i>Tunisia</i>	Lake of Tunis	i	21.2	55
19	<i>Turkey</i>	Adana	i	21.2	NA
20	<i>Croatia</i>	Split	m	21.1	66
21	<i>Algeria</i>	Oran Ville	m	21	NA
22	<i>Algeria</i>	Rouiba	m	21	NA
23	<i>Morocco</i>	Tangier	m	21	28
24	<i>Algeria</i>	Ghazaouet	m	20.8	NA
25	<i>Turkey</i>	Antakya	d	20.7	97.7
26	<i>Lebanon</i>	Gt Beirut Area	m	20.6	140
27	<i>Algeria</i>	Alger	m	20.2	NA
28	<i>Algeria</i>	Mostaganem	m	20	NA
29	<i>Syria</i>	Banias	m	20	35.6

Table 3.2.9 Priority Hot Spots (ranked in descending order of their weighted total impacts)

30	<i>Lebanon</i>	Jounieh	m	19.9	62.6
31	<i>Turkey</i>	Iskenderun	d	19.7	13.4
32	<i>Greece</i>	Thermaikes Gulf	m	19.5	40.6
33	<i>Algeria</i>	Bejaia	m	19.4	NA
34	<i>Lebanon</i>	Saida-Ghaziye	m	19.3	44
35	<i>Egypt</i>	El-Mex Bay	m	19.1	61.6
36	<i>Morocco</i>	Tetouan	m	19	19.6
37	<i>Lebanon</i>	Tripoli	m	18.9	126.5
38	<i>Syria</i>	Jableh	m	18.8	41.7
39	<i>Greece</i>	Inner Saronic Gulf	m	18.8	130
40	<i>Israel</i>	Gush Dan	m	18.8	0.7
41	<i>Croatia</i>	Sibenik	m	18.8	30
42	<i>Algeria</i>	Annaba	m	18.7	NA
43	<i>Tunisia</i>	Lake of Bizerte	i	18.5	77
44	<i>Croatia</i>	Zadar	m	18.5	35
45	<i>Slovenia</i>	Koper (including Rizana River)	m	18.2	16
46	<i>Tunisia</i>	Sfax-South	I	18.1	30+
47	<i>Malta</i>	Cumnija	m	18.1	8
48	<i>Greece</i>	Patraikos Gulf	m	17.9	15
49	<i>Malta</i>	Ras il-Hobz	m	17.9	4
50	<i>Algeria</i>	Skikda	m	17.8	NA
51	<i>Egypt</i>	Alexandria	d	17.8	in implementation
52	<i>Croatia</i>	Pula	m	17.5	30
53	<i>Turkey</i>	Kirikhan	d	17.3	35.9
54	<i>Turkey</i>	Dortyol	d	17.1	41.7
55	<i>Turkey</i>	Erdemli	d	17.1	52.2
56	<i>Libya</i>	Zanzur	i	17	0.1
57	<i>Croatia</i>	Rijeka (Oil Refinery)	i	16.9	8
58	<i>Lebanon</i>	Batroun Selaata	m	16.8	5.9
59	<i>Italy</i>	Genova	m	16.7	NA
60	<i>Italy</i>	Augusta-Melilli	m	16.6	NA
61	<i>Italy</i>	Brindisi	m	16.5	NA
62	<i>Italy</i>	Gela	m	16.4	NA
63	<i>Turkey</i>	Silifke	d	16.4	40.5
64	<i>Croatia</i>	Kastela Bay (Kaltenberg)	i	16	2
65	<i>Italy</i>	La Spezia	m	16	NA
66	<i>Italy</i>	Milazzo	m	16	NA
67	<i>Croatia</i>	Zadar (Adria)	i	15.9	2
68	<i>Italy</i>	Golfo di Napoli	m	15.9	NA
69	<i>Italy</i>	Ravenna	i	15.9	NA

70	<i>Israel</i>	Ashdod	i	15.8	20
71	<i>Italy</i>	Taranto	m	15.8	NA
72	<i>Turkey</i>	Osmaniye	d	15.6	22.7
73	<i>Italy</i>	Rosignano Solvay	i	15.6	NA
74	<i>Italy</i>	Bari-Barletta	d	15.5	NA
75	<i>Libya</i>	Tripoli	d	15.3	12
76	<i>Slovenia</i>	Izola	m	15.3	12
77	<i>Croatia</i>	Rijeka	d	15.2	25
78	<i>Croatia</i>	Boker (ex Cokery)	I	15.2	1.5
79	<i>Italy</i>	Livorno	i	15.2	NA
80	<i>Morocco</i>	Nador	m	15	NA
81	<i>Croatia</i>	Dubrovnik	d	14.5	6
82	<i>Slovenia</i>	Delamariš	i	14.2	2.5
83	<i>Libya</i>	Benghazi	d	13.8	1
84	<i>Israel</i>	Haifa bay	i	13.8	0.45
85	<i>Greece</i>	Pagasetikos Gulf	m	13.7	8
86	<i>Albania</i>	Durres	d	13.3	48
87	<i>Albania</i>	Vlore	d	13.3	48
88	<i>Italy</i>	Manfredonia	m	13.3	NA
89	<i>Italy</i>	Ancona-Falc	i	13.1	NA
90	<i>Cyprus</i>	Limassol	m	13	32.75
91	<i>Morocco</i>	Al-Hociema	m	13	NA
92	<i>Greece</i>	Heraklio Gulf	m	12.9	NA
93	<i>Greece</i>	Elefsis bay	i	12.6	0.6
94	<i>Croatia</i>	Zadar (Tannery)	i	12.1	1.5
95	<i>Libya</i>	Zawwia	d	12	2
96	<i>Libya</i>	Tobruk	d	12	1.5
97	<i>Cyprus</i>	Larnaca	m	11.9	0.5
98	<i>France</i>	Marseille	d	11.9	110
99	<i>Albania</i>	Chemical Factory (Durres)	i	11.4	2 to 3
100	<i>Greece</i>	NW Saronic Gulf	i	11.2	0.3
101	<i>Greece</i>	Larymna bay	i	11.2	0.3
102	<i>France</i>	Gardanne	i	10.9	N.A.
103	<i>Slovenia</i>	Piran Submarine Outfall	d	10.7	8.5
104	<i>France</i>	Toulon	d	10.4	40
105		Cannes	d	10.4	32
	France				
106	<i>France</i>	Frejus	d	10.4	18
107	<i>Greece</i>	Nea Karvali Bay	i	9.5	0.3
108	<i>Albania</i>	Vlore (PVC Factory)	i	9.3	2
109	<i>Cyprus</i>	Larnaca	I	8.1	1

Table 3.2.10 Main Pollution Loads\*

No.	Country	Hot Spot	Population	BOD T/Yr	COD T/Yr	Total-N T/Yr	Total-P T/Yr	TSS T/Yr
1.	<i>Egypt</i>	El-Manzala	-	-	-	-	-	-
2.	<i>Turkey</i>	Izmir	2,017,711	44,188	73,647	11,047	4,419	66,285
3.	<i>Egypt</i>	Abu-Qir Bay	-	91701	575,490	4966	8248	120,035
4.	<i>Israel</i>	Haifa Bay (River)	-	28,940	183,770	11,055	1272	6800
5.	<i>Turkey</i>	Icel City	694,867	15,218	25,363	3,804	1,522	22,830
6.	<i>Turkey</i>	Antalya	505,862	11,078	18,463	2,769	1,108	16,620
7.	<i>Syria</i>	Tartous	319,152	18.5+	-	73.5+	34.3+	-
8.	<i>Turkey</i>	Hatay	-	-	-	-	-	-
9.	<i>Turkey</i>	Adana	1,066,005	23,346	38,910	5,837	2,335	35,025
10.	<i>Syria</i>	Lattakia	746,851	530	-	-	-	168
11.	<i>Tunisia</i>	Gabes	150,000	1732	-	320	724.3	4860
12.	<i>Italy</i>	Porto Marghera	1,243,869	9,988	39,953	3,746	2,497	19,977
13.	<i>Malta</i>	Weid Ghammieq	270,085	117,968	153,556	135,415	12,447	124,538
14.	<i>Croatia</i>	Kastela Bay	See Split (20)	5,006	11,095	594	129	8,481
15.	<i>Israel</i>	Naharaiya	37,500	2900	6200	122	86	2250
16.	<i>Israel</i>	Akko	46,000	2000	4400	330	53	2200
17.	<i>Turkey</i>	Tarsus	333,302	7,299	12,165	1,825	730	10,950
18.	<i>Tunisia</i>	Lake of Tunis	400,000	2243	4384	300	25.8	1210
19.	<i>Turkey</i>	Adana	-	-	-	-	-	-
20.	<i>Croatia</i>	Split	350,000+	1643	3286	411	115	1232
21.	<i>Algeria</i>	Oran Ville	m	-	-	-	-	-
22.	<i>Algeria</i>	Rouiba	m	-	-	-	-	-
23.	<i>Morocco</i>	Tangier	526,215	2496	5187	-	-	1057
24.	<i>Algeria</i>	Ghazaouet	m	-	-	-	-	-
25.	<i>Turkey</i>	Antakya	317,725	6,958	11,597	1,740	696	10,440
26.	<i>Lebanon</i>	Gt Beirut Area	-	29,235	-	-	-	14
27.	<i>Algeria</i>	Alger	m	-	-	-	-	-
28.	<i>Algeria</i>	Mostaganem	m	-	-	-	-	-
29.	<i>Syria</i>	Banias	142,564	163.3	316	-	-	-



30.	<i>Lebanon</i>	Jounieh	200,000	4280	-	-	-	80
31.	<i>Turkey</i>	Iskenderun	276,163	10,047	222,080	115,512	76005	9075+
32.	<i>Greece</i>	Thermaikes Gulf		297	1043	-	14.7	142
33.	<i>Algeria</i>	Bejaia	m	-	-	-	-	-
34.	<i>Lebanon</i>	Saida-Ghaziye	205,000	5134	-	-	-	293
35.	<i>Egypt</i>	El-Mex Bay	-	219498	175654	2081	2628	286645
36.	<i>Morocco</i>	Tetouan	367,349	6861	15304	723	114	7143
37.	<i>Lebanon</i>	Tripoli	353,000	7446	-	-	-	-
38.	<i>Syria</i>	Jableh	166,779	542	-	-	-	225
39.	<i>Greece</i>	Inner Saronic Gulf	3345000	59386	118735	-	-	42815
40.	<i>Israel</i>	Gush Dan	1,100,000	-	-	2900	1200	44,000
41.	<i>Croatia</i>	Sibenik	60,000+	201.4	410	88.6	20	240
42.	<i>Algeria</i>	Annaba	m	-	-	-	-	-
43.	<i>Tunisia</i>	Lake of Bizerte	250,000	2687	-	476.3	118.2	2329
44.	<i>Croatia</i>	Zadar	85,000+	1056	3940	154	26	1,410
45.	<i>Slovenia</i>	Koper (including Rizana River)	46,221	484.8	5,111	76.4	8.4	249.7
46.	<i>Tunisia</i>	Sfax-South	395,277	843	1900	100	40	345
47.	<i>Malta</i>	Cumnija	59,224	17,361	31,515	1,914	1,495	14,240
48.	<i>Greece</i>	Patraikos Gulf	155180	127.3	472.6	110	29	110
49.	<i>Malta</i>	Ras il-Hobz	25,957	15,136	26,916	1,777	2,233	28,165
50.	<i>Algeria</i>	Skikda	m	-	-	-	-	-
51.	<i>Egypt</i>	Alexandria	4,000,000	1632	-	1520	2266	8831
52.	<i>Croatia</i>	Pula	63,979+	329	513	-	4	259
53.	<i>Turkey</i>	Kirikhan	120,472	2,638	4,397	660	264	3,960
54.	<i>Turkey</i>	Dortyol	116,380	2,549	4,248	637	225	3,825
55.	<i>Turkey</i>	Erdemli	108,927	2,386	3,977	597	239	3,585
56.	<i>Libya</i>	Zanzur	-	-	-	-	-	-
57.	<i>Croatia</i>	Rijeka (Oil Refinery)	-	32	121	-	-	25
58.	<i>Lebanon</i>	Batroun Selaata	51,000	1077+	-	-	-	-
59.	<i>Italy</i>	Genova	1,967,109	15,796	63,184	5,923	3,949	31,592
60.	<i>Italy</i>	Augusta-Melilli	225,165	1,808	7,232	678	452	3,616
61.	<i>Italy</i>	Brindisi	258,667	2,077	8,308	779	519	4,154
62.	<i>Italy</i>	Gela	267,053	2,144	8,578	804	536	4,289
63.	<i>Turkey</i>	Silifke	128,509	9,084	100,290	57604	38481	4,215
64.	<i>Croatia</i>	Kastela Bay (Kaltenberg)	-	35.1	1.287	6.1	2.3	148.5
65.	<i>Italy</i>	La Spezia	-	-	-	-	-	-
66.	<i>Italy</i>	Milazzo	76,720	616	2,464	231	154	1,232

67.	<i>Croatia</i>	Zadar (Adria)	-	66.5	120.7	1.5	2.5	18.2
68.	<i>Italy</i>	Golfo di Napoli	2,023,809	16,251	65,005	6,094	4,063	32,502
69.	<i>Italy</i>	Ravenna	792,435	6,363	25,453	2,386	1,591	12,727
70.	<i>Israel</i>	Ashdod	-	2630	12150	600	7	258
71.	<i>Italy</i>	Taranto	309,368	2,484	9,937	932	621	4,968
72.	<i>Turkey</i>	Osmaniye	139,116	3,047	5,078	761	305	4,575
73.	<i>Italy</i>	Rosignano Solvay	23,242	187	747	70	47	373
74.	<i>Italy</i>	Bari-Barletta	959,736	7,707	30,827	2,890	1,927	15,413
75.	<i>Libya</i>	Tripoli	1,200,000	3,100	4,650	740	-	4,300
76.	<i>Slovenia</i>	Izola	13,770	1092	-	90.1	21.3	414.2
77.	<i>Croatia</i>	Rijeka	206,229+	1,927	4,614	201	32.9	1,728
78.	<i>Italy</i>	Livorno	335,982	2,698	10,792	1,012	674	5,396
79.	<i>Croatia</i>	Boker (ex Cokery)	-	-	-	-	-	-
80.	<i>Morocco</i>	Nador	246,113	1888	4435	83.2	100	1433
81.	<i>Croatia</i>	Dubrovnik	50,000+	160.4	310	78.8	19.4	139
82.	<i>Slovenia</i>	Delamaris	(See Izola No. 79)					
83.	<i>Libya</i>	Benghazi	750,000	1.5	2100	306	-	1226
84.	<i>Israel</i>	Haifa bay (industrial)	-	800	-	-	-	1400
85.	<i>Greece</i>	Pagositikos Gulf	77907	657	1095	-	-	-
86.	<i>Albania</i>	Durres	120,000	2864	-	477	95.5	4,300
87.	<i>Albania</i>	Vlore	110,000	2,628	-	438	87.6	3,942
88.	<i>Italy</i>	Manfredonia	158,367	1,272	5,087	477	318	2,543
89.	<i>Italy</i>	Ancona-Falc	372,319	2,990	11,959	1,121	747	5,979
90.	<i>Cyprus</i>	Limassol	130,000	1181	2185	39	15	336
91.	<i>Morocco</i>	Al-Hociema	112,588	519	1073	-	-	452
92.	<i>Greece</i>	Heraklio Gulf	117167	83.9	140.5	-	-	29.1
93.	<i>Greece</i>	Elefsis bay	-	61.2	446.4	-	-	70
94.	<i>Croatia</i>	Zadar (Tannery)	-	23.3	68.3	4.7	0.03	14.7
95.	<i>Libya</i>	Zawwia	-	-	-	-	-	-
96.	<i>Libya</i>	Tobruk	-	-	-	-	-	-
97.	<i>Cyprus</i>	Larnaca	-	-	-	-	-	-
98.	<i>France</i>	Marseille	900,000	13,700	24,800	4,700	300	3,100

99.	<i>Albania</i>	Durres	-	-	-	-	-	-
100.	<i>Greece</i>	NW Saronic Gulf	-	21.5	21.5	-	-	5.4
101.	<i>Greece</i>	Larymna bay	-	-	7516	-	-	2505
102.	<i>France</i>	Gardanne	-	-	-	-	-	316,000
103.	<i>Slovenia</i>	Piran Submarine Outfall	17,000 :	124.5	290.4	23.4	26	116.2
104.	<i>France</i>	Toulon	310,000	1,300	5,000	1,500	150	1,000
105.	<i>France</i>	Cannes	144,000	1,900	3,800	600	150	1,000
106.	<i>France</i>	Frejus	175,000	650	1,700	400	40	400
107.	<i>Greece</i>	Nea Karvali Bay	-	295	739	625	126	-
108.	<i>Albania</i>	Vlore (PVC Factory)	-	-	-	-	-	-
109.	<i>Cyprus</i>	Larnaca	55,346	-	6000 (mg/l)	-	-	-

\* Blank cells mean no information available.

+ signes after figures mean more pollution loads, not quantified.

NA means not available.

Table 3.2.11 Pollutants Discharges\*

No.	Country	Hot Spot	Hg kg/yr	Cd kg/yr	Pb kg/yr	Cr kg/yr	Cu kg/yr	Zn kg/yr	Ni kg/yr	POPs	Other
1.	<i>Egypt</i>	El-Manzala	-	-	-	-	-	-	-	-	-
2.	<i>Turkey</i>	Izmir	-	-	-	-	-	-	-	-	-
3.	<i>Egypt</i>	Abu-Qir Bay	-	31+	193+	362+	2669+	3394+	859	-	Oil (1906 t/yr)
4.	<i>Israel</i>	Haifa Bay (River)	-	2600	-	-	3250	58,500	-	-	Oil (50,000 t/yr)
5.	<i>Turkey</i>	Icel City	-	-	-	-	-	-	-	-	-
6.	<i>Turkey</i>	Antalya	-	-	-	-	-	-	-	-	-
7.	<i>Syria</i>	Tartous	-	54	2703	1784	5406	5163	2649	-	-
8.	<i>Turkey</i>	Hatay	-	-	-	-	-	-	-	-	-
9.	<i>Turkey</i>	Adana	-	-	-	-	-	-	-	-	-
10.	<i>Syria</i>	Lattakia	-	85.4	4271	2135	4271	7687	2562	-	-
11.	<i>Tunisia</i>	Gabes	-	13.6	80+ (ppm)	36.2	-	91.6+	-	-	-
12.	<i>Italy</i>	Porto Marghera	14.2 micg/g	22.9 micg/g	282 micg/g	-	247 micg/g	18.20 micg/g	-	PCB 720 mg/g	-
13.	<i>Malta</i>	Weid	-	-	-	-	-	-	-	-	-
14.	<i>Croatia</i>	Ghammieg Split (See 14)	-	-	-	-	-	-	-	-	-
15.	<i>Israel</i>	Naharaiya	-	-	-	-	-	-	-	-	-
16.	<i>Israel</i>	Akko	-	-	-	-	-	-	-	-	-
17.	<i>Turkey</i>	Tarsus	-	-	-	-	-	-	-	-	-

18.	Tunisia	Lake of Tunis	-	0.15	0.6	70	23.4	11.3	4.4	-	-
19.	Turkey	Adana	-	-	-	-	-	-	-	-	-
20.	Croatia	Split (See 14)	-	-	-	-	-	-	-	-	-
21.	Algeria	Oran Ville	-	-	-	-	-	-	-	-	-
22.	Algeria	Rouiba	-	-	-	-	-	-	-	-	-
23.	Morocco	Tangier	-	-	-	-	-	-	-	-	-
24.	Algeria	Ghazaouet	-	-	-	-	-	-	-	-	-
25.	Turkey	Antakya	-	-	-	-	-	-	-	-	-
26.	Lebanon	Ct Beirut Area	-	-	-	-	-	-	-	-	-
27.	Algeria	Alger	-	-	-	-	-	-	-	-	-
28.	Algeria	Mostaganem	-	-	-	-	-	-	-	-	-
29.	Syria	Banias	-	-	-	-	-	-	-	-	Oil (438 t/yr)
30.	Lebanon	Jounieh	-	-	-	-	-	-	-	-	-
31.	Turkey	Iskenderun	15.4	19.21	-	-	-	-	-	-	-
32.	Greece	Thermaikes Gulf	-	-	-	-	-	-	-	-	Oil (38 t/yr)
33.	Algeria	Bejaia	-	-	-	-	-	-	-	-	-
34.	Lebanon	Saida-Ghaziye	-	-	-	-	-	-	-	-	-
35.	Egypt	El-Mex Bay	1278	1562	-	530	25430	46524	-	-	Oil 1319 t/yr
36.	Morocco	Tetouan	0.38	14.66	307.59	75.75	572.23	1378.95	-	-	-
37.	Lebanon	Tripoli	-	-	-	-	-	-	-	-	-









94.	Croatia	Zadar (Tannery)	10.1	-	3.2	3,932	-	-	-	-	Oil (0.13 t/yr)
95.	Libya	Zawwia	-	-	-	-	-	-	-	-	-
96.	Libya	Tobruk	-	-	-	-	-	-	-	-	-
97.	Cyprus	Larnaca	-	-	-	-	-	-	-	-	-
98.	France	Marseille	-	-	-	-	-	-	-	-	-
99.	Albania	Durres (ex Chem- factory)	1,431.88	5,848.78	18,331.95	23,111.38	65,915.29	615,757.2	11,409.5	-	Oil 54,709,238
100.	Greece	NW Saronic Gulf	-	-	-	-	-	-	-	-	Oil (5.4 t/yr)
101.	Greece	Larymna bay	-	-	-	-	-	313170	-	-	Oil (940 t/yr)
102.	France	Gardanne	-	-	-	-	-	-	-	-	-
103.	Slovenia	Piran	-	4.26	60.96	8.43	27.26	703	9.8	-	-
104.	France	Toulon	-	-	-	-	-	-	-	-	-
105.	France	Cannes	-	-	-	-	-	-	-	-	-
106.	France	Frejus	-	-	-	-	-	-	-	-	-
107.-	Greece	Nea Karvali Bay	-	-	-	-	-	2586	-	-	-
108.	Croatia	Vlore (PVC factory)	-	-	-	-	-	-	-	-	-
109.-	-	Larnaca	5 (micro g/L)	-	0.4 (micro g/L)	-	80 (micro g/L)	75 (micro g/L)	-	-	Oil (0.018 t/yr)

\* Blank cells mean no information available.

+ sign after figures mean more pollution loads, not quantified.

## **3.3 Sensitive Areas in the Mediterranean Sea**

### **3.3.1 Introduction**

Aim of this chapter was to identify estuarine and coastal areas of natural and socio-economic value in the Mediterranean Sea, which are particularly sensitive to damage from land-based activities.

Sensitive areas were defined as estuaries and coastal waters of natural or socio-economic value that are at higher risk to suffer negative impacts from human activities.

This chapter summarizes the results of consolidating and analyzing country reports prepared by national teams headed by the government-designated national coordinators for the Strategic Action Programme in the country. The national teams were supported by consultants nominated by Coordinating Unit for MAP (WHO). The work on collection of the data and information was done simultaneously with the same type of work for the hot spots and by the same national coordinators and consultants. Guidelines were also provided, outlining procedures for the identification of sensitive areas.

### **3.3.2 Methodology**

Following methodology was applied for the analysis:

The sensitive areas identified for each country were supposed to be graded (on a scale of "1" (no effects) to "6" (extreme effects) according to the relative importance of their impacts on six aspects:

- public health;
- drinking water quality;
- recreation;
- other beneficial uses;
- aquatic life (including biodiversity); and
- economy and welfare (including marine resources of economic value).

The risks associated with them were also evaluated, as a weighted total, using a multiplier applied to the previous grading. This reflects the importance of the effect on each of the six issues considered. The multipliers were:

- 1.0 for public health;
- 0.9 for drinking water quality;
- 0.8 for recreation;
- 0.8 for other beneficial uses;
- 0.7 for aquatic life (including biodiversity); and
- 0.7 for economy and welfare (including marine resources of economic value).

As a first attempt at identifying the transboundary effects of the sensitive areas, the impacts on each of the following considerations were to be listed in a separate column in the tables:

- Fisheries (F);
- Biodiversity (B);
- Reduction of regional value of Mediterranean tourism (L);
- Public health (P); and
- Habitats (H).

Finally, available estimates of the costs of selected remedial actions were listed.

Natural characteristics may determine the vulnerability of a coastal system. For example a bay with low flushing rate is more sensitive to pollution impacts than one which is well flushed. Human activities determine the level of risk, hence planned development may increase the risk of environmental degradation. Both vulnerability and risk contribute to the "sensitivity" of a particular area of system in the context of this assessment.

The questionnaires for hot spots and guidelines for sensitive areas were discussed in a preliminary meeting to brief the consultants on the project, the proposed methodology, and the time schedule for implementation of the project. The questionnaires and guidelines were sent to the national focal points and the national coordinators were asked to start collecting as much as possible of the data required, drawing on the help and support of the national inter-ministry working groups, to be established whenever possible to ensure that the views of all relevant government structures are taken into account<sup>(1)</sup>. The nominated consultants visited the different countries and worked with national teams on finalising the country reports.

The country reports were next discussed at length and edited during a meeting attended by the national coordinators and the consultants and finally a consultant consolidated the country reports. This has been reviewed in the Coordinating Unit to produce the present report.

### **3.3.3 Analysis of Results**

Unfortunately, due to the lack of reliable information most of the information of sensitive areas was not complete and the summary of collected data are presented in Table 3.3.1.

The national reports identified 25 sensitive areas in 8 countries, as shown in the table 3.3.1.

1. \_\_\_\_\_

<sup>(1)</sup> In fact, only one country referred to the establishment of an inter-ministry working group

Table 3.3.1 Sensitive areas in the Mediterranean countries

Country	Albania	Croatia	Cyprus	Egypt	France	Greece	Lebanon	Slovenia	Syria	Total
No. of Sas	3	5	1	1	4	2	2	2	5	25

Estimates of costs for remedial actions for protecting the sensitive areas are given for 12 sensitive areas in 4 countries only. These total US\$ 72-75 millions (Table 3.3.2).

Table 3.3.2 Sensitive areas in the Mediterranean countries

Country	Sensitive Area	Estimated Costs of Protective Action (millions of dollars)
<i>Albania</i>	Kuna-Vain Lagoons	26
	Karavasta Lagoon	1-2
	Narta Lagoon	3-5
<i>Croatia</i>	Malostonski	1.2
	Limski Channel	0.7
	Kornati	0.9
	Mljet	0.2
	Krka est.	1.5
<i>Cyprus</i>	Vassilikos Bay	
<i>Egypt</i>	Lake Bardawil	-
<i>France</i>	Collioure- Cap	-
	Leucate	
	Cap Leucate-	-
	L'Espiguette	
	Rhone Mouth	-
	Fos Gulf	
	Bonifacio	-
<i>Greece</i>	Amvrakikos Gulf	11
	Lagoon of Mesologgi	
<i>Italy</i>	Vado Ligure-Savona	-
	Secche della Meloria	-
	Isola d'Elba	-
	Pesaro-Cervia	-
	Mouth of Po	-
	Venezia and its lagoon	-
	Panzana Bay	-
<i>Lebanon</i>	Sour	19
	Jbail (Byblos)	7.5
<i>Slovenia</i>	Koper Bay	(included in Rizana River)
	Piran Bay	(see Piran)

### 3.3.4 Remarks

Most country reports underscore important gaps and constraints that are worth highlighting here. Most important among these are:

- scarcity of information on quality of receiving waters;
- difficulty of obtaining sufficient information on industrial effluents and estimates of remedial actions to reduce their undesirable impacts; and
- the need under the new orientations of MAP and the Barcelona Convention and LBS Protocol to establish good working relations between the, so far, predominantly scientific nature of the MEDPOL national focal points and other socio-economic institutions involved in environmental protection (government, business, academia and NGOs).

The majority of remedial actions proposed are of the wastewater treatment type. While appropriate in the case of domestic wastewaters, this is highly undesirable for industrial effluents, where pollution prevention/ cleaner production, pollution prevention, approaches are more rational and efficient than "end of pipe" treatment of effluents.

Some estimates are given for necessary feasibility studies or capacity building projects.

The identification of sensitive areas and their analysis leaves a lot to be desired. The impression given by national reports is that there has been in many cases confusion about applying the definition of sensitive areas given in the guidelines as well as reporting on the sensitive areas identified.

### **3.4 Tourism**

**TO BE PREPARED**

### **3.5.1 Living marine resources (fishery)**

#### **3.5.1.1 Introduction**

Preparation of the fisheries component of the Mediterranean transboundary diagnostic analysis reported here followed the procedures and formats developed in preparing a similar document for the Black Sea in June 1996. The difference was that, unlike the Black Sea cooperative Transboundary Diagnostic Analysis (TBDA), the fisheries component was prepared by the GFCM Secretariat, without the opportunity for consultation with analyses for other sectors going on elsewhere through the work of other isolated groups or consultants. This would imply that a phase of consolidation should follow, since, in a multidisciplinary topic such as fisheries, there are many linkages to other sectors. Such a consolidation is evidently required, among others, with respect to pollution, endangered species and habitats, aquaculture and coastal zone management, all of which have obvious linkages with the fishery sector.

Like the Black Sea Transboundary Analysis, these diagnoses was approached in four stages and following results are presented in the form of tables:

- a detailed analysis of the problems; stakeholders; uncertainties; proposed actions and associated costs; and products and milestones (Chapter 2, Table 2.5.1.1);
- a listing of perceived major problems and main root causes affecting the fishery sector due to human interventions and environmental impacts (Table 3.5.1.1);
- areas of intervention and proposed actions in order to solve problems (Table 3.5.1.2);
- problems categorised by key resource type (Table 3.5.1.3);
- key fishery "hot spots" (Table 3.5.1.4);
- Mediterranean landings by key resources and their indicative values (1992) (Table 3.5.1.5); and
- cost of proposed actions (Table 3.5.1.6).

Given that extension of jurisdiction has not occurred here, the main fishery resources of the Mediterranean are transboundary between the territorial seas and the high seas beyond 12 nautical miles from shore. Joint management of these resources, and in particular control of fleet size and effort, are top priorities. This perspective gives the management of most coastal as well as high seas resources a transboundary nature, and hence they come under the jurisdiction of the General Fisheries Council for the Mediterranean (GFCM), an intergovernmental body with membership of all coastal States of the Mediterranean proper.

With respect to the environment, the Mediterranean Action Plan has played a major role in documenting environmental impacts on Mediterranean environments, but there has been relatively little liaison between fisheries and environmental organisations. This is doubly unfortunate since environmental impacts, notably from environmental runoff of nutrients into this semi-enclosed sea, have already been documented as having a significant impact on

fisheries productivity; an impact that is not entirely negative in moderation, given that Mediterranean food chains were formerly considered seriously limited by availability of nutrients. This aspect of the analysis presents serious problems, however, in quantifying impacts or even predicting future trajectories, since fisheries trends since the 1970's have not been readily explainable in terms of fishing effort alone, which would almost certainly have led to catch declines if environmental productivity had remained constant. We illustrate one possible hypothesis for discussion which assumes that, as for the Black Sea, fisheries productivity tracks biological productivity of the system before eutrophic effects, especially on bottom fauna, leads to declines. Current experience suggests that this decline may be on the verge of occurring for the upper Adriatic but that southern and eastern Mediterranean environments are still strongly nutrient-limited.

It is clear also in relation to conventional resource management problems that for many Mediterranean resources exploitation has been driven by rising prices and demand, especially for demersal and shellfish species, and the overall value of resources is much in excess of what the relatively modest tonnage (1.1 millions tons or so landed) would suggest. A control of fishing effort is an urgent priority identified by GFCM but, although diversion of funds away from supporting a high fishing fleet capacity would release important funds for other purposes, coastal fisheries by 'petit metier' small-scale boats play an important social and economic role along the Mediterranean littoral. We have been unable to fully document here the social ramifications of small scale fisheries, however, except to suggest that management measures will need to be reconciled with social, community and other infrastructure needs of the countries concerned.

Especially for the Southern and Eastern Mediterranean, the technical problems involved in resource management are not easily soluble, largely because of the absence of funds to address the technical problems concerned. Some provisions are therefore made in this proposal for funding to tackle these, while recognising that the governments concerned will also have to make provisions for the major capital and infrastructure costs involved.

### **3.5.1.2 Effects of nutrient runoff on fishery production in the Mediterranean**

Early studies in biological oceanography established the low biological productivity of Mediterranean waters compared with oceanic areas elsewhere, and up to the 1970's fisheries production figures per shelf area were also much lower than the world's average. Evidence has been accumulating for the Mediterranean (Caddy et al, 1995), and for semi-enclosed seas elsewhere, (Caddy, 1993) that fisheries production in inland seas has been showing a steady rise, even after fish stock assessments have shown that the key stocks are fully exploited. This phenomenon has been tied to runoff of nutrients from catchment basins; and in particular for the Mediterranean, predominantly due to the influence of the rivers Rhone, Po, Ebro, and for the Aegean, to nutrient rich outflow of water from the Marmara Sea. In the case of the Nile, the opposing effect has demonstrated the rule, through a significant decline in sardine landings following construction of the Aswan Dam, and more recently a recovery of production around the Nile Delta and associated lagoons, due to increased inputs of domestic wastes and fertilisers. In the Black Sea, a previous GEF-sponsored Trans-Boundary Analysis summarised evidence for the impact of nutrient runoff, in causing progressive anoxia of shelf bottom waters, especially in the NW Shelf under influence of the Danube and Russian rivers to the north. Episodes of anoxia in the Northern Adriatic have led to localised fish kills, and illustrate



that under certain conditions, high oxygen demand due to high nutrient inputs from the River Po, if not diffused, may cause summer kills, suggesting that in this area at least, we may expect further increases in nutrient inputs to lead to declines in production, as has also happened for demersal fish in the Baltic sea.

Evidently, fishery production is positively influenced, like other biological production, by moderate levels of nutrient inputs, even if these inputs can also lead to negative and noxious effects close to the coast, such as harmful algae blooms, and health and aesthetic impacts, which are of particular concern to tourism and aquaculture, and are likely to damage critical habitats and have effects on biodiversity.

It nonetheless emerges from an objective analysis of GFCM fishery statistics that fishery production per shelf area, especially in the Northern Mediterranean, which is under the predominant influence of incoming rivers, has been increasing. Evidently there is a risk, especially for the high value demersal fish and invertebrates, that in semi-enclosed basins, estuaries and lagoons an excessive level of nutrient runoff will lead to drops in demersal and benthic commercial production, with extremely serious consequences. Judging from experience in the Black Sea, the impact of high nutrient inputs on pelagic fish is not negative, unless eutrophication allows jelly predators such as ctenophores to dominate the pelagic ecosystem, as occurred there, with drastic consequences on the anchovy fishery.

Although it is not possible to separate quantitatively the effects of fishing and of eutrophication on marine fisheries in the Mediterranean, it seems likely that a significant proportion of yield increases since the 1970's, especially in the Northern Mediterranean, are due to nutrient inputs, since evaluations performed since the mid 1970's suggested that we were close to, or at, Maximum Sustainable Yield (MSY), especially for the demersal fish.

The first conclusion therefore from this discussion, is that it would be misleading to consider nutrient runoff as a purely negative phenomenon from the perspective of fisheries, even though this impact is certainly negative for some other sectors. The focus should probably be on placing upper limits to nutrient runoff, and focusing elsewhere in this diagnosis more particularly on severely reducing non-biodegradable and toxic waste discharges, pesticides, organotin residues and other toxic by-products of industry and agriculture.

As noted, an exact quantification of nutrient impacts is not possible, but it may be concluded from existing fisheries statistics which show a plateau of landings, that current levels of nutrification have reached or recently exceeded optimal levels in the Adriatic and Gulf of Lions. We are probably approaching these optima also for the Aegean and directly off shore from the Nile Delta. Judging from satellite imagery of ocean colour, other areas such as the Levant and much of the southern Mediterranean, can still be considered strongly nutrient limited, and may show further increases in fishery yield if coastal runoff of domestic and agricultural nutrients continue. Over the long term, given the long period (quoted as of the order of 80 years), of nutrient accumulation and recycling of land runoff is likely to complete the conversion of the northern Mediterranean from an oligotrophic system to a eutrophic one some time in the 21st century. The implications of this obviously go beyond issues related to fishery production, and are not dealt with further here.

### 3.5.1.3 Indicative costs and benefits associated with Mediterranean fisheries

A simple mathematical model attempts to illustrate how increases in fishery production can occur when fishing intensity has exceeded levels that would result in catch declines under stable levels of biological production. This model may in future be tuned to fit the observed situation and hence tied to relative impacts of fishing and nutrient enrichment, but for the moment this is intended purely for purposes of illustrating synergistic effort of fishing effort and increases biological productivity due to increased nutrient runoff from land.

Considerable difficulties are associated with estimating losses due to human interventions in the Mediterranean environment, including the costs and benefits of different actions. These mainly stem from the fragmentary nature of the database, and here fisheries are no exception. One of the priorities for action in the fisheries sector is in fact to collect data that will allow both an indicative idea of the benefits of management action, and the losses associated with inaction. In relation to the problems of making financial estimates on management issues at this point in time, there is a need for basic analytical tools to support the decision-making process for managing fisheries on the basis of economic and eventually social considerations.

It is therefore clear that at this stage any attempt to calculate the value of the Mediterranean fishery and the economic impact of different actions to manage it, cannot hope to provide other than an order of magnitude of the likely effects, and the following brief analysis should be read in this light.

In absence of the data to permit detailed analysis, discussions in this paper have had to be based on the results obtained from a simple global model of Mediterranean fisheries (see next page) incorporating some conventional assumptions as to the trends in costs and revenues under equilibrium.

Indicative prices for fish and shellfish from the Northern Mediterranean confirm that fish prices here are among the highest in the world. Thus despite a figure for landings of 1,098,745 MT in 1992 (FAO sources), given current dockside prices, the indicative value for landings is some 3.8 billion dollars annually,<sup>1</sup> making the fishery sector a major contributor to the whole Mediterranean economy (Table 3.5.1.5) If we consider that coastal fishing units are labour-intensive, we can readily see that the fishery sector in most of Mediterranean countries constitutes an important source of revenue and also of employment.

At the same time, the limited stock assessment work done to date, supports the idea that most demersal and shellfish stocks are at or beyond the point corresponding to Maximum Sustainable Yield (MSY), as are the large pelagic fish and anchovy stocks, while other less important small pelagic stocks are probably below this level of fishing. It would seem logical therefore to perform indicative calculations on the basis that the fishery for the more important target species is either operating at MSY (for Maximum Sustainable Revenue (MSR): see

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<sup>1</sup> The FAO GFCMSTAT PC database for species landings was used. The total value of landings for each species (133 species or group of species) was calculated in US \$. An indicative value for US \$ per kilogram of "developing" countries was assumed, since the list of prices per kg refers to dockside prices in "developed" countries. For each species, prices of "developing" countries were taken as equivalent to half of those on "developed" country markets.

below) conditions, or between MSY, and at the extreme, even approaching the Point of Bioeconomic Equilibrium (PBE: see below) when net earnings from investment in the fishery approach zero.

If the fishery is currently at PBE, and the revenues of the fishery of the order of US \$ 3.8 billion annually, the costs of fishing under equilibrium should be of the same order of magnitude (Fig 3.5.1.1); indicating a considerable wastage in investment to result in a level of fishing that in the long run is unsustainable, especially for longer-lived species.

Based on this indicative model, if the fishery is then brought to MSY conditions, the revenues should go up to US \$ 4.2 billion, and costs drop to US \$ 3.7 billion, with a resulting increase in economic rent of the order of US \$ 451 million.

If the effort drops still further to Maximum Economic Yield (MEY), with this simple model, costs drop to US \$ 2.4 billion, and revenues drop slightly to US \$ 3.6 billion, and the economic rent should go up by some US \$ 790 million with respect to MSY conditions.<sup>1</sup> The Table below indicates that economic performance should improve if fishing effort is cut, by as much as half (moving from PBE to MEY); although social considerations mitigate against such a move in the short term. The cost and benefit figures given here should be regarded as relative rather than absolute, but illustrate the predictions of the conventional bioeconomic model.

**Summary of indicative calculations (US \$ billions) if fishery currently at Point of Bioeconomic Equilibrium (PBE)**

Reference points	MEY	MSY	PBE
Revenues	3.6	4.2	3.8
Costs	2.4	3.7	3.8
Economic rent	0.79	0.45	0

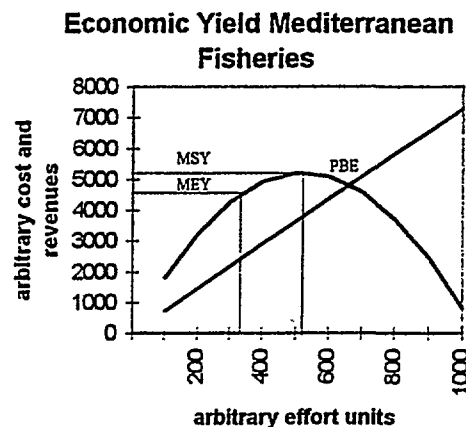


Figure 3.5.1.1

<sup>1</sup> This was done using a hypothetical yield curve which do not represent a fitting to the fishery, but is purely for indicative purposes.

The assumptions of the above indicative calculations are spelled out earlier. The assumption that the benefits of management might be phrased in terms of MEY conditions, ignores for the moment social considerations (in other words, unemployment in the fishery sector would certainly occur if effort were cut immediately to MEY conditions. This will certainly militate against an immediate and complete movement to the latter reference point.

As noted, costs of social considerations (such as unemployment) and management issues (such as research, MCS, etc.), have not been internalised in the model.\* However, it shows clearly that there are significant benefits in reducing the level of fishing effort, assuming the fishery is at or beyond MSY conditions, which we believe is the case. Furthermore, reducing fishing effort towards MEY conditions would have positive impacts on the ecosystem (a positive externality), would restore stock sizes, especially for longer-lived species, and would theoretically also contribute to a strengthening of coastal economies of the region, since funds saved would presumably be directed towards other more profitable investments.

#### **3.5.1.4 One hypothesis on synergistic effects of nutrients and fishing on fishery production**

A simple model (Fig.2) is postulated that is conceptually based largely on recent events in the Black Sea, Mediterranean and other inland seas (see e.g. Caddy, 1993), where sustained increases of fishery production despite high levels of exploitation strongly suggests that the usual model of stable or 'equilibrium' production does not apply, and that primary production, and hence standing biomass of biological production has been rising.

The model, used for illustration only, is a simple modification of the logistic model used above. Here the parameter in the simple logistic representing 'virgin biomass' or 'standing stock' is substituted for by a logistic function of primary production, such that fishery production is predicted to rise with increasing effort and increasing annual rates of nutrient enrichment to a maximum, before collapsing relatively rapidly, to simulate the combined effects of nutrient enrichment and overfishing. The model was adjusted such that in the absence of increases in nutrient runoff, the peak production would be reached in 1979, since it was in the 1970's that evidence that the fishery is at or beyond MSY was first mentioned. The overall fishery production peaks however in the early 1990's; a situation that resembles for example that in the Adriatic and Gulf of Lions divisions of GFCM (See Caddy et al, 1995).

**\*Note:** The cost of the interventions (US \$ 4.45 million) proposed in the Table is roughly 0.1% of the landed value estimate mentioned above

Hypothetical interaction between effort and primary production as it affects fishery yield

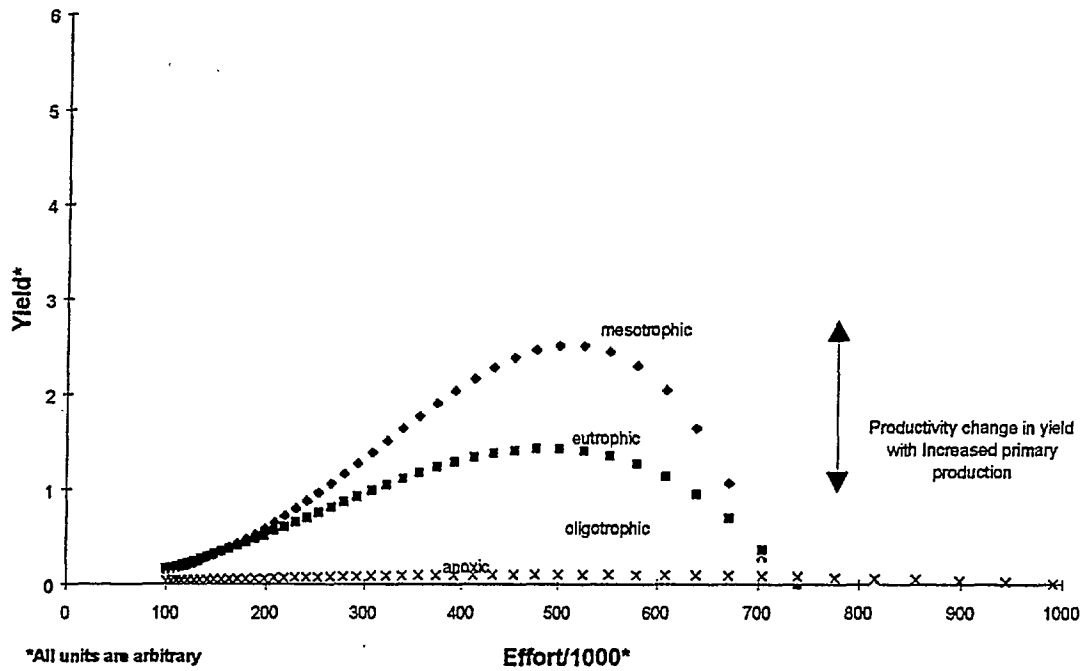


Figure 3.5.1.2

References

Caddy, J.F., 1993. Towards a Comparative Evaluation of Human Impacts on Fishery Ecosystems of Enclosed and Semi-enclosed Seas. *Rev. Fish. Sci.* 1(1-5) 38.

Caddy, J.F., R. Refk and T. Dochi, 1995. Productivity Estimates for the Mediterranean: evidence of accelerating ecological change. *Ocean and Coastal Management*, 26: 1-18. G. 104/Inf 6.

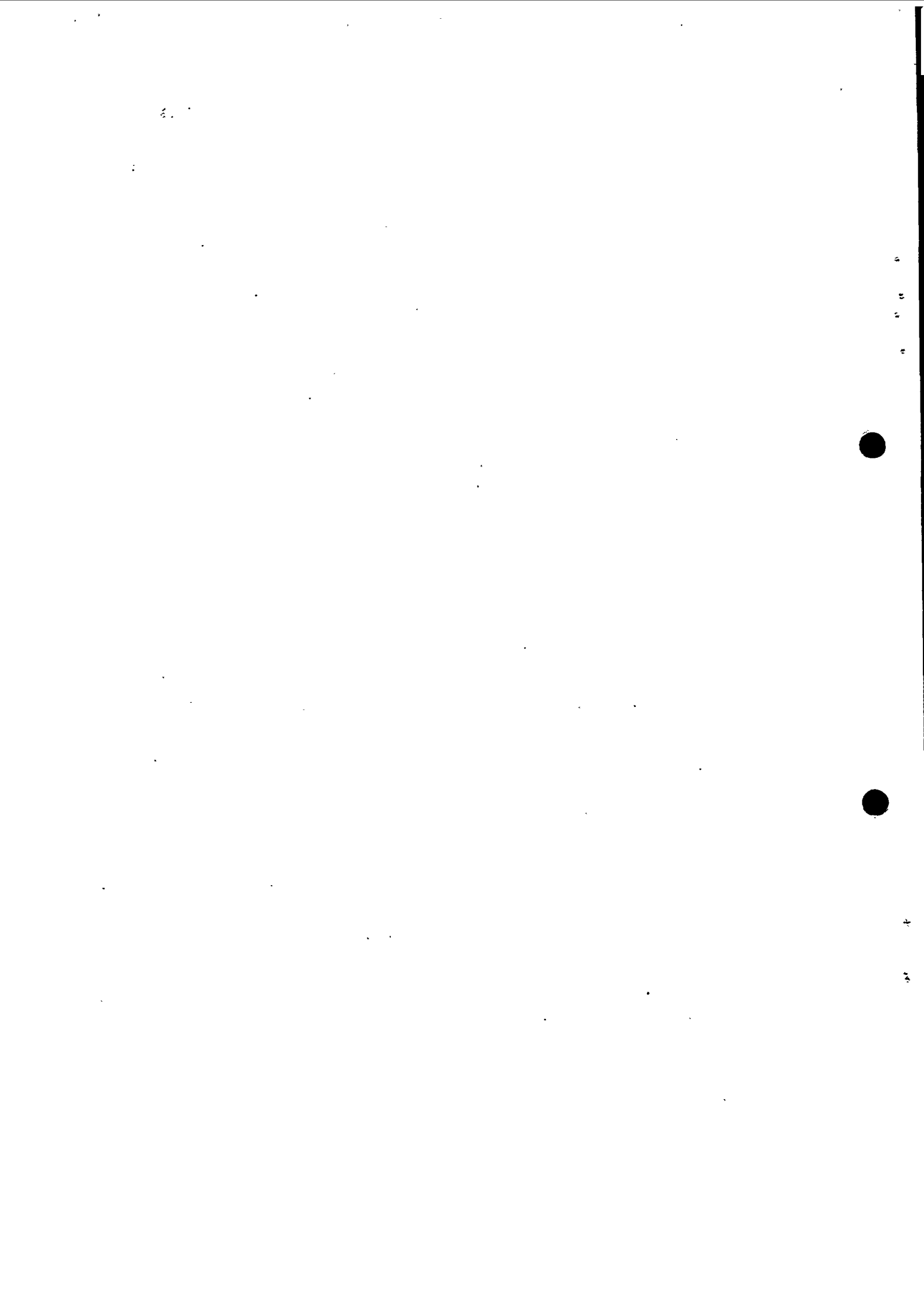


Table 3.5.1.1 Living marine resources (fishery) - root causes and associated problems

ROOT CAUSES	PROBLEMS
<p>A. Lack of appropriate institutional and legal frameworks at national levels needed to encourage sound responsible fisheries management within territorial waters</p>	<ol style="list-style-type: none"> <li>1. Poor planning capacity for responsible management of fisheries</li> <li>2. Poor communication between policy makers, fishers and fishery scientists</li> <li>3. Inadequate formulation of regulations and in particular, poorly defined rights and responsibilities of those with local access to resources within national legislation</li> <li>4. Inadequate fishery regulation enforcements in territorial waters</li> </ol>
<p>B. Weak and uncoordinated national approaches at the international level in fisheries research, to support decision making processes in fisheries management</p>	<ol style="list-style-type: none"> <li>5. Inadequate provisions for fisheries monitoring and statistical data gathering</li> <li>6.1. Lack of multidisciplinary approaches to fishery management issues</li> <li>6.2. Lack of coordination between fishery researchers and regulatory agencies</li> </ol>
<p>C. Inadequate formulation and application of international initiatives concerning transboundary fish resources management and conservation and consequent overexploitation</p>	<ol style="list-style-type: none"> <li>7. Weak subregional cooperation and insufficient role of the competent fisheries regional organizations</li> <li>8.1. Inadequate coordination and harmonisation of national measures for fisheries in international waters and on shared, straddling and highly migratory stocks</li> <li>8.2. Inadequate implementation of the UN Agreement on Straddling fish Stocks and Highly Migratory Fish Stocks and the provisions of the Code of Conduct for Responsible Fisheries Management</li> <li>8.3. Inadequate fisheries regulation enforcement, weak and uncoordinated fishery control and surveillance in international and national waters, including in port control</li> <li>9. Overexploitation of resources and overcapitalization of fleets</li> </ol>
<p>D. Lack of understanding of long-term effects of nutrient enrichment and pollutants from dumping and from incoming on fisheries in the Mediterranean</p>	<ol style="list-style-type: none"> <li>10.1. Absence of research work on the impacts of nutrient enrichment and pollutants on fisheries</li> <li>10.2. Inadequate quantification of nutrient and pollutant input rates and quantities into Mediterranean catchment basins</li> <li>10.3. Poor communication between research groups working on fisheries and on pollution issues in the Mediterranean</li> </ol>
<p>E. Lack of appreciation of effects of coastal development and other human activities, including trawling, on Mediterranean critical habitats and catchment basins of importance to fisheries</p>	<ol style="list-style-type: none"> <li>11.1. Insufficient research on incidental impacts of trawling and other non selective gears on marine ecosystems</li> <li>11.2. Lack of monitoring systems to detect introduced species</li> <li>11.3. Inadequate regulations and enforcement regarding trawling and dredging on critical habitats, nursery/spawning and inshore/estuarine and vegetated areas</li> </ol>

Table 3.5.1.2 Living marine resources (fishery) - areas of intervention and proposed action

AREAS OF INTERVENTION	PROPOSED ACTIONS
<p>A. Strengthening of the institutional and legal frameworks to ensure sustainable human development of those dependent on fisheries</p>	<ol style="list-style-type: none"> <li>1. Increase institutional capacity for sound planning and management of fisheries</li> <li>2. Develop tools for the dissemination of information on fisheries management issues in the language of the target audience</li> <li>3. Reconcile traditional management mechanisms and established fishers rights and responsibilities (top-down mechanisms) with governmental infrastructure for sectorial management (bottom-up mechanisms)</li> <li>4. Improve Monitoring, Control and Surveillance (MCS) systems for fisheries management</li> </ol>
<p>B. Improve infrastructure needed for monitoring and managing fisheries at national level and improve the international coordination of fisheries research</p>	<ol style="list-style-type: none"> <li>5. Provide networks for information gathering and exchange using standard formats and improve data gathering and statistical reporting on large scale and small scale fleets. Develop efficient and standardized data collection methods through collaborations at the national and international level</li> <li>6. Existing international organizations concerned with aspects of fisheries management (GFCM, ICCAT, CIESM, etc.) should revise their terms of reference and rules of procedure in light of advisory needs for fishery management</li> </ol>
<p>C. Establish effective mechanisms for co-ordination of resource management within international waters (GFCM is the concerned body) Implement adopted recommendations in relation to fleet registries and adaptation of fishing capacity to the resources</p>	<ol style="list-style-type: none"> <li>7. Strengthen the effectiveness of GFCM providing necessary financial support to it and its subsidiary bodies and revise its terms of reference and rules of procedure to support effective fishery management</li> <li>8. Increase support to international regulatory body (GFCM). Implement effective GFCM resolutions in national and international waters</li> <li>9. Establish of coordinated MCS systems. Complete a registry of fishing boats working in international waters and establish complementary national lists for additional vessels operating out of national ports. Reduce fishing effort as required to meet established reference points for safe resource production</li> </ol>
<p>D. Improve understanding of impacts of nutrient enrichment and pollution on fisheries in the Mediterranean</p>	<ol style="list-style-type: none"> <li>10.1. Establish research priorities and allocate adequate funding to investigate and analyse impact of nutrient enrichment and pollutants on fisheries in the Mediterranean</li> <li>10.2. Establish monitoring programs to assess nutrient runoff and pollutant concentrations in Mediterranean catchment basins (to be covered by the group outlined in section 3.1.6)</li> <li>10.3. Improve co-ordination between research groups working in Mediterranean catchment basins</li> </ol>
<p>E. Formulate effective measures for coastal area management and management of catchment basins and the reduction of ecological impacts on Mediterranean habitats and biota</p>	<ol style="list-style-type: none"> <li>11.1. Conduct research on the impact of fisheries on marine ecosystems (anthropogenic impacts on habitats, by-catch and discards, incidental catches, biodiversity reduction, "ghost" fishing). Formulate and implement. Regulations regarding trawling and dredging on critical habitats and nursery/spawning areas</li> <li>11.2. Establish monitoring programs to detect introduced species</li> <li>11.3. Regulate the use of trawling gears on critical habitats</li> </ol>



Table 3.5.1.3 Living marine resources (fishery) – problems categorised by key resource type

RESOURCE CATEGORY	STATE OF STOCKS	ECOLOGICAL/ENVIRONMENTAL CONTROLS	FISHERIES MANAGEMENT MEASURES	OPERATIONAL TARGETS
<i>Estuarine, anadromous and catadromous resources</i>	Eel populations declining in The Mediterranean. Other estuarine species affected <i>Landings: 31,263 MT</i> <i>Value: US\$ 95,666,000</i>	High priority to maintaining environmental quality and integrity, and runoff characteristics of estuaries, lagoons and wetlands needed	Selective closure, and effective monitoring, of sensitive nearshore estuarine areas to trawling and dredging operations	Management measures in these areas are largely outside fisheries control, and depend on events in other economic sectors and on runoff from catchment basins
<i>Benthic Shelf Resources</i>	Excessive levels of Dredging of "vongole" (clams) has depleted stocks in Adriatic and other areas like the Alboran Sea. We have to take into account that an undefined proportion of molluscan production referred to in this analysis comes from extensive aquaculture. Sponge epidemics noted <i>Landings: 234,018 MT</i> <i>Value: US\$ 1,220,276,000</i>	Institution of leases/rotational closures of areas subject to dredging for shellfish will allow time for stock recovery. Closures on bottom dredging and trawling in very shallow and vegetated areas, and in high temperature seasons over anoxic muddy bottoms, especially when low oxygen conditions are a risk	Season/area closures of Inshore/ecologically sensitive areas to bottom dredging/trawling, especially in warm season. Possible incentives are provision of leases to fishermen, or rotational harvesting schemes. Requirement for monitoring provisions at national expense	National plans of ecologically sensitive areas developed, implemented and monitored within GIS plan for coastal resource development with fishermen participation
<i>Demersal Shelf Resources</i>	Key stocks fully to Overfished <i>Landings: 198,136 MT</i> <i>Value: 1,032,485,000 \$</i>	Control fishing effort/fleet size	Seasonal closures of trawling Especially inshore during juveniles recruitment periods. Consideration to protect areas of adult spawners from excessive fishing	Mapping of nursery areas/seasons, and spawning areas/concentrations for key demersal fish species

<p><b>Pelagic Resources</b></p>	<p>Some potential for Expansion, except anchovy</p> <p><i>Landings 493,604 MT</i> <i>Value: US\$ 549,824,000</i></p>	<p>Monitor changes to ecological condition of pelagic environment due to nutrient enrichment, and invasions by jelly predators</p>	<p>Encourage conversion of fishing effort from demersals, anchovy and large pelagic fish to sardines and other small pelagics</p>	<p>Promote consumer acceptance of sardines and other low value species present in abundance</p>
<p><b>Slope Resources</b></p>	<p>Red coral resources/lobsters overfished or seriously overfished. Offshore spawning concentrations of Hake need protecting from recruitment overfishing</p> <p><i>Landings: 85,256 MT</i> <i>Value: US\$ 646,273,000</i></p>	<p>Monitor health of slope ecosystems</p>	<p>In order to avoid listing in CITES book of species (such as red coral) for which trade is prohibited, Formal management plans for slope resources are needed with specific access rights, which specify areas where certain types of fishing gear may not operate</p>	<p>A management system for slope resources is called for, at least initially on a species by species basis. Effective monitoring, and control is essential</p>
<p><b>Migratory Resources</b></p>	<p>Bluefin tuna stocks Depleted, and swordfish in some areas are overfished, and dominated by very young fish</p> <p><i>Landings: 56,468 MT</i> <i>Value: US\$ 248,604,000</i></p>	<p>General monitoring of Mediterranean environment needed</p>	<p>Fishing with long drifting gear should be controlled, and prohibited in the vicinity of straits where migration routes pass</p>	<p>Apply provisions of UN agreement on highly migratory species, and ICCAT and GFCM resolutions on minimum sizes and effort control</p>

Table 3.5.1.4 Living marine resources (fishery) – key fishery “hot spots”

DIVISIONS	ECOLOGICAL/ENVIRONMENTAL CONTROLS	FISHERIES MANAGEMENT MEASURES	OPERATIONAL TARGETS
1. <i>Alboran Sea</i>	None	Need for fisheries agreement on research and management of shared pelagic resources between coastal States	Seek basis for agreement through GFCM
2. <i>Gulf of Lions</i>	Monitor nutrient and pollutant inputs from Rhone and Ebro. Check level of contaminants	Promote cooperative exploitation of resources shared by adjacent States. Promote rational aquaculture	Seek specific consultative mechanism for common stocks via EC, involving local fishermen
3. <i>Adriatic</i>	Monitor nutrient and pollutant inputs from Po. Check level of contaminants	Promote cooperative exploitation of resources shared by adjacent States. Promote rational aquaculture	Seek international mechanism for management of Adriatic resources in cooperation with EC/GFCM
4. <i>Sicily Channel and Gulf of Gabes</i>	Establish monitoring system for Gulf of Gabes environment/habitats (especially plan for protection of sea grass beds)	Promote cooperative exploitation of resources shared by adjacent States. Promote rational aquaculture	Seek international mechanism for management of Sicily Channel and Gulf of Gabes resources in cooperation with EC/GFCM
5. <i>Aegean</i>	Monitor nutrient and other inputs from Marmara and from coastal rivers and cities	Need for fisheries agreement on research and management of shared resources between coastal States, despite political differences	Seek international mechanism for management of Aegean resources in cooperation with EC/GFCM
6. <i>Levant</i>	Monitor nutrient and other inputs from Nile Delta and from coastal cities. Check Lessepsian immigrants from Red Sea	Need for fisheries agreement on research and management of shared resources between coastal States, despite political differences	Seek international mechanism for management of shared resources in cooperation with GFCM

Table 3.5.1.5 Living marine resources (fishery) – Mediterranean landings by key resources and their indicative values (1992)

TYPE OF RESOURCE	TOTAL LANDINGS (MT)	DEVELOPED COUNTRIES LANDINGS (MT)	DEVELOPING COUNTRIES LANDINGS (MT)	VALUE OF LANDINGS DEVELOPED COUNTRIES (US\$ 1000)	(*) VALUE OF LANDINGS DEVELOPING COUNTRIES (US\$ 1000)	VALUE OF LANDINGS TOTAL (US\$ 1000)
PELAGIC RESOURCES	493604	249135	244469	437397	112426	549824
HIGHLY MIGRATORY RESOURCES	56468	32323	24145	193212	55391	248604
DEMERSAL RESOURCES	198136	116490	81646	736914	295571	1032485
SLOPE RESOURCES	85231	70090	15141	577733	64853	642585
BENTHIC RESOURCES	233955	227013	6942	1191123	29110	1220233
ESTUARINE RESOURCES	31263	13950	17313	72759	22907	95666
CORALS	25	12	13	2374	1314	3688
SPONGES	63	23	40	23	20	43
<b>TOTAL</b>	<b>1098745</b>	<b>709036</b>	<b>389709</b>	<b>3211535</b>	<b>581592</b>	<b>3793128</b>

\* Indicative value for US\$ per kilogram in developing countries assumed = (US\$ per kilogram in developed countries / 2)

TOTAL CATCH = 1.009 million metric tons

TOTAL VALUE = US\$ 3.793 billion

NOTES:

- Black Sea excluded
- "Developed" countries: Italy, France, Greece and Spain
- "Developing" countries: Remaining countries

Table 3.5.1.6 Costs of proposed actions

PROPOSED ACTIONS (numberes correspond to table 2.5.1.)	ACTIVITIES AND BASIS OF CALCULATIONS	COST IN US\$ 1000	
		Activities	Actions
1. Increase in institutional capacity and communications between fisheries experts*	<ul style="list-style-type: none"> <li>Seminars<sup>1</sup> (2 x 50 people)</li> <li>WG<sup>1</sup> of experts (4 meetings of 3 days and 6 experts)</li> <li>Consultants (1 man -year)</li> <li>WG<sup>1</sup> for scientists/economists/managers and fishery sector (2 meetings of 3 days and 12 people)</li> <li>Included in GFCM activities (5 and 6)</li> </ul>	100 72DSA+24trav= 39 80 72DSA+24trav= 39	258
2. Develop tools for dissemination of info.*	<ul style="list-style-type: none"> <li>Newsletters, dialogue meetings, seminars, video programs</li> </ul>		100
3. Reconcile "top-down" with "bottom-up" management mechanisms	<ul style="list-style-type: none"> <li>WGs<sup>2</sup> for scientists/economists/ managers and fishery sector (4 meetings of 3 days x 6 people)</li> <li>Seminars<sup>2</sup> (2 seminars x 50 people)</li> </ul>	72DSA+24trav= 39 100	139
4. Establish Fishery Monit., Control & Surveillance (MCS) system at natl. level to ensure implementation of regulations <sup>3</sup>	<ul style="list-style-type: none"> <li>Establish the mechanism + provide advisory service</li> <li>WG of experts (4 meetings of 3 days x 6 exp.)</li> <li>Consultants (1 man-year)</li> <li>(Does not include costs of equipment and installation)</li> </ul>	72DSA+24trav= 39 80	119
5. Provide networks for information and develop data collection methods*	<ul style="list-style-type: none"> <li>Establishment of networks.</li> <li>WG of experts (4 meetings of 3 days x 6 exp.)</li> <li>Consultants (1 man-year)</li> </ul>	72DSA+24trav= 39 80	119
6. Intern. Organ. Schemes to provide advice for manag*	<ul style="list-style-type: none"> <li>Advisory WG for fisheries management : 5 meetings</li> </ul>		250
7/8. International Management Body	<ul style="list-style-type: none"> <li>GFCM annual budget currently paid for out of FAO Regular Programme funds, but in future will be progressively be paid for by member states. (Transition costs to independent function = \$400.000)</li> </ul>	(Assumes coordinating role over other items)	400
Establish co-ordinated international systems of MCS and Registry of fleets <sup>3</sup> (any compensation fishermen for licence reduction at expense of national Administrations)	<ul style="list-style-type: none"> <li>Control systems + Inspection Vessel<sup>4</sup> of inspection at sea (US\$ 1500 /year/vessel)</li> <li>Consultants*</li> <li>WG of experts (4 meetings of 3 days x 6 exp.)*</li> <li>(Does not include costs of equipment and installation)</li> </ul>	(cost/vessel/yr= 4000-nat. expense) 80 72DSA+24trav= 39	119
9. Research on fisheries*	Taking as reference the annual budget of a Research Centre with 5 scientists, 10 technicians, 10 support personnel + infrastructure and material, but allocated among Mediterranean fisheries institutes Support to costs of running cooperative subreg. research cruises	Total cost = 1200 <sup>5</sup> 2000	550 2000
10. Research on impacts of fisheries on environment* Monitor and control Impact of introduced species*	Research projects (general research expenses included in 10) Research projects (general research expenses included in 10)	200 200	400
		<b>TOTAL</b>	<b>4454</b>

\*Preferably annual, or at least for first few year of a possible integrated project of 3-5 yr duration

<sup>1</sup> People involved in fisheries management.<sup>2</sup> People involved in fisheries.<sup>3</sup> Annual budget for infrastructure would be at expense of national administrations.<sup>4</sup> Inspection Vessels of around 1000 GRT. Other possibilities are combine with small vessels, helicopters, etc =.<sup>5</sup> Annual Salaries 650 (not included), Travels 70, Materials + Supplies 110, General Maintenance 70, Research Projects 300 = 1200.

### 3.5.2 Living Marine Resources (Aquaculture)

The development of aquaculture practices in the last twenty years has entirely changed its philosophy and standards by reaching a respectable production capacity.

From traditional extensive rearing of finfish (mainly mullet and eel) and crustaceans (shrimps, crabs) in lagoons and/or lagoon-like ponds it moves towards more intensive way of production. Based on natural productivity of shallow coastal and estuarine zones of Egypt, Tunisia, Spain, France, Italy, Albania and Greece, and being affected by human impacts this activity is now in a state of crisis in many countries.

A more recent (the 60's and 70's) shellfish culture (mainly mussels, oysters and clams) in highly productive coastal zones has been developed. Although developing under enormous pressure this activity has remained in the Mediterranean and adjacent seas reliable and prospective. The main limiting factors to its expansion are competition on international markets and the water quality which may affect commercial quality standards.

A very recent intensive finfish culture (mainly sea bass and sea bream) in the marine waters of Greece, Spain, France, Italy, Turkey, Croatia, Israel, Cyprus, Malta, Tunisia, Morocco resulted in commercialization of large volumes of finfish. From an early research stage in 1970, the successful scientific and technical development of Mediterranean marine aquaculture over recent years made possible a production which is exceeding 40.000 tons in 1996 (compared to 16.000 in 1992) - as much as 50% from Greece alone. The technology of fingerlings production include more or less a total control of biological cycle while majority of the on growing facilities are developed on the sea (floating cages) and very few on land (tanks). This finfish mariculture industry comprises above 500 production units operating in about 11 Mediterranean countries.

Aquaculture in Mediterranean represents 5% of the world total (780.000 tones). It is more developed in marine species particularly in shellfish than in the rest of the world, in which freshwater species are dominant (Tab. 3.5.2.1). Main moluscs production are mussels especially from Spain, and oysters mainly from France. The production of some fin fish, such as sea bass and sea bream is in constant progression (Table 3.5.2.2).

Table 3.5.2.1 Main characteristics of Mediterranean aquaculture in 1996 as related to world production

	MEDITERRANEAN	WORLD
TOTAL PRODUCTION	780.000 (5%)	14.000.000
% Marine aquaculture	76	35
% Freshwater aquaculture	24	65
% Fish	34.6	48.9
% Crustaceans	0.3	5.1
% Mollusks	64.5	18.1
% Algae	0.6	27.9

In terms of value of aquaculture production in Mediterranean, the estimates are rising to over 1.950 million in 1996 (Table 3.5.2.3). The most important group in terms of economic value were molluscs (900 million USD), followed by marine finfish (sea bass and sea bream) and freshwater finfish (salmonids).



Table 3.5.2.2 Aquaculture production in Mediterranean countries in 1992 and 1996 (in 000 tons)

Country	GREECE		SPAIN		ITALY		FRANCE		ALBANIA		ALGERIA		CROATIA		CYPRUS	
	92	96	92	96	92	96	92	96	92	96	92	96	92	96	92	96
Species																
Sea bass	3.20	8.00	0.15	0.50	1.80	3.60	1.00	2.70					0.56	1.50	0.03	0.12
Sea bream	3.30	9.00	1.67	3.00	1.10	3.20	0.30	0.95					0.17	0.25	0.04	0.52
Mullet			0.05	0.15	2.90	3.00			0.03							
Trout	2.05	2.00	18.50	20.00	35.4	50.00	41.00	45.00	0.02	0.04			0.40	0.40	0.09	0.08
Carp	0.16	0.15			0.35	0.60	5.00	5.50	0.10	0.10	0.11		8.7	6.5		
Tilapia								0.05								
Salmon	0.04	0.03	0.78	0.56			0.95	1.30								
Eel	0.13	0.60			3.30	3.00	0.80	0.80								
Turbot			1.60	2.00			0.20	0.70								
Other fishes					4.70	2.00	4.00	4.20			0.01		1.85	1.8		
<b>TOTAL FISH</b>	8.88	19.78	22.75	26.21	49.55	65.40	53.25	56.20	0.12	0.14	0.15		13.36	10.45	0.16	0.72
Mussel	13.70	22.00	138.00	93.00	84.00	105.00	62.00	62.00	0.30	0.40	0.02		1.70	1.60		
Oyster			2.60	2.80			133.00	154.00					0.25	0.10		
Clam			3.50	3.60	26.00	60.00	0.40	0.50								
<b>TOTAL MOLLUSKS</b>	13.70	22.00	144.1	99.4	110.00	165.00	195.4	216.50	0.30	0.40	0.02		1.95	1.70		
<b>CRUSTACEA</b>																
<b>ALGAE</b>			2.20	2.20	0.05	0.05	0.05	0.05								
<b>COUNTRY TOTAL</b>	22.58	41.78	169.05	125.61	164.60	235.45	248.70	272.75	0.42	0.54	0.17		15.31	12.15	0.16	0.72

Sources: IMBC Nireus Group (Greece); IEO/SGPN (Spain); ICRAM/FAO (Italy); IFREMERM (France); DOF (Albania); ANDP (Algeria); IOF (Croatia); FNR (Cyprus).



Table 3.5.2.2.a Aquaculture production in Mediterranean countries in 1992 and 1996 (in 000 tons)

Country Year Species	EGYPT		ISRAEL		MALTA		MOROCCO		TUNISIA		TURKEY		OTHERS*	
	92	96	92	96	92	96	92	96	92	96	92	96	92	96
Sea bass	0.72	0.95			0.10	0.4	0.12	0.30	0.09	0.05	0.81	2.80	0.01	0.02
Sea bream	0.94	1.50	0.05	0.20	0.20	1.3	0.25	1.00	0.10	0.30	0.94	4.80	0.01	0.01
Mullet	8.20	20.10	0.90	0.90			0.20	0.20	0.04	0.20	1.0			
Trout			0.38	0.45			0.15	0.07			6.2	7.50	0.15	0.60
Carp	7.30	23.50	9.00	8.50					0.03	0.05	0.25	0.35	2.15	2.50
Tilapia	21.50	27.80	3.90	4.50									0.60	0.60
Salmon											0.68	0.65		
Eel					0.04	0.10	0.07	0.10						
Turbot					0.01									
Other fishes	0.50	1.00							0.13	0.20				
<b>TOTAL FISH</b>	<b>39.16</b>	<b>74.85</b>	<b>14.23</b>	<b>14.55</b>	<b>0.30</b>	<b>1.75</b>	<b>0.51</b>	<b>1.67</b>	<b>0.39</b>	<b>0.80</b>	<b>9.88</b>	<b>16.1</b>	<b>2.92</b>	<b>3.37</b>
Mussel									0.14	0.04				
Oyster							0.12	0.15						
Clam										0.03				
<b>TOTAL MOLLUSKS</b>										0.07				
<b>CRUSTACEA</b>							0.01					0.04		
<b>ALGAE</b>														
<b>COUNTRY TOTAL</b>	<b>39.16</b>	<b>74.85</b>	<b>14.23</b>	<b>14.55</b>	<b>0.30</b>	<b>1.75</b>	<b>0.71</b>	<b>1.83</b>	<b>0.53</b>	<b>0.87</b>	<b>9.88</b>	<b>16.14</b>	<b>2.92</b>	<b>3.37</b>

Sources: GAIRD (Egypt); IORL (Israel); NAC (Malta); ISPM (Morocco); DGPA (Tunisia); TUBITAK (Turkey); MBRC (Libya); MRC (Lebanon); DOF (Syria)

\* Libya, Lebanon and Syria

Table 3.5.2.3 Aquaculture production in Mediterranean in 1996 (tons and USD)

Species	Quantity (tons)	Value (USD million)*
Sea bass	20 940	188.50
Sea bream	26 030	208.20
Mullet	24 550	98.20
Trout	126 140	264.90
Carp	21 470	27.90
Tilapia	32 950	82.40
Salmon	2 540	17.80
Eel	4 540	45.40
Turbot	2 710	21.70
Other fish	9 200	23.00
<b>TOTAL FISH</b>	<b>271 070</b>	<b>978.00</b>
Mussel	284 040	199.00
Oyster	157 050	550.00
Clam	64 130	151.00
<b>TOTAL MOLLUSKS</b>	<b>505 220</b>	<b>900.00</b>
<b>CRUSTACEA</b>	<b>2 350</b>	<b>70.50</b>
<b>ALGAE</b>	<b>5 000</b>	<b>2.00</b>
<b>AQUACULTURE TOTAL</b>	<b>783 640 tons</b>	<b>1 950.50 million USD</b>

The rapid mariculture development in northern Mediterranean countries is expected to slow down because of several recent problems. Cost-effectiveness and the quality of products on one side and high competition for the use of coastal area on the other, as well as global quality of the coastal environment in which mariculture is taking place remain main obstacles for the future development.

The number of suitable sites for marine aquaculture in the Mediterranean is continuously decreasing due to competition between coastal area users while at the same time the pollution and degradation of existing mariculture sites is progressing.

Many of the polluting substances originating from land-based sources are of particular concern to the marine aquaculture since they exhibit at the same time toxicity, persistence and bioaccumulation in the food chain.

Pollutants entering a mariculture system show a large time-scale variability and should, therefore, be viewed as a dynamic process. For example, pollution reaching the aquaculture site could have a distant origin, but be transported into area by local currents. Concentration of a pollutant could be at a very reduced level but on a large time scale could contaminate the reared species to a harmful level. Water quality standards are, therefore, often difficult to set because of the dispersion processes.

Over-urbanized or industrialized areas are often responsible for organic matter discharges leading to eutrophication or oxygen depletion (Table 3.5.2.4).

\* Value was estimated based on average of Italian and French market according to ICRAM (Italy) and IFREMER sources of data (FAO/ICRAM meeting Bari, 1997)

Table 3.5.2.4 Pollution from land-based sources and its relationships with marine aquaculture in Mediterranean

ACTIVITY	IMPACT ON QUALITY OF AQUACULTURE ENVIRONMENT
Urbanization	<ul style="list-style-type: none"> <li>• Sewage (-)</li> <li>• Organic matter (-)</li> <li>• Bacteria and viruses (-)</li> <li>• Nutrients (+/-)</li> </ul>
Industry and harbor	<ul style="list-style-type: none"> <li>• Organic matter (-)</li> <li>• Pollutants (-)</li> <li>• Ballast waters (-)</li> <li>• Heated waters (+/-)</li> </ul>
Tourism and recreation	<ul style="list-style-type: none"> <li>• Sewage (-)</li> <li>• Anti-fouling paints (-)</li> <li>• Specific organic-detergents (-)</li> </ul>
Agriculture	<ul style="list-style-type: none"> <li>• Pesticides (-)</li> <li>• Suspended solids</li> <li>• Fertilizers (+/-)</li> <li>• Organic matter (+/-)</li> <li>• Freshwater input (-)</li> </ul>

(-) negative effect relationship to marine aquaculture

(+) in favor of marine aquaculture

Although sewage can be depurated, viruses could pass through the depuration plant and be responsible for viral contamination.

Two categories of pollutants may be distinguished: organic loadings as one kind and toxins as another. Organic loading (nutrients) in an extensive or semi-intensive aquaculture system can affect adversely an aquatic ecosystem when leading to dystrophy, but also it may play a quite positive role.

Nutrients, mainly nitrogen and phosphorus, whether derived from urban waste waters, from industrial discharges, from agricultural runoff or from natural weathering of the land, act as biostimulants, causing eutrophication - an enhancement of the growth of seaweeds and phytoplankton. One of final consequences is depletion of the oxygen with adverse impact on fish and invertebrates. The effect of nutrients are particularly pronounced in sheltered areas where water exchange with the open sea is restricted, and where there is considerable urbanization or industrialization, or where large rivers draining agricultural land reach the coast. The inner Adriatic is an obvious example, and also Nil Delta, Gulf of Lions. Sewage presents an additional problem by carrying pathogenic organisms that can cause disease in human beings by contamination of seafood and beaches.

Examination of literature on high yielding lagoons in the Mediterranean (over  $400\text{kg/ha}^{-1}\text{yr}^{-1}$ ) indicates that in most cases changes in the environment may be explained by "cultural eutrophication". Man-made eutrophication plays a role in lagoon fishery productivity in many lagoons where a positive effect has been recognized and quantified.

It was repeatedly reported that crabs and mollusks resources may be even under harvested in many lagoons where impact of eutrophication is underestimated.

There is much evidence of coastal area being damaged by eutrophications. The effects of introduction of such eutrophizing load into coastal waters are well known and can be summarized as follows: higher BOD, decrease DO, nutrient enrichment, increase of primary production, algal blooms, and in particularly stressed conditions production of hydrogen sulfide.

Some coastal areas in the Mediterranean where marine aquaculture is practiced are severely polluted by specialized industries and agricultures with various kind of toxins which are more or less toxic for culturing organisms.

Pollution can cause economic losses in a variety of ways. The degree of impact on cultured organisms depends basically on the extent of pollution into receiving waters, and their chemical characteristics.

Poor water quality due to presence of certain toxic substances at the source is generally closely associated with high mortality of the culturing organisms without suffering any symptoms or lesions. In most cases whole population is subjected to the stress syndrome in response to a global environmental stimulus which may include both natural and anthropogenic stressors with all the possible interaction between them. Stress factor can induce disease by themselves or by weakening of an organism can facilitate spreading of the pathogens.

Reduction of quality of end-product is a common problem in shellfish industry. Hygienic quality of aquaculture product in most developing countries in the Mediterranean is not meeting EU quality standards. Very precise classification of the culturing areas is required as well as continuous monitoring of it if healthy end-product will be achieved.

Little informations are available on the economic value of losses in Mediterranean mariculture caused by pollution. Algal blooms often present problems in respect to optimal utilization of shellfish resources, and the effect can be catastrophic. Mussel culture in Spain, but also at certain extent in other Mediterranean countries were drastically reduced due to blooms of dinoflagellate. The occurrence and persistence of troublesome algae, even if not at the level of bloom concentrations may cause problems; hypoxic conditions over summer may have the negative consequences on the entire aquaculture operations.

Because of the problems with algal bloom the insurance rates for marine aquaculture operations has increased. This has a negative effect on the effort made towards reduction of cost of production. However, because of lack of exact information related to disruption of optimal utilization of shellfish resources it is not possible to give precise estimation on economic value of losses.

Insurance records from Greece which is producing nowadays above 50% of the Mediterranean finfish total could be used as a useful tool in order to estimate the losses value of the Mediterranean finfish aquaculture.

Table 3.5.2.5 Frequency analysis of the damages of Greek Mariculture Industry during the period 1986-1994 (from Report on SELAM Network, Montpellier-France, 1995)

Reasons	Cases (No)	Loses value (USD million)	Loses value (%)	Cases freq. (%)
Adv. climatic conditions	70	1.76	48.21	35.53
Diseases	68	0.89	24.48	34.51
Environmental changes	17	0.42	11.64	8.62
Illegal actions	16	0.23	6.41	8.12
Unknown reasons	4	0.12	3.24	2.03
Bad management	9	0.12	3.24	4.56
Aq. Animals attacks	2	0.04	1.12	1.01
Transport	5	0.03	0.84	2.53
Other	6	0.03	0.82	3.04
<b>Total</b>		<b>3.64</b>		

Results from table 3.5.2.5 show a diversification of the damages. The major problems of the industry are due to the adverse weather conditions as a results of inadequate technology and the lack of experience in the beginning.

The frequencies of losses due to the environmental conditions (i.e. algal bloom, lack of oxygen, etc.) are on the third place, and is increasing with the production growth and the expansion of the mariculture industry. The similar pattern is recorded with the spreading of diseases which has been recorded as main unknown factors of serious fish losses during the period 1987-1989. It is possible that number of cases attributed to diseases outbreaks are also environmentally related. Namely, environmental stimulus which may include both natural and antropogenic stressors by weakening of an organism can facilitate spreading of the pathogens.

Concern about increasing pollution from land-based sources to marine aquaculture environment has created new demands to prevent, reduce, and control possible negative impact to aquaculture industry so as to maintain and improve its productive capacity. There is currently no global scheme to address aquaculture pollution from land-based sources. Since it depends on the intensity of impact caused by human settlements, land use, construction of coastal infrastructure, agriculture, urban development, tourism and industry that can affect the marine environment. Coastal erosion and siltation are also of particular concern, particularly when dealing with shellfish culture. The contaminants themselves are also in variable order of importance and depending on different national or regional situations as regard characteristics of the recipient waters, sediments, sewage, nutrients, synthetic organic compounds, etc.

## Activities

To deal with the degradation of the coastal marine environment from land-based pollution, states should take action at the national level, and where appropriate, at the regional and subregional levels in concern with specific environmental requirements of marine aquaculture.

### Proposed intervention at national level

\* As concerns placing of marine aquaculture, priority actions to be undertaken by states may include:

- Consideration of updating Guidelines with the support of relevant international organizations. Site selection is probably one of the main factors that determines the feasibility and sustainability of mariculture projects. Site selection must be adapted to the aim pursued and should be closely related to coastal zone planning and management policy, especially in a climate of competition for coastal space and resources use;
- With respect to regulation, a correct application of the existing laws will generally meet basic needs. Regulatory simplifications and harmonizations may also be useful to make the task easier to aquaculturists;
- Promoting risk and environmental impact assessments studies (EIA) to ensure an acceptable level and environmental quality.

\* As concern sewage, priority actions may include:

- Reducing the emission or discharge of pollutants that may accumulate to dangerous levels in the marine environment devoted to aquaculture operations;
- Promotion of primary treatment of municipal sewage discharged to rivers, estuaries and the coastal sea;
- Collection, treatment and disposal of urban and industrial wastewater;
- Improvement waste treatment techniques and discharge regulations from land based sources through the enforcement of effluent standards;
- Promotion of controls over anthropogenic inputs of nitrogen and phosphorus that enter coastal waters where eutrophication can be expected;
- Promotion of the use of environmentally less harmful pesticides, fertilizers and alternative methods for pest controls, and consider the prohibition of those, found not to be environmentally friendly;
- Application of incentives such as concessionary lease, taxes exemption on equipment, energy subsidies and depreciation allowances on facilities to encourage coastal

resources users to take full responsibility for mitigating or minimizing environmental change;

- Monitoring for environmental changes in coastal waters and in the vicinity of effluent discharge points in particular, all with the aim to "identify the level and/or trend in a particular variable and ensure that it does not fall below or exceed predetermined value";

- Cooperating with neighboring countries in the region, thorough financial and technological support, to maximize the best practicable control and reduction of substances and wastes that are toxic, persistent or liable to bio-accumulate;

- Development and implementation of environmentally sound land-used techniques and practices to reduce run-off to water-courses and estuaries which could cause pollution of aquaculture sites.

**\* Planning related activities**

- Orientate planning methods and implementation policies towards achieving long term environmentally sustainable development of coastal areas;

- Favorize non-polluting activities and regulate activities likely to generate pollution;

- Encourage the relocation of polluting activities which does not necessarily require a shoreline location.

**\* Management related activities:**

- Assessment of the deterioration of mariculture environments caused by agriculture, industry and urban discharges;

- Make use of existing infrastructure compatible to aquaculture industry;

- Assessment of economic value and social impact of the aquaculture sector;

- Education from the level of the technicians up to the manager;

- Upgrade the level of existing institutions to undertake relevant research and training.

**Proposed intervention at regional level**

**\* Appropriate UN agencies and regional organizations should:**

- Establish and maintain a system for collecting, analyzing and disseminating data on quantity and quality of pollutants and their impact on human health and the environment;

- Develop financial and technical cooperation to enhance the capacity of developing countries in marine aquaculture;

- Develop agreed criteria to be used in locating the marine aquaculture, both intensive and semi-intensive, and also for better understanding relationships between the farm and environment; quality and the biophysical characteristics of the site are essential for farming performance and profitability of mariculture enterprises;

*(Even though the Mediterranean region shows apparently common conditions, but it is also important to identify local reliable circumstances at the ecological, socio-economical, and socio-cultural level to use all available opportunities and satisfy specific local needs. First step is to select aquaculture site by applying an advanced sitting methodologies that consider both biotic and abiotic parameters, and get at least a global insight into the carrying capacity of the aquatory concerned);*

- Promote collection and exchange of data on a regular basis regarding economic issues such as:

- Insurance record that could be compared on the regional level and also cross-checked with other data sources in order to have better approach to the planning of future both regional and national development;

- The frequency and the value of the damages due to the environmental factors could be also used by the sector decision makers in the further industry development;

- Enhance collection of the data to improve disease diagnosis and to clear up relationship between diseases outbreaks, losses recorded as "unknown factors" and pollution from the land-based sources;

- Promote fish food quality in order to promote access to markets, improve quality of the product, maximize economic returns and protect environment from nutrient loading (selfpollution);

*(Significant amount of contaminants are found in cultured, healthy looking fish. It is not always clear if fish contamination is due to water quality or food. Therefore, the quality of artificial food which has a marked effect on fish flesh quality should be treated as general topics requiring research effort. The research need should be directed in particular towards (a) improvement of flesh food and water quality and (b) improvement of relationship between mariculture and environment;*

- Develop financial, scientific and technical cooperation to promote transfer of environmentally sound technologies for marine aquaculture;

*(Some of the environmentally-related problems appeared in today aquaculture practices may be overcome by improvements in technology, e.g. offshore fish farming, recirculating water system etc., but also by improving integrated coastal zone management ensuring aquaculture development to be fully integrated into ecological and socio-economical structures of coastal regions);*



- Support for capacity-building of developing countries in the managing and protecting culturing sites;
- Create training opportunities at regional and national levels to enable monitoring of shellfish farms as related to phytoplankton toxins that represent a serious threat to human health, as well as to fish and shellfish farms.

### 3.6 Critical Habitats and ecosystems and Endangered Species in the Mediterranean Sea

Although the Mediterranean Sea is only 0.8% of the area and less than 0.25% of the volume of the world oceans, it includes about 7% of the world marine fauna species, 18% of the world marine flora and a high level of endemism (28% of Mediterranean species).

A total of 10,000 to 12,000 marine species have been registered for the Mediterranean sea (with 8,000 species for fauna excluding protozoa), a rich biodiversity which represents 8 to 9% of world seas species richness.

The only region in the world that compares to the Mediterranean in the wealth of its marine flora is the southern coast of Australia (Luning, 1990).

The reasons for the general wealth of Mediterranean flora and fauna are to be found in the origin of its stock. One of the reasons for such richness is doubtless the coexistence, in the Mediterranean, of species from the temperate and boreal Atlantic, the tropical Atlantic and the Indo Pacific (Fredj, 1974); the other reason is its exceptional rate of endemism.

The distribution of biodiversity throughout the Mediterranean is not homogenous. The biodiversity of the Western Mediterranean is greater than that of the Eastern Mediterranean: 51% greater for Fucophyceae (calculated according to the data in Ribera *et al.*, 1992) and nearly 100% greater for fauna (Fredj, 1974).

The distribution of Mediterranean fauna and flora varies with depth (Table 3.6.1).

Table 3.6.1 Bathymetric distribution of Mediterranean fauna: number of species observed below a given depth, as a percentage of total fauna (according to Fredj, 1974; Fredj *et al.*, 1992).

Below (metres)	Percentage of species
0	100 %
50	63 %
100	44 %
150	37 %
200	31 %
300	25 %
500	18 %
1000	9 %
2000	3 %

Amongst the marine species of the Mediterranean sea, 20-30% are assessed to be endemic, 3-10% are pantropical (living in world tropical seas), 55-70% are of Atlantic origin and 5 % are "lessepsian" (introduced through the Suez canal from the Red Sea) (Fredj *et al.*, 1992).

Few regions of the world present a rate of endemism comparable to or greater than that of the Mediterranean.

There are about 350 introduced species in the Mediterranean, among which are almost 60 macrophyte algae (Boudouresque, 1994; Boudouresque and Ribera, 1994; Ribera, 1994; Zibrowius, 1991, 1994). Most are lessepsian immigrants and they have been mentioned above, bearing in mind their Indo Pacific affinities (Por, 1978, 1990). The rest of the introduced species arrived with fouling, on ships' hulls, as ornamental species for aquaria and especially with aquaculture. In a few cases, these are cultured species which have escaped (for example, the clam *Ruditapes philippinarum* and the seaweed *Caulerpa taxifolia*). In most cases, these are species that accompany aquaculture species.

A great variety of habitats, communities or ecosystems have been described in the Mediterranean (Augier and Boudouresque, 1971; Peres and Ricard, 1964; Peres, 1967; Gamulin Brida, 1974, etc.).

In general terms, Mediterranean communities can be divided into five zones, whose bathymetric size varies according to hydrodynamism (supralittoral and mediolittoral) or with the limpidity of the water (the other zones).

Among the most characteristic communities/ecosystems of the Mediterranean the following deserves to be mentioned: for the mediolittoral zone, the *Lithophyllum lichenoides* rims, for the infralittoral zone the *Posidonia oceanica* meadows, and for the circalittoral zone the "Coralligenous" communities.

### **Lithophyllum lichenoides**

*Lithophyllum lichenoides* rims, usually known as platforms, are built up by the calcareous Rhodophyta *Lithophyllum lichenoides* (= *L. tortuosum*) which lives at the bottom of the mediolittoral zone, i.e. slightly above mean sea level, especially in very ravaged mode and where the light is weak (rifts, corridors, etc.) (Laborel, 1987; Laborel *et al.*, 1994). The most spectacular rims are those of the Grand Langoustier in Porquerolles (Var, France) and the Punta Palazzu (Scandola Reserve, Corsica).

### **Posidonia oceanica**

*Posidonia oceanica* meadows develop in the infralittoral, between the mean level and a depth of 25-40 m (according to water limpidity), and on a crumbly as well as a hard base (Molinier and Picard, 1952). The biggest meadows in the Mediterranean are those in the Gulf of Gabès (Tunisia), the harbours of Hyères and Giens (Var, France), the eastern plain of Corsica, the western coast of Sardinia (giving the town of Alghero its name) and Sicily (near Marsala).

The *Posidonia* meadows, because of the length and density of foliage (several thousand leaves per square metre) trap large quantities of sediment.

*Posidonia oceanica* meadows are considered as the most important ecosystem in the Mediterranean (Boudouresque and Meinesz, 1982).

## **"Coralligenous" communities**

After the *Posidonia oceanica* meadows, the Coralligenous communities constitute the second pole of biodiversity in the Mediterranean: the flora and especially the fauna there are indeed very rich, with many endemics. Coralligenous communities moreover constitute one of the most spectacular and most characteristic underwater sceneries of the Mediterranean. As such, they are one of the main diving grounds in the Mediterranean and have therefore great economic importance.

## **Coastal wetlands**

Under this general term a number of different coastal features are included, such as lagoons, marshes, lakes, temporary pools, river estuaries, channels, irrigated agriculture and shallow coastal zones.

These habitats generally shelter a rich and diversified flora and fauna, either permanently or temporarily (although this aspect varies considerably according the characteristics of each of them), what in itself attributes to their maintaining a considerable value for the conservation of biodiversity. In addition, coastal wetlands perform other important functions related to biodiversity conservation, such as shoreline stabilisation, toxicant retention, nutrient retention and recycling, spawning, breeding and nursery ground for numerous species.

## **Sea caves**

Coastal caves are the main resting, breeding and rearing habitat of the Mediterranean monk seal.

Underwater caves constitute the habitat of several rare, endemic or endangered species, often known to occur in very few or even a single locality.

## **Seagrass meadows (other than *Posidonia* meadows)**

Other species of phanerogams than *Posidonia oceanica*, especially *Cymodocea nodosa* and *Zostera marina*, set up meadows in the Mediterranean.

## **Sandy beaches and sand dunes**

Sandy beaches constitute the habitat of several globally or regionally threatened species, such as sea turtles and the ghost crab *Ocypode cursor*.

In addition, sandy beaches and associated sand dunes perform important functions in coastal protection and the maintaining of shallow water marine ecosystems.

## **Open sea**

Open sea is considered here as it constitute the habitat of numerous endangered species, in

particular several fishes, marine turtles and cetaceans.

### Endangered species

In the present state of knowledge, it does not seem that any species have disappeared yet from the Mediterranean as a result of human activity. However, numerous species appear to be threatened, either because of their rarity which makes them vulnerable, or because of a dynamic of rapid decline. Certain of these are actually on the verge of extinction.

Within the Mediterranean Action Plan, different meetings of experts have been held in order to determinate the red list of marine endangered species in the Mediterranean, which led to the adoption of a list including 89 marine species (without considering birds).

Information concerning the ecology, distribution, status, threats and protection of these species is summarized in Table 3.6.2.

### Critical habitats and ecosystems

The following main criteria have been used to identified habitats and ecosystems particularly critical for the conservation of Mediterranean biodiversity : (i) species richness; (ii) constituting the habitat of endangered species; (iii) specificity to the Mediterranean region; (iv) sensitiveness to human disturbance and severity of threats; (v) irreversibility of their loss (on a human time scale).

On the basis of the above criteria, seagrass meadows, and in particular *Posidonia oceanica* beds, biogenic constructions, in particular *Lithophyllum lichenoides* Rim and "coralligenous" communities, and coastal wetlands should be considered as the most critical ecosystems in the Mediterranean.

### The status of the protection

Several among the marine species identified as endangered are presently granted a protected status in some Mediterranean countries. When available, this information is incorporated in the Table 3.6.2.

All the species included in Table 3.6.2 are listed in Annex II "List of Endangered and Threatened Species" to the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean . This protocol, adopted in 1995 within the framework of the Convention for the Protection of the Mediterranean Sea against Pollution (Barcelona Convention), will replace upon its entry into force the Protocol concerning Mediterranean Specially Protected Areas (Geneva, 1982). The new protocol contains provisions for the conservation of endangered or threatened species.

Within the Mediterranean Action Plan, three Action Plans have been adopted by the parties to the Barcelona Convention:

- Action Plan for the management of the Mediterranean monk seal

- Action Plan for the conservation of Mediterranean marine turtles
- Action Plan for the conservation of cetaceans in the Mediterranean sea

Other international treaties to which Mediterranean countries are parties have provisions for the conservation of species in special need of protection: African convention, CITES, Bern Convention, Bonn Convention, Ramsar, etc. The applicability of the provisions of such treaties to each species is indicated in Table 3.6.2.

### Mediterranean biodiversity hot spots

The present section of the report summarizes available information on marine and coastal sites and areas having a particular importance for the conservation of biodiversity in the Mediterranean region.

The following Tables 3.6.3, 3.6.4 and 3.6.5 concern:

- 3.6.3 National "Hot Spots" for coastal and marine biodiversity in the Mediterranean: the first column gives by country the list of existing and proposed sites (terrestrial, wetland and marine); the second column lists only the marine sites;
- 3.6.4 Transboundary "Hot Spots" for marine biodiversity in the Mediterranean; and
- 3.6.5 Marine critical habitats for each country (including the number of endangered species listed in Table 3.6.2) and the relevant national sites (quoted \* if not protected).

These tables have been built on the list of existing coastal and marine protected areas (RAC/SPA, 1994), the list of areas recommended for protection at the regional level (RAC/SPA and IUCN, 1993) and the lists established at the national level or resulting of projects or expert meetings at the regional or national level.

Table 3.6.3 National "Hot Spots" for coastal and marine biodiversity in the Mediterranean

Country	Coastal Biodiversity Hot Spots	Marine Biodiversity Hot Spots
1. Albania	Kune/Vain - Fushe Kuge Patok - Rodoni - Rrushkulli - Divjaka/Karavasta - Narta - Vlora Bay - Orikumi - Karaburuni - Sazanit - Kanali/Llogara	Vlora Bay Karaburuni-Sazani
2. Algeria	El Kala - Gouraya - Taza - Chenoua - Collo Peninsula - Habibas islands	El Kala - Matifou Banks - Habibas islands - Rachgou/Ras Kela
3. Bosnia and Herzegovina	No information	No information
4. Croatia	Cres-Losinj - Brioni - Kornati - Limski - Malostonski - Krka - Lokrum - Mljet - Neretva - Paklenica - Suma Dundo/Rabu	Brioni - Kornati - Limski - Malostonski
5. Cyprus	Akamas (Lara-Toxefra) - Lamaca - Akrotiri/Limassol - San Andreas	Akamas - San Andreas

6. Egypt	Zaranik/Bardawil - Burullus Lake - El Omayad - El Arish/Rafah - Ras El Hekma - El Ksar - Sidi Barani	Ras El Hekma - El Ksar - Sidi Barani
7. France	Cerbère/Banyuls - Camargue - Riou - Le Brus - Hyères Archipelago - Corsica (several sites) - Bagnas - Larrieu - Croton - CELRL (several sites)	Brusc - Hyères Archipelago (Port Cros, Levant) - Cerbère Banyuls - Corsica (Lavezzi, Finocchiarola, Scandola, Saint Florent, Santa Manza)
8. Greece	Nikopoli Mytikas - Pefkias Xylokastron - Sporades - Amvrakikos Gulf - Skiathos - Zakynthos - Portolagos - Kephallonia	Sporades - Zakynthos - Kephallonia
9. Israel	Alexander - Dor Habonim - Ma'agan Michael - Poleg - Rosh hanikra - Sharon - Taninim	Ma'agan Michael - Rosh Hanikra - Dor Habonim
10. Italy	Burano - Caprera - Castellabate - Ciclopi - Circeo - Egadi - Maremma - Miramare - Montecristo - Orbetello - Archipelago Toscano - Torre Guaceto - Tremiti - Portoferraio - Ustica - Orosei - Sinis - Maddalena - Pontines Archipelago	Caprera - Castellabate - Ciclopi - Egadi - Maremma - Miramare - Montecristo - Archipelago Toscano - Tremiti - Ustica - Orosei - Maddalena - Marsala - Stagnone - Taormina - Messina Straight - Sinis - Pontines Archipelago
11. Lebanon	Palm Islands - Ras EL Chekaa - Ras El Ain	Palm Islands
12. Libya	Garabulli - Syrt Gulf - New Hisha - El Kouf - Bomba Gulf - Tobruk - Farwah lagoon - Sabratha - Leptis - Soussa	Syrt Gulf - Bomba Gulf - Tobruk
13. Malta	Filfla - Ghadira - Fungus Rock	Sea around
14. Monaco	Larvotto - Red Coral	Larvotto - Red Coral
15. Morocco	Djebel Gourougou - Beni Snassene - Smir Restinga - Rhomara - Al Hoceima - Trois Fourches - Nador Lagoon - Moulouya	Al Hoceima - Trois Fourches - Nador
16. Slovenia	Strunjan	Strunjan
17. Spain	Benidorm - El Campello - Alboran Island - Cabo de Creus - Cabo de Gata - Valencia - EL Grao - Ampurias - Ebro - Pals - San Pedro Pescador - Algenda - Cabrera - Medas - S'Arenal Regana - Tabarca - Columbretes - Mitzana - Calblanque - Ciutadella - Llobregat - Es Trenc Salobrar - Entina - N'Amer - Sa Canova - Mallorca - San Pedro Pinatar - Mar Menor - Ibiza - Peix de Formentera - Santa Pola - Ifach - Montgo - Prat Cabanes - Tarifa - Mata Torre Vieja - Chaffarinas - Cerrillos - Guardamar	Alboran island and Banks - Cabo de Gata - Cabo de Creus - Benidorm - Cabrera - Medas - S'Arenal Regana - Tabarca - Columbretes - Balearic Islands - Tarifa - Cerrillos - Chaffarinas Islands

18. Syria	Om-Attouyour	Om'Attouyour
19. Tunisia	Galite Archipelago - Tabarka area - Ichkenl - Zembra - Chikly island - Cap Bon lagoons - Kerkennah islands - Kuriates islands - Kneiss islands - Thyna - Bahiret el Biban	Tabarka - Galite Archipelago - Zembra - Cap Bon - Kerkennah islands - Kuriates islands - Kneiss islands - Gabès Gulf (several sites) - Bahiret El Biban
20. Turkey	Dilek - Gelibolu - Olympos - Belek - Datka/Botzburun - Fethiye/Gocek - Foca - Gokova - Goksu - Kekova - Patara - Koycegiz/Dalyan - Ceyhan - Menderes - Halikarnassus Peninsula - Akyatan	Datka/Botzburun - Fethiye/Gocek - Foca - Gokova - Goksu - Kekova - Patara - Koycegiz/Dalyan - Halikarnassus Peninsula - Akyatan

Table 3.6.4 Transboundary "Hot Spots" for Mediterranean marine biodiversity

AREA / SPECIES / SITE OF INTEREST	COUNTRIES CONCERNED
Seagrasses	All countries Tunisia - Libya
Benthic species	All countries
Cetacean	All countries Ligurian sea: France - Italy - Monaco Northern Adriatic: Italy - Croatia
Mediterranean Monk seal	Western: Morocco - Algeria Ionian: Albania - Greece Aegean: Greece - Turkey Eastern: Turkey - Cyprus - Libya
Mediterranean marine turtles	All countries Green turtle: Eastern: Cyprus - Turkey Loggerhead: Ionian: Italy - Greece Southern: Tunisia - Libya-Egypt Aegean: Greece - Turkey Alboran: Spain - Morocco
Alboran Sea: mixed Atlantic and Mediterranean Fauna and Flora	Morocco - Spain
Bonifacio Strait (and western tip of Sicily): representative Mediterranean marine ecosystems with endangered/endemic species	France - Italy



Table 3.6.5 Critical habitats and relevant sites in the Mediterranean countries

Country/Number of endangered species	Main Critical Habitats	Specific sites quoted * if not protected
1. Albania (38)	Seagrasses (SG) Biogenic constructions (BC) Monk seal caves (MS) Rocky substrate (RS)	* Vlora Bay (SG) * Karaburun-Sazani (MS, RS, BC)
2. Algeria (56)	Seagrasses Biogenic constructions Monk seal caves Rocky substrate	El Kala (SG, MS, RS, BC) * Matifou Banks (RS, BC) Habibas islands (MS) * Rachgou/Ras Kela (MS)
3. Bosnia and Herzegovina (37)	No information	No information
4. Croatia (40)	Seagrasses Open sea Cetacean (CE) Rocky substrate	Cres Losinj (CE) Brioni (RS, MS) Kornati (RS, MS) Limski - Malostonski
5. Cyprus (38)	Seagrasses Marine turtles beaches (MT) Monk seal caves	* Akamas (SG, MT, MS, RS) * San Andreas (RS, SG)
6. Egypt (33)	Seagrasses Marine turtles beaches Sandy substrate	* Ras El Hekma * El Ksar * Sidi Barani
7. France (49)	Seagrasses Open sea Cetacean Rocky substrate Sandy substrate	* Brusc (SG) * Hyères Archipelago (SG, RS) Cerbère Banyuls (SG, RS) Corsica (Lavezzi, Finocchiarola, Scandola, Saint Florent, Santa Manza)
8. Greece (50)	Monkseal caves Marine turtles beaches	Sporades (MS) Zakinthos (MT) Kephalonia (MT)
9. Israel (30)	Marine turtles beaches Monk seal caves Biogenic constructions	Ma'agan Michael (RS, BC) Rosh Hanikra (RS) Dor Habonim (MS)
10. Italy (63)	Seagrasses Rocky substrate Sandy substrate Open sea sCetacean	Caprera - Castellabate - Ciclopi - Egadi - Maremma - Miramare - Montecristo - Archipelago Toscano Tremiti - Ustica - Orosei - Maddalena Marsala - Stagnone - Taormina - Messina Straight - Sinis - Pontines Archipelago
11. Lebanon (30)	Rocky substrate Biogenic constructions	Palm Islands (RS, BC)

12. Libya (36)	Seagrasses Marine turtles beaches Monk seal habitat Sandy substrate Open sea Cetacean	* Syrt Gulf (SG, MT) * Bomba Gulf (SG, MT, MS) * Tobruk (RS, MS, CE)
13. Malta (38)	Rocky substrate Open sea Cetacean	Sea around
14. Monaco (36)	Rocky substrate Seagrasses	Larvotto - Red Coral (RS, SG)
15. Morocco (53)	Monk seal caves Rocky substrate Sandy substrate Seagrasses	Al Hoceima (MS, RS) * Trois Fourches (MS, RS) * Nador (SS, SG)
16. Slovenia (38)		Strunjan
17. Spain (57)	Seagrasses Rocky substrate Sandy substrate	* Alboran island and Banks Cabo de Gata - Cabo de Creus Benidorm - Cabrera Medas - S'Arenal Regana Tabarca - Columbretes Balearic Islands - Tarifa Cerrillos - Chaffarinas Islands
18. Syria (33)	Rocky substrate Seagrasses	* Om'Attouyour (RS, SG)
19. Tunisia (43)	Seagrasses Marine turtles beaches Rocky substrate Sandy substrate Monk seal caves Biogenic constructions	* Tabarka (RS, BC) Galite Archipelago (RS, MS) Zembra (RS, MS) Cap Bon (RS, MS) * Kerkennah islands (SG, MT) Kuriates islands (MT, SG) * Gabès Gulf (SG, MT, SS) * Bahiret El Biban (BC)
20. Turkey (44)	Monk seal caves Marine turtles beaches Rocky substrate Sandy substrate	Datka/Botzburun - Fethiye/Gocek Foca (MS) - Gokova Goksu (MT) - Kekova Patara - Koycegiz/Dalyan (MT) Halikarnassus - Akyatan (MT)

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Species	Ecology/Distribution	Status/Threats	Protection
<b>Magnoliophyta</b> <i>Posidonia oceanica</i>	Posidonia meadow is a pole of biodiversity for the Mediterranean, it also plays an important role in controlling sedimentary flows (stability of the coastline). Endemic to the Mediterranean, present along most of the coastline (except for Israel).	Deeply in regression, pollution, lowering of water transparency, mooring of boats, trawling, explosives illegally used for fishing. At a human time scale, the destruction of <i>P. oceanica</i> meadows is irreversible.	Protected by law in several Mediterranean countries. Listed in Appendix I to the Bern Convention (limited to the Mediterranean) (*)
<i>Zostera marina</i>	Rare and very localized in the Mediterranean. It plays an important role in some Mediterranean coastal lagoons	It regressed considerably in the Atlantic and in the Mediterranean. Disappeared from sites where it was abundant.	Protected by law in Catalonia (Spain) and in "Cote d'Azur" (France). Listed in Appendix I to the Bern Convention (Mediterranean only) (*)
<i>Zostera noltii</i>	It plays an important ecological role in some Mediterranean lagoons. Rare and very localized in the Mediterranean, where it is found mainly in coastal lagoons.	Its rarity and localization makes it vulnerable to habitat loss or degradation.	Protected by law in France and Spain (*)
<b>Chlorophyta</b> <i>Caulerpa ollivieri</i>	Endemic to the Mediterranean (France, Lybia, Spain, Turkey).	Sites are extremely isolated, usually of less than one hectare. Two of the three French sites have indeed already disappeared.	Listed in Appendix I to the Bern Convention (limited to the Mediterranean) (*)
<b>Phaeophyta</b> <i>Cystoseira amentacea</i>	Infralittoral Endemic to the Mediterranean. Species with three varieties: <i>amentacea</i> (eastern Mediterranean), <i>spicata</i> (Adriatic) and <i>stricta</i> (western Mediterranean).	Highly sensitive to pollution, the species has receded considerably close to all large urban areas. It is appreciated by several micro-herbivores, making it liable to overgrazing.	Listed in Appendix I to the Bern Convention (limited to the Mediterranean) (*)
<i>Cystoseira mediterranea</i>	Infralittoral Endemic to the Mediterranean. Species replacing <i>C. amentacea</i> (phenomenon of vicariousness) in certain regions of the western Mediterranean.	Status and threats are the same as for <i>C. amentacea</i> ; however <i>C. mediterranea</i> is rarer and more localized than <i>C. amentacea</i> .	Listed in Appendix I to the Bern Convention (limited to the Mediterranean) (*)
<i>Cystoseira sedoides</i>	Distribution restricted to the coasts of Algeria (from around Algiers to El Kala), Tunisia and the extreme south of Italy (island of Pantelleria).	Its limited area of distribution and the rarity of sites make <i>C. sedoides</i> a threatened species. Probably sensitive to pollution and overgrazing.	Listed in Appendix I to the Bern Convention (limited to the Mediterranean) (*)

<i>Cystoseira spinosa</i>	Endemic to the Mediterranean, with a subspecies in the Adriatic, <i>C. spinosa adriatica</i> .	The species seems to have formed until the sixties large forests which have now disappeared almost everywhere, leaving at best isolated individuals. Suggested causes for the rarification of <i>C. spinosa</i> include pollution, uprooting by nets and trawlers, and also overgrazing by sea urchins.	Listed in Appendix I to the Bern Convention (limited to the Mediterranean) (*)
<i>Cystoseira zosteroides</i>	Found in deep water at the bottom of the infralittoral level and mainly in the circalittoral level (down to depths of 100m) on hard substrates, mainly in sectors with unidirectional currents. Endemic to the Mediterranean.	The species has become rare in many sites where it was once abundant. Threats: increase in water turbidity, increase in sedimentation and overgrazing by sea urchin.	Listed in Appendix I to the Bern Convention (limited to the Mediterranean) (*)
<i>Laminaria rodriguezii</i>	Lives at great depths (60 to 150m) and requires cold and very clear water, swept by seabed currents. Endemic to the western Mediterranean. Highly localized sites.	The threat is the reduction of water transparency, resulting from eutrophication and/or increased turbidity.	Listed in Appendix I to the Bern Convention (limited to the Mediterranean) (*)
<b>Rhodophyta</b> <i>Goniolithon byssoides</i>	Endemic to the Mediterranean. Highly localized sites (Corsica, Sicily, Algeria, Adriatic).	Rare species, its cushions are vulnerable to trampling (fishermen on foot, sea bathing) and to pollution (hydrocarbon film on the surface of the sea).	Listed in Appendix I to the Bern Convention (limited to the Mediterranean) (*)
<i>Lithophyllum lichenoides</i>	In a few sites, it builds up small mounds (better known as 'pavements'), up to 2m wide, in formations unique to the Mediterranean.	Threats mainly concern the mounds through surface pollution (hydrocarbons?) and trampling. The building up of a mound takes about a thousand years; its destruction is therefore irreversible at a human level.	Listed in Appendix I to the Bern Convention (limited to the Mediterranean) (*)
<i>Phlophora mediterranea</i>	Endemic to a limited area of the Mediterranean (between mainland Greece and Crete).	The threat is mainly from reduction of water transparency, either from eutrophication and/or turbidity.	Listed in Appendix I to the Bern Convention (limited to the Mediterranean) (*)
<i>Schimmelmammia schousboei</i>	Algae of a rare beauty. Species with highly localized sites (Southern Italy, and Libya).	The very rare sites of <i>Schimmelmammia schousboei</i> are susceptible of destruction by coastal development.	Listed in Appendix I to the Bern Convention (limited to the Mediterranean) (*)
<b>Porifera</b> <i>Asbestopluma hypogea</i>	Small <i>Cladorhizidae</i> sponge species able to catch and feed on small preys (Crustacea). Known only in one underwater cave (France)	Since it constitutes a zoological curiosity (carnivorous sponge), it may be feared that its single site may be visited by divers who may involuntarily cause damage or gather it to try and raise it in aquaria or as a curiosity.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)

<i>Aplysina cavernicola</i>	Endemic to the Mediterranean. Reports especially from the Marseille region (France), from Cap Corse and from the North Adriatic.	Relatively rare species. It is dependent on special biotope (underwater caves).	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<i>Axinella canabina</i>	Beautiful large ramified sponge, yellow in colour. Lives between the sea level and 50 metres depth, mainly on muddy bottoms at the circalittoral level. Endemic to the Mediterranean, lives mainly in the southern Mediterranean.	As for the other <i>Axinella</i> species, the growth is very slow making the species unsustainable on bottoms where trawling is regular.	(*)
<i>Axinella polypoides</i>	Large ramified sponge, living on rocky bottoms between 30 and 100 m depth. Its distribution range include the Mediterranean and the Atlantic (Senegal and Mauritania)	Relatively rare. Susceptible of being collected by scuba-divers for decoration purposes.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<i>Geodia cydonium</i>	Lives on sandy and muddy bottoms, in particular coarse sand bottoms, between 20 and 25 m depth.	Its slow growth makes the species vulnerable to trawling.	(*)
<i>Ircinia foetida</i>	Large massive sponge, reaching 50-80 cm in diameter. Living in deep waters, below 45-50 m. Present in the Mediterranean and the near Atlantic.		(*)
<i>Ircinia pipetta</i>	Encrusting species living in semi-dark caves. Endemic to the Mediterranean.	Rare species.	(*)
<i>Petrobiona massitana</i>	It is a living fossil. Lives in dark zones of underground caves, between the surface and a depth of 30m. Endemic to the Mediterranean, known in some sites the Western Basin and in the Adriatic.	The species is rare and is only known in a limited number of underwater caverns. The increasing frequentation of these caverns by underwater divers and the fact that it is a zoological curiosity are additional threats.	Listed in Appendix I to the Bern Convention (limited to the Mediterranean) (*)
<i>Tethya sp. plur.</i>	Small round species, mainly living in sciaphilous infralittoral biotopes.	Rare species.	(*)
<b>Cnidaria</b> <i>Astroides calycularis</i>	Spectacular species due to its bright orange colour, living in sciaphilous biotopes between 2 and 70 m depth. Its distribution in the Mediterranean is restricted to the southern part of the western basin.	The Mediterranean range of the species is reducing. Its esthetic value makes it susceptible of being collected by scuba-divers for decorative purposes..	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<i>Errina aspera</i>	Nearly endemic to the Mediterranean. Only two sites are known, the Straits of Gibraltar and their environs (Atlantic coast) and the Straits of Messina (Italy).	Rare species, the threat comes from the very limited area of distribution.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)

<i>Gerardia savaglia</i>	Lives on secondary hard substrates, often the dead trunk of another gorgon, towards depths of (25) 40-50m. Mediterranean and near Atlantic.	Sometimes caught up and brought up to the surface in fishing nets. Also harvested by divers for decoration. The species has probably never been very abundant, but today it seems to be increasingly rare.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<b>Echinodermata</b> <i>Asterina panzerii</i>	Small starfish dependent on deep <i>Posidonia oceanica</i> meadows. Endemic to the Mediterranean. Reported from France, Italy, Greece, Libya and Spain.	It now seems to be in decline. The threat comes from trawling in <i>Posidonia oceanica</i> meadows	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<i>Centrostephanus Longispinus</i>	Very rare in the northwestern Mediterranean, a little more common in the eastern Mediterranean	Rare species, the threat is from collection by divers for decoration.	Protected in France (1992) Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<i>Ophidiaster ophidianus</i>	Known in the southwestern Mediterranean (from Morocco to Sicily and to the southern Italian mainland) and in the Adriatic, is rarer in the northwestern and eastern Mediterranean.	Rare species, the threat comes from its collection by divers.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<b>Bryozoa</b> <i>Hornera lichenoides</i>	Colony-forming species on muddy coastal sites. Found in Northern Atlantic and in North-Western Mediterranean.	Colonies are susceptible to be damaged by trawling.	(*)
<b>Mollusca</b> <i>Charonia lampas lampas</i>	It is the largest gastropod from the Mediterranean sea, and reaches up to 30 cm in length. It feeds mainly upon large echinoderms.	The shell is very appreciated in decoration, trawling and decoration are the main origin of threat. Its populations have been strongly diminished over the last years; the species almost disappeared in some polluted coastal zones of the NW Mediterranean and Tyrrhenian sea.	The species is included in "Livre rouge des espèces menacées en France. Tome 2" (BEAUFORT & LACAZE, 1987). Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<i>Charonia tritonis variegata</i>	Gastropoda species which was recorded exclusively in the eastern basin (RUSSO ET AL., 1990). According to these authors, the sill between Sicily and Tunisia is the only geographical area where the distribution of both Mediterranean species of triton may overlap.	The isolated populations of the eastern basin of the Mediterranean may be consider as vulnerable, and will probably soon move into the "endangered" category. Decoration and collection are the main origin of threat.	The nominal subspecies, <i>Ch. tritonis</i> is included in the IUCN invertebrate red data book Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)



<i>Dendropoma petraeum</i>	<p>Endemic species of the Mediterranean, where it is only present in the warmest areas (north Africa, eastern Mediterranean, southeast Spain, Sicily and Malta). The bioconstructions built by this Gastropoda species are very important from different points of view: they can be considered as modulators of geomorphological processes in the coast line, as indicator of the recent sea level changes, as biological engineers that creates new habitats on the narrow intertidal fringe.</p>	<p>The main threat are the surface pollution, trampling and the development of the littoral. The destruction of these biogenic constructions is irreversible on a human scale.</p>	<p>Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)</p>
<i>Erosaria spurca</i>	<p>In the Mediterranean its number has been strongly diminished during the last decade</p>	<p>The species of this family are among the most appreciated by shell collectors all over the world. Collection is the main origin of threat.</p>	<p>Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)</p>
<i>Gibbula nivos</i>	<p>Endemic species of Malta. Lives in shallow water (0-10 m), in bottoms with algae or marine phanerogames (<i>Cymodocea nodosa</i> and <i>Posidonia oceanica</i>). It presents nocturnal habits.</p>	<p>Due its very restricted geographical range, <i>G. nivos</i> must be consider as vulnerable, becoming endangered by the human pressure (development of the littoral) over the few bays where it is present. Another origin of threat are the shell collectors.</p>	<p>This species is protected by law in Malta. Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)</p>
<i>Lithophaga lithophaga</i>	<p>Rock-boring bivalve drilling tunnels in calcareous substrata where it lives. Because its peculiar mode of life, its capture implies the destruction of the entire habitat. The species ranges from Portugal to Morocco, in western Atlantic, and the entire Mediterranean.</p>	<p>It is becoming rare in many areas because of its high market value. The harvesting of this species is highly destructive, by using underwater pneumatic drills (and explosives in some places), causing considerable damage to the infra-littoral hard substrata biocenosis as a whole.</p>	<p>Protected by law in Italy and France. Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)</p>
<i>Lurja lurida</i>	<p>This species ranges throughout Mediterranean and west African coast. It lives mainly in shallow water (0-20 m), and more rarely deeper.</p>	<p>its populations are under a pressure by shell collectors. its populations have been strongly diminished during the last decade. It may be considered vulnerable. Collection are the origin of threat.</p>	<p>Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)</p>
<i>Mitra zonata</i>	<p>It lives semi-buried in detritic bottoms mixed with sand and mud between 10 and 60 m. It ranges from the western Mediterranean to west African coast. It has been recently recorded from Algarve (south of Portugal), Azores and Madeira. In the Mediterranean it is most common in the Adriatic sea. It has been also found in Sicily, Sardinia, Tyrrhenian and Alboran sea. Some isolated records exist from France. It has not been recorded in the eastern basin.</p>	<p>This species is rare in its whole area of distribution and it must be considered as vulnerable. The main origin of threat are collection and trawling.</p>	<p>Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)</p>

<p><i>Patella ferruginea</i></p>	<p>At the present times <i>P. ferruginea</i> is limited to some areas of the south-western part of the Mediterranean. Its most viable populations are located in some areas of north African coast, from Morocco to Tunisia. Relict populations are present in Corse, Sardinia and south Spain. It lives in the upper mid-littoral fringe over vertical rocky surfaces.</p>	<p>It is the Mediterranean species most seriously threatened with rapid disappearance. Its numbers have fallen drastically in a few years, at least in some places such as Corse, Sardinia and southern Spain. Its reproductive potential and dispersal abilities are very low. It is possible that its numbers are below the critical threshold in some areas. The main threats are the human consumption and its use as a bait for amateur fishing, but also the littoral development.</p>	<p>Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)</p>
<p><i>Patella nigra</i></p>	<p>It is basically a west African species that reaches the Alboran sea as the northern limits of its area of distribution. It is common in the upper sublittoral level (0-5 m in depth) of rocky shores from Morocco south to Angola. The only European populations are located in south Spain (coasts of Cadiz and Malaga).</p>	<p>No evidence of danger exist, considering the whole area of distribution, and the Mediterranean populations seem to be stable up to date. The need to protect it is related to its resemblance to <i>P. ferruginea</i>, which would make it illusory to protect only one of the two species. Populations of both species overlap in the Mediterranean.</p>	<p>Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)</p>
<p><i>Pholas dactylus</i></p>	<p>It is a burrowing species, boring into compacted sand and mud, limestone and schists, from the mid-littoral down to a few meters deep. It ranges from the British Isles south to Morocco, and the entire Mediterranean, including Black Sea.</p>	<p>In the Mediterranean it is a common species in some places, but becoming scarce and vulnerable in most part of its area of distribution, due to the increase of exploitation for human consumption. Its harvesting causes a considerable damage, because implies the destruction of the entire habitat.</p>	<p>Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)</p>
<p><i>Pinna nobilis</i></p>	<p>Endemic species from the Mediterranean, where is widespread all around. It is the largest Mollusc species of the Mediterranean and one of the largest of the world. Reaches up to 80 cm in length.</p>	<p>Its populations have been continuously decimated during the last decades along with the decline of <i>Posidonia oceanica</i> meadows and with the development of the littoral. It is highly appreciated as souvenir by tourists and has been overfished by local people and divers. The breakage by boat anchors and trawling is another origin of threat. <i>Pinna nobilis</i> have disappeared in wide areas, but is still common in a few unaltered zones.</p>	<p>Fan shell is protected by law in Croatia and France. Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)</p>
<p><i>Pinna rudis</i></p>	<p>In the Mediterranean it is only present in the warmest area of the western basin. It lives mainly in fissures and crevices of rocky substrates, between 5 and 30 m deep.</p>	<p>Rare and vulnerable in the Mediterranean. <i>Pinna rudis</i> is very appreciate by shell collectors.</p>	<p>Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (as <i>Pinna pernuta</i>) (*)</p>

<i>Ranella olearia</i>	In the Mediterranean is common in the Alboran sea and scarce in other areas.	Very appreciated by shell collectors. The main threats are trawling, collection and decoration.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<i>Schilderia achatidea</i>	In the Mediterranean is mainly restricted to the Alboran sea. Some isolated records exist in other areas of the western Mediterranean. It lives in detritic bottoms with mud (from 50 to 100 m deep)	Its restricted area of distribution in the Mediterranean and its high value for shell collectors make it a very vulnerable species. Collection, decoration and trawling are the main threats.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<i>Tonna galea</i>	In the Mediterranean it is only relatively frequent in the Adriatic, and Maltese and Greek coasts. It can be found semi-buried in sandy or muddy bottoms between 20 and 80 m.	Becoming rare because this shell is very appreciated for decorative purposes. Therefore, decoration and trawling are the main threats	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<i>Zonaria pyrum</i>	In the Mediterranean it is more frequent in southern Greek islands and in some localities from north Africa.	The species is very rare, and has to be considered as vulnerable. The shell collectors constitute the main threat.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<b>Crustacea</b> <i>Ocyrops cursor</i>	Lives on sandy beaches in the eastern part of the Mediterranean. Known as predator of newly hatched sea turtles	Threats comes from the use of its habitat by tourists.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<i>Pachylasma giganteum</i>	Small species living on hard substrate in relatively deep sites. Endemic to the Mediterranean. Species known in Sicily (Straits of Messina, Italy)	Rare species, the threat being related to its restricted range	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<b>Pisces</b> <i>Acipenser naccarii</i>	Known in Adriatic. Lives on sandy and muddy bottom not exceeding a depth of 40 metres. Heads upriver in spring to spawn and returns to the sea after laying.	Rare species with restricted range	(*)
<i>Acipenser sturio</i>	Present in the Black Sea and along the northern coasts of the Mediterranean.	The species has become rare in the Mediterranean, main threats being fisheries and habitat degradation	Its exploitation is forbidden in some countries. Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<i>Aphanius fasciatus</i>	Small species living mainly in coastal lagoons of the eastern Mediterranean and the eastern part of the western basin (Corsica, Sardinia, mainland Italy, Eastern Algeria, Tunisia)	The species is rare, the main threat being the degradation of its habitat.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)

<i>Aphanius iberus</i>	Endemic to the Mediterranean: south and southwest of Spain and west of Algeria. Lives in fresh and brakish waters and feed on small invertebrates.	The threat comes from its rarity, its extremely restricted geographical area and the reduction of its habitat.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<i>Carcharodon carcharias</i>	Present throughout the basin, including the Adriatic and Aegean Seas.	Rare throughout the region. It have been incidentally caught in semi-industrial fisheries. IUCN status is: <i>vulnerable l bcd+2cd</i>	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<i>Cetorhinus maximus</i>	Reported from the entire Mediterranean except for the waters adjacent to Libya, Egypt and the Levantine basin	There are presently no directed fisheries for this species in the Mediterranean, although it was occasionally captured in the past, particularly off southern France. Accidental captures are reported in pelagic driftnets and longlines as well as in bottom gillinets and purse seines IUCN status is: <i>vulnerable l ad+ 2d</i>	(*)
<i>Hippocampus hippocampus</i>	Lives at the infracoastal level in alga populations on hard substrates and in marine Magnoliophyte meadows	The species has probably never been very common but has now become genuinely rare. Its similarity with <i>H. ramulosus</i> makes it necessary to associate them in the protection.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<i>Hippocampus ramulosus</i>	Lives at the infracoastal level, in rock alga populations and especially in <i>Posidonia oceanica</i> meadows; can penetrate coastal lagoons	Once very common, it has become less so and in places rare, especially in the northwestern Mediterranean. The threat comes from the regression of its biotope and trawling in meadows	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<i>Huso huso</i>	Lives in the sea at depths between 70 and 180m, penetrates fresh water (rivers) to reproduce. Lives mainly in the Black Sea and the Caspian Sea. Rare in the Mediterranean, where is known for the Aegean and Adriatic seas.	Vulnerable because of its rarity.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<i>Lethenteron zanandreae</i>	Fresh water lamprey species endemic to Po basin	Rare and vulnerable.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<i>Mobula mobular</i>	Found in pelagic waters throughout the Mediterranean, including the Aegean Sea and the eastern basin. Rare in the Adriatic	High mortality rates are reported from accidental catches in pelagic driftnets. It is also accidentally captured in longlines, purse seines, and trawls	(*)

<i>Pomatoschistus canestrini</i>	Small species living in fresh and brackish waters. Reported in Dalmatia (Croatia) and in the Venice lagoon (Italy)	Rare and vulnerable.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<i>Pomatoschistus tortonesei</i>	Small species living in brackish lagoons in shallow water. Present in Sicily (Marsala) and in the extreme west of Libya (Farwah).	Rare and very localized species.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
<i>Valencia hispanica</i>	Lives in fresh and brackish waters. Endemic to eastern part of Spain and French Catalonia.	Rare species with very restricted range.	(*)
<b>REPTILES</b>			
<i>Caretta caretta</i>	Found throughout the Mediterranean, nesting reported on sandy beaches along the coast of the eastern basin.	Mediterranean population is diminishing. Main threats are incidental catches in fishing gears, and loss of nesting sites.	Protected in several Mediterranean countries. Listed in Appendix II to the Bern Convention, Appendices II and IV of the Habitat Directive, on the list of protected species (class A) of the Algiers Convention, in Appendix I of the Washington Convention and in Appendix II of the Bonn Convention. (*)
<i>Chelonia mydas</i>	In the Mediterranean it occurs mainly in the eastern part. Nesting in a limited number of sites mainly in Cyprus and Turkey. Genetic studies found evidence of the isolation of the Mediterranean population from a reproductive point of view (deme)	The main threat to the Mediterranean population comes from the loss of nesting sites due to development of the coastal area. Catches in fisheries, either incidental or deliberate, and pollution are additional threats.	Protected in several Mediterranean countries. Listed in Appendix II to the Bern Convention, Appendix IV of the Habitat Directive, on the list of protected species (class A) of the Algiers Convention, in Appendix I of the Washington Convention and in Appendix I and II of the Bonn Convention. (*)
<i>Derموchelys coriacea</i>	Large species, regularly occurring although rare in the Mediterranean. Its nesting in the Mediterranean is questionable	Catches in fishing gears are reported	Protected in several Mediterranean countries. Concerning international treaties, same as <i>C. mydas</i> . (*)
<i>Eretmochelys imbricata</i>	Occurring only occasionally in the Mediterranean.	Catches in fishing gears are reported	Protected in a few Mediterranean countries. Concerning international treaties, same as <i>C. mydas</i> . (*)
<i>Leptodochelys kempii</i>	Its occurrence in the Mediterranean is exceptional.	Catches in fishing gears are reported	Protected in a few Mediterranean countries. Concerning international treaties, same as <i>C. mydas</i> . (*)

<p><i>Trionyx triunguis</i></p>	<p>Lives in Nile basin and coastal hydrographic networks of the eastern Mediterranean (from Israel to Turkey). <i>Trionyx triunguis</i> is essentially a freshwater turtle, but it also frequents coastal saltwater lagoons and even seems to use the sea environment for its dispersion from one estuary to another.</p>	<p>The species has died out in Egypt. It is on the edge of extinction in Israel and Syria. Main threats are (i) habitat loss or degradation due to human development, (ii) pollution, (iii) incidental catches, (iv) deliberate killing by fishermen, (v) collisions with boats.</p>	<p>Listed in Appendix II to the Bern Convention (limited to the Mediterranean)</p> <p>(*)</p>
<p><b>Mammalia</b> <i>Balaenoptera acutorostrata</i></p>	<p>Very rare in the western Mediterranean, where the species is an occasional visitor from the North Atlantic. Specimens were sighted or stranded off Spain, France (continental and Corsica), Italy (Ligurian and Tyrrhenian coasts, Sicilian Channel), Algeria and Tunisia.</p>	<p>There have been some cases of accidental capture in driftnets in the Mediterranean IUCN status: <i>Lower risk: near threatened.</i></p>	<p>The species is listed in Appendix III of the Bern Convention, in Appendix I and Appendix II of the Washington Convention and in Annex IV of the EU Habitats Directive.</p> <p>(*)</p>
<p><i>Balaenoptera borealis</i></p>	<p>Extremely rare in the Mediterranean, where this species is vagrant from the North Atlantic</p>	<p>No viable population of this species exists in the Mediterranean. IUCN status: <i>Endangered/A1abd.</i></p>	<p>The species is listed in Appendix III of the Bern Convention, in Appendices I and II of the Washington Convention and in Annex IV of the EU Habitats Directive. (*)</p>
<p><i>Balaenoptera physalus</i></p>	<p>The second largest cetacean, reaching 27 m (southern hemisphere) and 75 t. In the Mediterranean, reliable length measurements are considerably smaller (&lt;22 m) Abundant in the western and central (Ionian Sea) Mediterranean, rare in the eastern region.</p>	<p>Recent genetic evidence supports the hypothesis that fin whales in the Mediterranean are a resident population, reproductively isolated from the Atlantic. IUCN status <i>Endangered/A1abd.</i></p>	<p>The species is listed in Appendix II of the Bern Convention, in Appendices I and II of the Washington Convention and in Annex IV of the EU Habitats Directive. (*)</p>
<p><i>Delphinus delphis</i></p>	<p>Once common everywhere in the Mediterranean, it is now rare throughout the region except than in the Alboran Sea and in the coastal waters of western Greece (Ionian Sea). Small communities may also persist in yet unexplored areas of the eastern and southern portions of the Mediterranean.</p>	<p>The causes of this species' sharp decline in the region are unknown. The Mediterranean population(s) should be considered endangered, and is regarded as a conservation priority by the IUCN 1996-1998 Action Plan for the Conservation of Cetaceans. Common dolphins are accidentally caught in fishing gear, and their tissue contaminant levels are often very high.</p>	<p>The species is listed in Appendix II of the Bern Convention, in Appendix II (limited to western Mediterranean, North and Baltic Seas, Black Sea and eastern tropical Pacific populations) of the Bonn Convention, in Appendix II of the Washington Convention and in Annex IV of the EU Habitats Directive. (*)</p>
<p><i>Eubalaena glacialis</i></p>	<p>The species is exceptional in the Mediterranean, certainly reflecting its status of near extinction in the eastern North Atlantic.</p>	<p>There is no viable northern right whale population in the Mediterranean. The northern right whale is the most endangered of the large whale species IUCN status is: <i>Endangered/C1, D1.</i></p>	<p>The species is listed in Appendix II of the Bern Convention, in Appendices I and II of the Washington Convention and in Annex IV of the EU Habitats Directive. (*)</p>

<i>Globicephala melas</i>	Common in the region of Gibraltar and in the deepest portions of the Alboran Sea, Balearic waters and waters west of Sardinia, pilot whales become rare in the Tyrrhenian Sea, and are virtually absent from the Adriatic Sea and the eastern basin.	Pilot whales are known to occur in pelagic driftnet bycatch even in mass captures. Some individuals have been known to be affected by hydrocarbon spills.	The species is listed in Appendix II of the Bern Convention, in Appendix II (limited to North and Baltic Seas populations) of the Bonn Convention, in Appendix II of the Washington Convention and in Annex IV of the EU Habitats Directive. (*)
<i>Grampus griseus</i>	A common Mediterranean odontocete, particularly frequent in waters over steep continental slopes throughout the basin.	There have been some instances of accidental capture in fishing and some individuals have been known to be affected by hydrocarbon spills. IUCN status is: <i>Data deficient</i> .	The species is listed in Appendix II of the Bern Convention, in Appendix II (limited to North and Baltic Seas populations) of the Bonn Convention, in Appendix II of the Washington Convention and in Annex IV of the EU Habitats Directive. (*)
<i>Kogia simus</i>	Its known occurrence in the Mediterranean is limited to the stranding of one specimen in central Italy	No viable population in the Mediterranean.	The species is listed in Appendix III of the Bern Convention, in Appendix II of the Washington Convention and in Annex IV of the EU Habitats Directive. (*)
<i>Megaptera novaeangliae</i>	Extremely rare in the Mediterranean (limited to the northwestern basin)	No viable population of humpback whales in the Mediterranean, where the specimens observed were certainly vagrants from a now very reduced eastern North Atlantic population IUCN status is: <i>vulnerable/A1ad</i> .	The species is listed in Appendix II of the Bern Convention, in Appendices I and II of the Washington Convention and in Annex IV of the EU Habitats Directive. (*)
<i>Mesoplodon densirostris</i>	Only one certain occurrence of the species in the Mediterranean	No viable population of Blainville's beaked whales in the Mediterranean. IUCN status is: <i>Data deficient</i> .	The species is listed in Appendix III of the Bern Convention, in Appendix II of the Washington Convention and in Annex IV of the EU Habitats Directive. (*)
<i>Monachus monachus</i>	The overall population, estimated to 300 to 500 specimens, is divided in a few scattered groups mainly located along the coasts of Greece, Turkey and, to a lesser extent, North Africa in the Mediterranean, and in the Madeira archipelago and Cap blanc in the Atlantic	The monk seal is today exceedingly rare in the Mediterranean, and among its most endangered vertebrates. IUCN status is: <i>Critically endangered/C2a</i> .	The species is listed in Appendix II of the Bern Convention, in Appendices I and II of the Bonn Convention, in Appendices I and II of the Washington Convention and in Annex IV of the EU Habitats Directive. (*)

<p><i>Orcinus orca</i></p>	<p>Uncommon in the Mediterranean, where it is considered an occasional visitor from the North Atlantic</p>	<p>No viable population of killer whales in the Mediterranean. The species is known to have been accidentally captured in fishing gear IUCN status is: <i>Lower risk: conservation dependant.</i></p>	<p>Listed in Appendix II of the Bern Convention, in Appendix II (limited to eastern North Atlantic and eastern North Pacific populations) of the Bonn Convention, in Appendix II of the Washington Convention and in Annex IV of the EU Habitats Directive. (*)</p>
<p><i>Phocoena phocoena</i></p>	<p>Despite its regular occurrence in the Black Sea (<i>P. p. relicta</i>) and in the eastern North Atlantic (<i>P. p. phocoena</i>), this species is virtually absent from the Mediterranean.</p>	<p>The presence of the harbour porpoise in the Mediterranean is highly questionable IUCN status is: <i>Vulnerable/Alcd.</i></p>	<p>The species is listed in Appendix II of the Bern Convention, in Appendix II (limited to North and Baltic Seas, western North Atlantic, and Black Sea populations) of the Bonn Convention, in Appendix II of the Washington Convention and in Annexes II and IV of the EU Habitats Directive. (*)</p>
<p><i>Physeter macrocephalus</i></p>	<p>Found throughout the Mediterranean in deep waters, particularly where the continental shelf slope is steepest. Although the species appears to be more frequent in the western basin and in the Ionian Sea, it is present in the eastern basin as well</p>	<p>Considered common in the Mediterranean in the older literature, sperm whales are currently infrequent</p>	<p>The species is listed in Appendix III of the Bern Convention, in Appendices I and II of the Washington Convention and in Annex IV of the EU Habitats Directive. (*)</p>
<p><i>Pseudorca crassidens</i></p>	<p>Quite rare in the Mediterranean, as a vagrant from the North Atlantic</p>	<p>No viable population in the Mediterranean.</p>	<p>The species is listed in Appendix II of the Bern Convention, in Appendix II of the Washington Convention and in Annex IV of the EU Habitats Directive. (*)</p>
<p><i>Stenella coeruleoalba</i></p>	<p>Today the commonest pelagic cetacean in the Mediterranean, the striped dolphin is found throughout the region in deep waters.</p>	<p>High mortality rates are reported for this species from accidental takes in driftnets, considered unsustainable. Mediterranean striped dolphins were affected by a severe outbreak of morbillivirus epizootic in 1990-91, possibly linked to high levels of contamination by PCBs and other organochlorine compounds IUCN status is: <i>Lower risk: conservation dependant.</i></p>	<p>Listed in Appendix II of the Bern Convention, in Appendix II (limited to western Mediterranean and eastern tropical Pacific populations) of the Bonn Convention, in Appendix II of the Washington Convention and in Annex IV of the EU Habitats Directive. (*)</p>



<i>Steno breitanensis</i>	Rare in the Mediterranean Sea, where it is considered a vagrant from the North Atlantic.	No viable population in the Mediterranean IUCN status is: <i>Data deficient</i> .	The species is listed in Appendix II of the Bern Convention, in Appendix II of the Washington Convention and in Annex IV of the EU Habitats Directive. (*)
<i>Tursiops truncatus</i>	The commonest coastal marine mammal in the Mediterranean	This species' coastal habits expose it to extremely high levels of contamination from organochlorine compounds and trace elements (ANON., 1992), and make bottlenose dolphins particularly vulnerable to human encroachment on the coastal environment. IUCN status is: <i>Data deficient</i> .	The species is listed in Appendix II of the Bern Convention, in Appendix II (limited to western Mediterranean, Black Sea, and North and Baltic Seas) of the Bonn Convention, in Appendix II of the Washington Convention and in Annexes II and IV of the EU Habitats Directive. (*)
<i>Ziphius cavirostris</i>	Found throughout the Mediterranean Sea, in deep pelagic waters, particularly where the continental slope is steepest.	Known to occur in the driftnet bycatch. Contaminant levels in their tissues appear to be relatively low. IUCN status is: <i>Data deficient</i> .	The species is listed in Appendix II of the Bern Convention, in Appendix II of the Washington Convention and in Annex IV of the EU Habitats Directive. (*)

(\*) Note: All the following species are listed in Annex II to the Protocol concerning Specially Protected Areas and Biological diversity in the Mediterranean. This information is therefore not-repeated in column concerning protection.

### **3.7. COASTAL ZONE MANAGEMENT AND PLANNING**

Coastal zones, among the most productive and valuable global subsystems, encompass diverse, unique and highly fragile resources. Development pressure and population growth in coastal zones and a number of other interrelated causes are resulting in pollution, overexploitation, degradation and disruption of ecosystems, loss of natural habitats and decline of biological diversity. The traditional sectoral management and planning practices, characterized by absence of integration and proactive approach, have proved as incapable to slowdown and/or reverse the present negative trends.

After 25 years of successful implementation, Integrated Coastal Zone Management (ICZM) is considered as a proven and viable process, capable to substitute the traditional planning and management practices in coastal zones, overcoming thus the present management deficiencies and weaknesses.

ICZM is now widely accepted as the major tool for achieving a sustainable development of coastal zones and as an indispensable framework when implementing coastal zone specific initiatives and programmes. However for its efficient and fully successful implementation, in a number of Mediterranean countries there is still the need for an outside support and strengthened institutional and legal framework.

Hitherto experiences indicate that the wider context of any single transboundary related coastal zone issues cannot be addressed outside the ICZM conceptual and management framework. Therefore, the application of ICZM is a transboundary related issue by itself, due to the needs for and benefits from its application, as well as due to poor results of sectoral non integrated transboundary related initiatives. The systemic, proactive and integrating character of ICZM provides the needed base for successful implementation of transboundary related initiatives in coastal zones. Nevertheless, the present level of methodological and practical considerations of transboundary related issues in ICZM should be further upgraded, and specific approaches and instruments developed, tested and applied in Mediterranean practice.

The major issues and problems affecting the Mediterranean Sea and its coastal zones are related to:

- pollution;
- degradation of ecosystems;
- loss of natural habitats;
- overexploitation of natural resources;
- decline in biodiversity;
- socio-economic and other human related issues; and
- climate change.

All the above and other relevant issues are closely interrelated and triggered by a number of causes acting individually and/or in a cumulative and interrelated manner, most of these causes being of a long term nature.

The relevant causes can be classified in two groups: a) issues exercising an overall or multiple influence; and b) those influencing one or few single impacts.

The most frequent causes exercising an overall impact are:

- population growth;
- unsustainable, uncontrolled development;
- uncontrolled urban expansion along the coastline;
- poverty, lack of economic potential for sustainable development;
- inadequate institutional and governance arrangements for coastal zone management practices;
- absence of appropriate legal base and/or poor implementation and enforcement;
- unproper/unsustainable/sectoral planning and management practices, absence of proactive and integrated approach;
- disregarding of the influence of cumulative effects and transfer of impacts;
- weak institutional and human capacities;
- insufficient scientific knowledge and data on coastal ecosystems and resources;
- lack of awareness on specificities of coastal zone environmental and sustainable development related issues; and
- absence or weak participation of the general public, NGOs, scientific community and interest groups in coastal zone related issues.

The complex nature and interrelations of the above causes are intrinsic to the scope and contents of the ICZM process. Therefore, programmes addressing these causes, pretending to be successful and efficient, have to be comprehensive, integrated and proactive, i.e. have to be formulated and implemented within the ICZM framework.

### **3.7.1. Major ICZM related transboundary relevant issues**

Most of the issues presented above are dealt with separately and in detail in other chapters of the TDA. The basic and foremost relevant fact is individual transboundary issues cannot be addressed without being interrelated with and integrated into a larger systemic context of ICZM, in particular outside its integrating and proactive approach.

Taking into account all the above, the **major ICZM related transboundary issues** might be formulated as follows:

**A. Those related to absence of applying ICZM as the major tool when addressing transboundary related issues:**

- a) absence of applying the ICZM context** when addressing single major transboundary issues affecting the Mediterranean Sea due to insufficient legal and institutional ICZM framework in the region;
- b) the present, still insufficient, level and geographical coverage of implementation of ICZM in the region:** need to strengthen, upgrade the implementation of ICZM, to extend its geographical coverage to all mediterranean coastal states and harmonize among the countries the procedures and instruments to be implemented; and

c) the present low level of experience in ICZM when addressing transboundary issues: need to deepen and better elaborate the relevant methodology, to gain more practical experience and identify and test the most appropriate instruments.

**B. A group of specific ICZM related sectoral issues:**

d) need for the protection and conservation of the physical, biological and socio cultural identity of Mediterranean islands, in particular of the medium and small ones;

e) the negative impacts of mass tourism, not harmonized with the environment and disregarding the carrying capacity of exploiting resources: tourism is a larger pollutant of a transboundary nature, causing pollution, overbuilding along the coastline with impacts on coastal and insular habitats, resources and identity, causing destruction of fragile ecosystems and virgin areas, endangering biodiversity;

f) impacts of large urban / industrial coastal agglomerations / ports: causing uncontrolled urban expansion along the coastline, loss of habitats, degradation of coastal ecosystems, pollution, degradation of adjacent marine ecosystems, decline in biodiversity and bioproductivity, economic and social conflicts;

The basic prerequisites for a successful mitigation and or abatement of negative trends caused by the mentioned ICZM transboundary related issues affecting the Mediterranean Sea are:

a) securing the application of ICZM when dealing with individual transboundary related issues; and

b) upgrading the present level and strengthening the implementation of ICZM in the region.

### 3.7.2 Causes of major ICZM relevant transboundary issues

The following are the causes influencing the ICZM related transboundary issues listed in 3.7.1 (using the same numeration):

a) causing absence of applying ICZM, when dealing with transboundary related issues:

- absence of a clear and well defined legal and institutional ICZM related framework at regional level, and consequently absence or poor implementation of ICZM at national levels when addressing transboundary related issues
- disregard of the complex, interrelated, cumulative and long term nature of causes influencing individual issues
- lack of awareness of the need for and benefits when applying ICZM within transboundary related initiatives
- lack of experience in implementing ICZM
- still dominating classical sectorial / single topic approach to decision making and management
- poor integration of single issue - related programmes into larger comprehensive programmes
- institutional and human capacity aspects
- uncertainties when addressing larger or of a higher level programmes / actions or absence of such programmes

**b) causing the present, still insufficient level and geographic coverage of implementation of ICZM and insufficient harmonization of ICZM procedures applied by various coastal states in the region:**

- absence of an appropriate institutional and legal framework for the implementation of ICZM related transboundary issues
- differences in institutional, legal and other conditions prevailing among Mediterranean coastal states, influencing their approach to ICZM
- lack of awareness of the values and nature of coastal zone resources and of the need for a decision making and management system different than the one applied in continental areas
- still dominating classical sectoral approach
- resistance to the integrated approach and sharing of competencies
- absence of participation of focus groups in the decision making and management practices in coastal zones
- insufficient institutional and human capacity for implementing ICZM
- lack of practical experience in applying ICZM
- lack of funds needed for implementation of larger ICZM transboundary related projects

**c) causing the present low level of addressing transboundary issues within ICZM:**

- insufficient methodological basis, tools not transboundary specific and or not applied / tested in Mediterranean conditions,
- hitherto insufficient attention given to transboundary issues within ICZM
- insufficient experience of responsible national authorities for the implementation of ICZM transboundary related initiatives
- the bilateral / multilateral / regional character of transboundary issues, requesting regional or sub regional actions / projects
- the complex nature of transboundary issues, requesting complex and multilevel measures

**d) causing loss or risk of loss of identity of medium and small Mediterranean islands:**

- the methodology and tools of ICZM not applied in the islands related decision making process
- need for further refining of practice for Integrated Management of Mediterranean Islands
- absence of awareness at national level of the need for specific approaches and instruments for islands, when formulating and implementing national development policies and strategies
- absence of awareness of the existence and values of the identity of Mediterranean medium and small islands (Mediterranean insular identity) and of the regional character of this identity
- absence of the proactive approach and of understanding of importance of present negative trends leading to loss of insular identity
- present and future development pressures, disregarding the fragility, limited carrying capacity and specific character of islands' natural resources and ecosystems contributing to their identity
- absence of awareness of socio economic, cultural and other specific insular values, contributing to their identity, and of organized efforts for their protection and conservation
- absence of understanding the future development potential of the complex system of insular identity and of the economic interest for its conservation and protection
- insufficient economic potential of mediterranean islands for achieving or substantially contributing to their sustainable development
- weak impact of insular authorities and other structures and population on the formulation of national development policies and strategies
- absence of coherent and comprehensive internationally supported regional programmes addressing the sustainable development and protection of the identity of Mediterranean islands

(Due to specific aspects and needs for a sustainable development of Mediterranean islands, within the transboundary context, a more detailed analysis on islands is presented in 3.7.3.)

**e) causing negative impacts of tourism:**

- uncontrolled and unsustainable development of mass tourism in coastal zones
- disregarding of or non applying the Carrying Capacity Assessment for tourism activities
- disregarding of the cumulative impacts of various parallel tourism activities
- disregarding of the importance and values of coastal zone resources, in particular of the specific environment, landscape, architectural and cultural values, of their limited carrying capacity, and the need of their rational utilization, conservation and protection
- influence of those international tour operators promoting short term economic interests and policies, imposing conditions alien to the identity of Mediterranean coastal zones
- absence of a long term and proactive approach when formulating tourism development projects
- weak awareness of tourists on the need to protect the coastal zone environment and resources, unproper behavior, increased risk of forest fires due to uncontrolled tourism activities, aggressive behavior and nature of nautical tourism
- illegal activities implemented by false / unproper tourists: theft, damaging, destruction of environmental, biological, cultural and other values; killing / taking / damaging rare / endemic / endangered species...
- negative impact of mass tourism and high class tourism on traditional values, customs and behavior, when planned and implemented without consideration of the need for protection and conservation of these values.

**f) causing negative impacts of large coastal urban / industrial agglomerations, ports:**

- absence of applying the ICZM coastal urban component and the relevant urban specific ICZM tools (such as Rapid Environmental Urban Assessment, Urban Sustainability Indicators, Strategic Environmental Assessment, Urban suitability Analysis.), although well proven and tested in practice
- absence of integrated approach to development of large coastal urban agglomerations
- priority given to short run benefits and sectoral / partial interests
- unproper land use and urban planning
- weak enforcement of adopted plans and regulations, illegal constructions
- absence of or inadequate waste treatment and disposal
- absence of port reception facilities
- absence of or weak public participation in the decision making process...

### **3.7.3 Sustainable Development of Mediterranean Islands - a specific major regional transboundary related issue**

The Mediterranean islands constitute, after the Pacific and Caribbean ones, the most important group of islands in the world. They are among those regional subsystems most threatened by present unsustainable development and are highly in need of a specific integrated management approach.

The insular environment is a balance of traditional use, specific ecosystems and biodiversity, highly vulnerable to exogenic agents.

During millennia of human presence, the Mediterranean islands developed rich and diverse cultures, resulting from and adapted to the insular environment and conditions, with specific economies and practices of resource use and management.

Flora and fauna of the Mediterranean islands are characterized by a great number of endemic species, with some of the primitive life forms, disappeared on mainland, many of them highly endangered.

The historic and cultural heritage of Mediterranean islands encompasses archaeological sites from prehistoric to ancient Greek and Latin origin, as well as from early centuries of the new era, until to day. For example, Croatian islands only count for 630 registered and protected historic and cultural sites, monuments and other cultural items. The traditional insular specific urban and rural architecture, many dialects specific for one group or one island only, folklore and customs, offer large evidence of the extraordinary importance and specificity of insular heritage.

The biotic insular system is characterized by a high degree of species endemism and presence of relict species, and is markedly different from the continental one. Insular species are more vulnerable than their continental counterparts. The number of species is reduced in comparison with same areas in the continent. Many insular species are seriously threatened by unsustainable development. In the last 4 centuries, out of the 100 bird species extinct in the region, 90 were insular ones. The number of floral taxa presently considered as threatened is relatively high and priority conservation measures must be implemented urgently (25). Among animal species threatened with extinction the monk seal, griffon vulture, the small island rabbit, some reptiles, have to be mentioned. The present situation might be further worsened in the future due to the abandonment of traditional insular agricultural and pasture systems and by the spread of invasive species, in particular of those highly competitive with indigenous ones.

The present socioeconomic insular context is predominantly influenced by intense tourism activities: "(...)nearly all the small Mediterranean islands have been recently convulsed by heavy chaotic development linked with seasonal tourism" ...leading to ..."destabilization, socioeconomic deregulation and loss of 'social identity' (...)" -Giavelli and Rossi - (26). Notable differences among various groups / islands regarding the attained level of development resulted in different economic structures, in many cases in a monoculture based on intensive, highly seasonal mass tourism (f. ex. Malta, Cyprus, Corsica, Rhodes, Ibiza have in the tourism sector about 20 % of their total employment; Minorca f. ex. counts on highest income per capita in Spain). But, many islands presently not involved in the tourism boom, suffer from economic decline, depopulation, ageing of inhabitants, abandonment. Weak or non existing public participation and stakeholders involvement in management practices, and in some cases, strong impacts from sectoral or private interest groups, mainly not of insular provenience contribute to socio economic tensions.

The above negative trends accompanying the unsustainable development of tourism are causing a number of human related impacts: abandonment of the traditional way of life, loss of traditional insular values and assets, conflicts of behavior of ethical and other nature; damage to historic sites and settlements, archaeological sites and monuments, degradation and or destruction of insular urban / rural architecture...natural beauties and landscape...

As presented above, the Mediterranean islands were so far characterized by a richness of diversities and specific intra insular features, with high internal heterogeneity and wide complexity. **They constitute an entity by themselves and represent a pronounced particular identity.** The insular population has developed in the past a strong sense of collective insular identification, related to the own island and to the belonging group of islands. This feeling favors and invites for stability and protection of the endangered identity. Basic elements of this identity constitute: an attractive climate, extraordinary scenic beauties, unique but limited and fragile environment, insular specific natural and man made resources, and a traditional and harmonized socio economic and cultural context.

This identity should not be considered as restricted to human related aspects only, but it should be understood in a comprehensive context, encompassing the ensemble of assets, elements, conditions and phenomena of insular areas and population..

Major issues, affecting the ensemble of Mediterranean islands may be listed as follows: unsustainable development of tourism, problems of communication and transport, scarce freshwater resources, over exploitation of natural resources (overgrazing, overfishing, "over tourism" - i. e. tourism disregarding the carrying capacity of receptive areas and resources); limited agricultural land, use of fertilizers and pesticides, outside and locally generated sources of pollution, expected impacts of climate change, exposure to seismic risk for some of them, complicated property issues...

Due to the complexity of problems related to sustainable development and protection of identity of mediterranean islands, the need for their integrated management is stronger than in any other segment of Mediterranean coastal zones. The facts presented above represent a good proof of the need for a specific ICZM approach, different from the standard coastal one, when dealing with Mediterranean islands. From a wider insular perspective such an approach should not be automatically identified with those for the Caribbean and or Pacific or other islands, the entire context being absolutely different.

**The Integrated Management of Mediterranean Islands (IMMI)** therefore should be understood as a segment of ICZM in the Mediterranean region, applying the same approach, principles and tools developed so far for Mediterranean coastal zones as a whole, but adapted to and focused on specific insular conditions and needs.

In order to provide a sound methodological and instrumental base for IMMI, the actual state of implementation of ICZM in the region has to be kept in mind. Presently, ICZM has not yet fully developed and or thoroughly tested the regional insular specificities of management procedures and tools (such as Carrying Capacity Assessment, Strategic Environmental Impact Assessment, Cost Benefit Analysis when implementing ICZM, economic instruments for IMMI...).

Therefore, ICZM island related priority activities in the region have to be oriented at:

a) further refining and adapting of the ICZM methodology, tools and techniques to insular conditions and needs, in order to secure their full applicability, cost effectiveness and efficiency, under specific regional, national and local conditions.

b) further coordinated insular related research on: (i) economic factors generating potential for sustainable development; (ii) governance and institution related insular issues, and (iii) studies



on insular specific sustainable development of tourism and (iv) updating the Blue Plan scenarios for the Mediterranean islands.

c) implementation of practical IMMI case studies on implementation of ICZM and IMMI and specific tools and techniques of ICZM ( SEIA, CCA, CBA, GIS...)

d) development of a comprehensive regional strategy for Mediterranean islands, applying IMMI, to be presented to regional fora and national / local authorities, and

e) presenting results obtained in practical and issue oriented documents, training.

### **3.7.4 Geographic coverage of ICZM related issues, affecting the Mediterranean Sea**

The geographic coverage of ICZM relevant transboundary issues is related either to the Mediterranean Sea as a whole including its coastal areas and in some cases river basins, or to certain larger geographic areas or subsystems. Smaller coastal areas affected by the ICZM related issues, in particular related to the transboundary ones are identified as ICZM specific "hot areas", such as semienclosed aquatories affected by ICZM related issues, estuaries of big rivers and areas of big coastal cities / ports influencing the Mediterranean Sea and coastal zones with pollution, expansion along the coastline, etc., causing consequences of a transboundary nature: pollution, loss of habitats, decline in biodiversity...

Having the above in account, the geographic coverage of the ICZM related issues affecting the Mediterranean Sea and its coastal areas is defined as follows:

**a) ICZM transboundary related issues with the entire Mediterranean system as geographic coverage:**

a-1) absence of applying the ICZM principles and context when addressing sectoral or individual issues due to weak legal and institutional ICZM arrangement in the region, and consequently in individual coastal states (in particular related to: integration of the decision making process and harmonization of actions with other interrelated initiatives / processes / phenomena; proactive approach; involvement of the general public and stakeholders; considering the larger context; applying integrated planning and management...) (cross ref. 3.7.1.a, 3.7.2.a)

a-2) insufficient level of practical implementation of ICZM and the relevant geographic coverage, not harmonized procedures and approaches presently applied by various Mediterranean coastal states (need for creating institutional, legal, methodological and capacity related conditions for a harmonized approach, for establishment of the relevant institutional and legal arrangements, as appropriate, for implementation of practical ICZM initiatives...) (cross ref. 3.7.1.b, 3.7. 2.b)

a-3) non specific and not properly adapted ICZM procedures and tools related to transboundary issues (need for development of new or better targeted standard ones). (cross ref. 3.7.1.c, 3.7.2.c.)

a-4) poor application of the ICZM context when dealing with sectoral activities affecting the entire Mediterranean system: mediterranean tourism, (to be dealt with in the Chapter on tourism, need to secure a-1) (cross ref. 3.7.1.d, 3.7.2.e)

**The above presented issues are affecting all regional resources, in particular habitats, biodiversity, coastal and adjacent marine systems and human resources.**

**b) subsystems or sub regions affected:**

b-1) the Mediterranean islands (need for a sustainable development, protection of identity, sustainable tourism, implementation of IMML...) (cross ref. 3.7.3)

the resources affected: insular ecosystems, insular identity, habitats, biodiversity, human resources

b-2) sub regional groups needing a differentiated approach when dealing with ICZM relevant issues defined under a), :

b-2.1) Slovenia, Croatia, Greece, Malta, Cyprus, Turkey, Egypt

b-2.2) Algeria, Morocco

b-2.3) Albania, Syria, Lebanon, Libya, Bosnia and Herzegovina  
(the first two groups need an advanced, but differentiated between the two, approach; the third group needing a more basic approach) (cross ref. 3.7.1.b, 3.7.2.b)

The resources affected are all national coastal and marine resources, with transboundary impacts to neighboring areas.

**c) Sub regional "Hot areas"**

The ICZM related "hot areas", are restricted to those sub regional coastal and marine areas, where the issues and impacts to be dealt with in some cases pertain to other chapters of the transboundary diagnostic analysis, but need the ICZM context for successful management. Main categories of such areas are:

- sub regional areas affected by pollution of a transboundary nature: Northern Adriatic; Ebro-Rhone area; Eastern Mediterranean (Greece, Turkey, impacts from the Black Sea); Gulf of Gabes (Tunisia, Libya);
- big river basins and their deltas, needing Integrated River Basin and Coastal Areas Management: Ebro; Rhone; Po; Nile; and
- areas of big coastal cities/ports, needing the application of the coastal urban component of ICZM: Barcelona; Marseilles; Genoa; Naples; Venice; Rijeka; Split; Athens/Piraeus; Izmir; Alexandria and others...

**3.7.5. Nature of interventions proposed**

When defining the nature of interventions needed in the domain of coastal zone management and planning, and in particular when formulating proposals for actions, the following was respected:

- need for a realistic approach, formulation of viable proposals, applicable and with short or medium term deadlines, but providing grounds for further deeper/larger initiatives;
- a proactive context, including foreseeable future transboundary impacts and issues;
- harmonization with past and on going relevant initiatives at all levels;
- consistence with global/regional/national objectives, strategies, and programmes;
- provisions formulated in Agenda 21, MED Agenda 21, MAP, GPA, and GEF, were respected and taken into account; and
- requirement that proposed activities be specific, issue and target oriented, providing for practical outputs and results, intended to mitigate/control/prevent present and future transboundary sources and issues.

Having in mind the above, as well as the present achievements and conditions of implementing ICZM when addressing transboundary related issues affecting the Mediterranean Sea, the basic objectives of the ICZM segment of TDA are:

- to secure the application of ICZM when addressing sectoral or individual topic specific or areas specific transboundary issues; and
- to strengthen/widen the geographic coverage and harmonize the implementation of ICZM throughout the region, as a major transboundary related issue by itself, and as a prerequisite for successful addressing of individual transboundary related issues.

On the basis of above considerations, proposals for concrete actions are presented in this chapter:

#### **Action area A: Strengthening the legal and institutional framework of ICZM at regional and national levels**

**Problem:** Despite commitments adopted in Agenda 21, in Med Agenda 21 and within the MAP 1995 documents, ICZM and its TB related segment in particular is not yet fully / properly implemented throughout the countries of the region, due, inter alia, to inappropriate and different legal and institutional framework and practices. The consequences are failures or poor results in coastal zone management and in particular related to TB issues, resulting in increased pollution, disruption of coastal ecosystems, loss of habitats, decline of biodiversity, absence of considerations of expected impacts of climate change..., unsustainable development. The problem is of utmost importance for TB related initiatives and common for all ICZM TB related issues.

#### **Proposed actions:**

**Action A-1. Preparation and adoption of a MAP Framework Protocol on Implementation of ICZM,** addressing the legal and institutional framework, basic procedures and management approaches, integration, transboundary issues, management of islands, coastal urban and industrial areas, industrial accidents, use of EIA in TB issues...to be prepared within the MAP and MCSD context.

**Action area B: Upgrading / strengthening / harmonizing the implementation of ICZM in the region,** as prerequisite and framework for TB related initiatives

**Problem:** Due to the lack of awareness on the needs for and benefits from applying ICZM, to various and different legal and institutional national frameworks, still predominating sectoral approach to planning and management in coastal zones, lack of experience and capacity,... - the ICZM process is still not deeply enough and in a harmonized way implemented in all states of the region. Sectorial planning, absence of integration and of a proactive approach result in failure of management practices and of remedial oriented initiatives. The consequences are unsustainable development, disruption of coastal ecosystems, loss of habitats, decline in biodiversity and negative socioeconomic and other human related impacts, as well as failures when addressing TB related issues.

#### **Proposed actions :**

**Action B-1: Development of a Regional Strategy for ICZM, within the context of sustainable development, as a part of, or harmonized with relevant SD initiatives in the region, in particular within MCSD. The strategy should include, inter alia, the TB related segment, IM of islands, of coastal urban and industrial areas, tourism, fisheries, aquaculture..., and use of major ICZM tools, adapted to Mediterranean conditions. Basic principles and approaches for integrated land and sea use planning and management, zoning, coastal urban planning and management, integrated approach to mitigation of impacts of climate change... should be addressed in the Strategy.**

**Action B-2.: Implementation of regional / sub regional ICZM pilot projects to include TB related issues, impacts of climate change..., with the participation of countries involved (f. ex.: Northern Adriatic - Italy, Slovenia, Croatia; entire Adriatic - all 6 Adriatic coastal states; North - western mediterranean - Spain, France, Italy, Gulf of Gabes - Tunisia, Libya ..)**

**Action B-3.: Preparing pilot projects on Integrated River Basin Management including the transboundary affected coastal areas**

At least one pilot project to be implemented involving two or three countries affected by TB impacts caused by river basin sources ( f. ex. river Po involving Italy, Slovenia and Croatia; Rhone Ebro area, involving Spain, France and Italy, Neretva river basin, involving Bosnia and Herzegovina and Croatia...)

**Action B-4.: Preparing in selected areas case studies on C/B when applying ICZM (one coastal, one insular area)**

**Action area C: Upgrading / strengthening the TB segment of ICZM in the region**

**Problem:** TB related issues are of a predominantly regional, multilateral or bilateral nature. The ICZM related initiatives in the region were so far of a either regional or national / sub national character. Many TB related initiatives implemented without an integrated and proactive approach resulted in insufficient meeting of project objectives or in failures. The consequences were poor prevention, control and mitigation of TB related causes / impacts, resulting in continuing and increased pollution, degradation of ecosystems, misuse of resources, loss of habitats, loss of identity, decline in biodiversity, disregard of impacts of climate change... There is an urgent need for upgrading and strengthening the TB related segment of ICZM.

### **Actions proposed:**

**Action C-1.: Implementing regional projects addressing TB issues, applying ICZM, up to 3 projects to be implemented, in selected areas ( one coastal urban / industrial, one coastal, one insular)**

**Action C-2.: Preparing Regional Guidelines for addressing TB related issues within ICZM**

**Action area D: Upgrading / strengthening the islands related ICZM segment, applying the Integrated Management of Mediterranean Islands (IMMI)**

**Problem:** The Mediterranean islands constitute a major specific regional sub system, characterized by unique natural and manmade resources, particular insular ecosystems, specific insular type of flora and fauna, and traditional assets, customs resource use harmonized with their carrying capacity. The Mediterranean islands are a specific regional entity and represent a pronounced particular mediterranean insular identity. This mediterranean insular identity has to be understood in a complex and comprehensive context, encompassing the ensemble of characteristics of insular areas and population. Uncontrolled development, unsustainable tourism monoculture, impacts of mass tourism, abandonment and disruption of insular specific traditional systems and arrangements, failure of governance procedures and remedial initiatives, weak development potential and political influence, absence of national and international support and initiatives - resulted in increased pollution, gradual loss of insular identity, endangered or disrupted fragile ecosystems, overexploitation of resources, particularly of those exploited by mass tourism, in decline of biodiversity, loss of habitats and negative socioeconomic and other human related impacts. Furthermore, if the present trends are to be continued, the monoculture economic system based on mass tourism is likely to be disrupted in the foreseeable future, with heavy consequences for insular population. Risks of impacts of climate change...

The Mediterranean islands are one of the regional sub systems most threatened by present development and other pressures, and highly in need of an integrated insular specific management approach.

### **Proposed actions:**

**Action D-1.: Implementing pilot projects in selected groups of islands, applying Integrated Management of Mediterranean Islands (IMMI)**

(implementing it at least in one archipelago, f. ex. Dodecanese, or middle Dalmatian (Croatia) islands, involving in the project or harmonizing it with UNESCO MAB 7, INSULA)

The project has to address the approach, principles, tools and all major issues relevant to insular specific problems, assessment of present state and trends, identification of critical factors, defining of policies, strategies and objectives of sustainable development, preparation of development scenarios, and proposal for an integrated plan and sustainable development programme, including prevention, control, mitigation of pollution, protection and rational use of insular resources, application of insular specific waste treatment and disposal technologies; integrated water resource management, sustainable use of energy,..., sustainable tourism development...

**Action D-2.: Preparing Guidelines on Integrated Management of Medium and Small Mediterranean Islands (IMMI), presenting ICZM approaches, procedures and tools specific for and applicable to medium and small Mediterranean islands, defining the institutional and**

governance arrangements appropriate for islands, defining insular specific protection regimes, measures for sustainable development and support measures, insular specific approaches to TB issues affecting them, timely remedial initiatives for climate change impacts, proactive socio economic insular context, sustainable concept of insular tourism, protection of identity, insular specific ICZM tools and techniques...

#### **Action area E: Upgrading the coastal urban related ICZM segment**

**Problem:** Large coastal urban and industrial agglomerations, ports, are exposed to high pressure of predominantly uncontrolled and unsustainable development. The conditions prevailing in many coastal urban agglomerations are characterized by absence of a proactive and integrated approach to land use and sea use planning and urban planning and management, by priorities often given to short run interests, weak enforcement of adopted plans...Neither the ICZM process nor a number of tested and efficient ICZM tools are applied. The consequences of such situation are: excessive urban expansion along the coastline, decline of coastal landscape and loss of habitats, pollution resulting in degradation of coastal and adjacent marine ecosystems, insufficient infrastructure and communal services, poor waste treatment and disposal, occurrence of TB impacts..., illegal housing, loss of agricultural land..

#### **Actions proposed:**

**Action E-1.: Implementation of ICZM pilot projects in selected large coastal urban areas, applying specific tools (RUEA, SUI, SA, SEA, GIS...), at least two studies up to 2000, one in a developing country, another in a large insular agglomeration**

**Action E-2.: Preparing Guidelines for Integrated Management of Mediterranean Coastal Urban / Industrial Agglomerations, presenting approaches, procedures and tools, with practical examples and evaluation of hitherto implemented projects**

#### **Action area F: Upgrading the human and institutional capacity for the implementation of TB related projects in countries needing assistance**

**Problem:** The present human and institutional capacity in a number of mediterranean coastal states or coastal zones, related to implementation of the TB segment of ICZM is rather weak, and in many cases there is a lack of practical experience on its implementation. The result is the absence of applying ICZM and its TB segment in coastal zone planning, development and management, even in cases when such an approach does not require additional expenditure or institutional rearrangement. The consequence is poor planning and management, failure of development initiatives, unsustainable development, pollution, disruption of ecosystems, misuse of resources, loss of habitats, poverty, human related conflicts...In many coastal zones of the region there is a foremost and urgent need of a comprehensive training and education programme on ICZM and its major segments.

#### **Actions proposed:**

**Action F-1.: Formulation and implementation of a comprehensive regional training and education programme on ICZM and addressing of TB and other major segments; to be implemented by MAP jointly or with the support of WB METAP, GEF; including relevant qualified NGOs (MEDCOAST, INSULA, ...) and mediterranean universities and interested countries. The programme to be intended on a biennial basis, including 3**

consecutive phases, with provisions for follow up. Selected target groups for training and education: responsible national and local decision makers, professionals involved in CZM, representatives of private interest groups and the general public.

### 3.7.6. Tables

In the Chapter 2.7 of this document proposals are presented for concrete actions related to Integrated Coastal Zone Management and Planning when dealing with transboundary problems, see Table 2.7.1. The justification for proposed actions has been presented in sections 3.7.1 & 3.7.2 of this Chapter. The interrelations between identified major issues, their causes and actions proposed are presented in the following Tables:

Table 3.7.1: presenting issues, transboundary elements, causes and action areas

Table 3.7.2: presenting causes of issues listed in Table 3.7.1

Table 3.7.3: presenting areas for actions and activities proposed.

Table 3.7.1 ICZM related transboundary (TB) issues, relevant causes and interventions proposed\*

Issues	TB elements	Causes	Areas for action
1. Absence of applying of ICZM when addressing transboundary related issues	TBE 1 Type B	C 1, 2, 3, 4	A1, B1, B3, F
2. Insufficient level, coverage and harmonisation of implementation of ICZM	TBE 1 Type B	C 2, 3, 4, 5, 6, 7, 8	A1, B1, B2, B3, F
3. Insufficient level of implementation of ICZM transboundary related tools and procedures	TBE 1 Type A	C 3, 4, 8, 9	B2, B3, B4, C1, C2, F
4. Degradation and risk of loss of identity of Mediterranean small and medium islands	TBE 2 Type A	C 2, 3, 4, 8, 10, 11, 12, 15, 16	A1, B2, D1, D2
5. Negative impacts of large coastal agglomerations	TBE 3 Type C	C 1, 2, 3, 4, 5, 8, 14, 15, 16	A1, E1, E2
6. Lack of institutional and human capacity for addressing transboundary related issues	TBE 4 Type B	C 4	F

\* The "issue" related numbers correspond to those in "problems" in Tables 3.7.1 & 3.7.3.

TB Elements (TBEs) relevant to issues presented in Table 3.7.1

TBE 1: Degradation of natural resources and values, loss of habitats, decline in biodiversity, increased pollution from TB sources, overexploitation of resources.

TBE 2: Degradation of entire insular ecosystems, loss of insular identity, loss of habitats, decline of biodiversity.

TBE 3: Excessive urbanisation along the coastline, loss of coastline and coastal resources, loss of habitats, decline of biodiversity, pollution often with TB impacts.

TBE 4 Pool implementation of transboundary related initiatives resulting in increased level of negative transboundary impacts.

Type A: Individual single topic issues, TB in *strictu sensu*.

Type B: Issues with cumulative effects having TB character.

Type C: Issues of common interest, having thus TB character.

Table 3.7.2 Causes of issues presented in Table 3.7.1

C 1: Disregarding the complex nature of CZ related phenomena and of the need for a wider integrated approach, *i.e.* for connecting sources and impacts

C 2: Lack of awareness of the need for, and benefits from applying ICZM

C 3: Inadequate and/or differentiated legal and institutional framework for coastal zone planning and management among Mediterranean coastal states

C 4: Lack of experience and/or human/institutional capacity for implementing ICZM

C 5: Different ICZM practices among Mediterranean coastal states

C 6: Absence or low level of participation of general public and stakeholders in CZM

C 7: Lack of local/national funds for implementing large ICZM projects

C 8: Absence of internationally supported regional/sub regional ICZM related projects of TB nature

C 9: Inadequate/not enough specific tools within ICZM

C 10: Lack of awareness on the need for, and benefits from, applying insular specific management approaches and procedures

C 11: Absence of awareness of the need to protect timely the Mediterranean insular identity

C 12: Insufficient economic potential of islands for autonomous sustainable development

C 13: Disregarding of the limited carrying capacity of insular resources exploited by tourism activities, absence of applying the Carrying Capacity Assessment procedure

C 14: Absence of application of the ICZM on integrated urban planning in coastal areas, absence of applying proven tools: Rapid Urban Environmental Assessment (RUEA), Strategic Environmental Assessment (SEA), Sustainability Urban Indicators (SUI), Suitability Analysis of housing and urban expansion (SA)

C 15: Failure of sectoral planning and of classical land use and urban planning

C 16: Poor enforcement of adopted plans, illegal housing and constructions



**Table 3.7.3 Areas for actions and actions proposed**

Areas for actions	Actions proposed
1. Strengthening the legal and institutional ICZM framework at regional and national levels	A1: Adoption of a MAP protocol on implementation of ICZM, including, among others, transboundary related as well as insular and coastal urban related issues
2. Upgrading, strengthening and harmonising the implementation of ICZM in the region	<p>B1: Developing regional strategy for ICZM, to be included later in the regional strategy for sustainable development</p> <p>B2: Developing and implementing regional/subregional ICZM projects including transboundary issues (N. Adriatic, NW Med, NE Med, Gulf of Gabes)</p> <p>B3: Preparing case studies on cost/benefit when implementing ICZM in selected areas (one coastal, one insular area)</p> <p>B4: Preparing case studies on Integrated River Basin and ICZM for affected coastal areas including transboundary issues (Po, Rhone/Ebro, or Evros)</p>
3. Upgrading/strengthening the TB related segment of ICZM	<p>C1: Implementing sub regional pilot projects addressing transboundary issues only, applying ICZM</p> <p>C2: Preparing Regional Guidelines for ICZM of transboundary related issues</p>
4. Upgrading/strengthening the islands related ICZM segment, Integrated Management of Mediterranean Islands (IMMI)	<p>D1: Implementing pilot projects in selected groups of islands, applying IMMI (one archipelago, for example Dodecanese, or Dalmatian Islands - Croatia)</p> <p>D2: Preparing Regional Guidelines for IMMI</p>
5. Upgrading/strengthening the implementation of the coastal urban related ICZM segment	<p>E1: Implementing case studies for selected coastal insular urban agglomerations</p> <p>E2: Preparing Regional Guidelines on applying ICZM of coastal urban areas, applying tools adapted to Mediterranean conditions (RUEA, SUI, and Suitability for housing and urban expansion)</p>
6. Upgrading the human and institutional capacity for the implementation of ICZM transboundary related projects in countries needing assistance	F1: Organising and implementing training and education programmes related to implementation of ICZM transboundary related issues in priority areas

### **3.8 Legal and Institutional arrangements for Transboundary Related Issues in the Mediterranean region**

Transboundary related issues are those felt across borders, requiring cooperation among states in order to: a) define policies, targets and actions at appropriate levels for assessment, control, prevention and or mitigation of sources and impacts, and b) to establish relevant preparedness programmes. Addressing transboundary related impacts, therefore, is a multilevel issue: regional / sub regional / multilateral / bilateral, involving always the national level too. Due to the nature of transboundary issues, the relevant cooperation requires regional and national integrative structures and capacities. For an effective addressing of those issues, the countries involved have to agree on more substantive authority and competence to an appropriate regional body/ mechanism, in particular when dealing with mitigation of transboundary related conflicts.

Since the coastal and marine ecosystems extend beyond national borders, all of them being interconnected and interrelated, in principle all major impacts affecting them might be considered as transboundary related ones. In practice transboundary related considerations are restricted to those having presently major impacts on resources and ecosystems. In the future, applying the precautionary principle, this approach will certainly be broadened. Furthermore, in addition to transboundary issues caused by Land Based Sources of Pollution, other ones have to be considered, such as those caused by: overexploitation of shared resources; by sectoral activities having transboundary impacts; by cumulative causes resulting in degradation of larger transboundary areas, and loss of their identity; by risks of industrial / navigation / other types of accidents; etc.

Due to their dual character, addressing transboundary issues requires **adequate and appropriate international and national legal and institutional arrangements.**

**The international legal / institutional transboundary related framework** has to provide the legal basis for cooperation among interested / affected countries and define the procedures to be applied and their institutional aspects. In addition, the role of the said international framework is to promote / require the adoption of relevant national legal and institutional arrangements, and to provide support, assistance and training when needed and requested.

**The national legal and institutional transboundary related framework** is supposed to / should comply with the transboundary related international framework.

The nature of transboundary issues requires coordination and integration of relevant activities at both regional and national level, as well as among the two levels. Of utmost importance is also the participation in transboundary related activities of interested / affected general public, relevant NGOs, of the scientific community and interested private groups. Addressing the problem of integration, many cases should be stressed of: institutional arrangements and management procedures non adapted to the needs and specificities of coastal zones; of authorities and responsibilities being interwoven, overlapping the transboundary affected space and activities, being fragmented and widely dispersed; and of the still prevailing sectoral approach to CZ planning and management.

Finally, it should be stressed that the **integrated and proactive approach when addressing the transboundary issues is a prerequisite** for understanding of the relevant processes and phenomena and for the formulation of comprehensive remedial measures.

### **3.8.1 Major legal and institutional transboundary related issues**

The above issues might be systematized in 3 groups, i. e. those related to: a) international level, b) national ( regional, sub regional, multilateral, bilateral) level and c) those related to application of relevant transboundary related methodologies, procedures and tools.

#### **3.8.1.1 Issues at regional level**

The following are major issues related to the regional level:

##### **A. Absence of or insufficient transboundary related provisions within relevant regional or global legal documents.**

Many of those documents are not enough transboundary specific or not precise enough, leaving space for arbitrary interpretations, providing escape clauses, without provisions regarding the enforcement mechanism, without clear targets and deadlines: **there is a need for more specific, clear and integrated regional transboundary related legal context.**  
( see point 3.8.2)

##### **B. Need to better define and strengthen the role and involvement of international institutions coordinating transboundary related initiatives.**

The absence or weak implementation of the coordinating and integrating role of relevant international agencies, absence of assistance when needed and requested, and of providing resource commitments for transboundary related initiatives and remedial actions in developing countries involved - **calls for legal identification of the relevant regional body to take the role of lead agency.** This role should be and up to a certain level has been already assigned to MAP in the case of the Mediterranean region.

**C. Absence of provisions in regional transboundary related documents for compulsory application of successful procedures and tools such as EIA and SEA in the transboundary context, and of ICZM as a basic prerequisite and tool securing the larger integrated and proactive approach.** This issue is related both to national and international level:

#### **3.8.1.2 Issues at national level**

The following issues at national level are considered as of major importance:

##### **D. Absence of appropriate national transboundary related institutional arrangements.**

In many cases in the region and with a varying degree, the institutional arrangements and management in CZ, consequently regarding also the transboundary issues, are dispersed, fragmented and not CZ specific. The responsibility for transboundary issues is unclear or shared by various authorities. Sectoral, often non integrated CZ related decisions, result with transboundary impacts; the relevant remedial initiatives are either not timely implemented or have poor results, or result in failures. The final consequence is pollution, misuse of resources, overexploitation, loss of habitats, decline in biodiversity, loss of identity...Since one single national institution / agency cannot address alone those issues, the need of a National high level

Coordinative Body and of a Lead Agency is evident. In most of the cases in the countries of the region there are no transboundary related specific arrangements of the kind.

**E. Absence of legal / institutional arrangements securing participation of the interested / affected general public, NGOs, scientific community and stakeholders in transboundary related initiatives.**

In many cases the interested groups are neither properly, fully or timely informed, educated on transboundary related issues, nor there are provisions for: securing such participation; for the right of requesting information; for raising issues at national and international level... Public hearings, if any, are not fully informative and / or not transparent... Consequently, the public support for initiatives addressing transboundary issues is weak or nonexistent.

**F. Absence of legal provisions for monitoring, securing compliance and enforcement of transboundary related regulations and obligations.**

In most cases, and in particular related to non ECE member states (see 3.8.2.2) there are no such provisions

**G. Insufficient institutional / human capacity of authorities responsible for transboundary issues.**

The lack of integrative capacity, and a poor implementation of ICZM as a framework for addressing transboundary issues is present in many cases. Monitoring of these causes and impacts and their assessment is not consistent, non efficient or inadequate, and the remedial programmes not integrated within the needed larger context, resulting in absence of control of causative factors and failure of remedial measures.

**3.8.2 Problems and their causes, related to institutional and legal arrangements on transboundary related issues in the region**

**3.8.2.1 Institutional arrangements relevant for transboundary related issues**

The existing institutional arrangements relevant when addressing transboundary issues are different among the countries, due to their differences in the degree of development, length of coastline, level of development and urbanization of the coast, wealth and ways of exploitation of resources, political system, form and manner of governance arrangement, etc. Other, not less important factors have to be added, such as historic, national, cultural, religious and other specificities.

In spite of the above, there is a general scheme of the institutional arrangement relevant to ICZM and transboundary related issues. That scheme can be defined as multi-level and multi-sectorial, frequently with specific arrangements within individual sectors and in a certain number of cases with specific arrangements of inter-sectorial integration. It could generally be said that:

- from the point of view of policy structure variables, there is a wide array ranging from strong administrative control to pronounced, but not exclusive, rights of private interest groups;
- administrative variables range from prevailingly sectorial planning to, often insufficiently developed, broad functional responsibilities;

- policy orientation is increasingly turning from the sectoral one towards the integrated approach within the concept of sustainable development.

The sectorial governance arrangement follows, more or less, the standard sectorial classification, which is, as a rule, more diversified in developed countries. Due to various reasons, in many countries the sectoral activities most relevant for transboundary issues are organized in larger sectorial units, such as fisheries and aquaculture within the ministry of agriculture, land-use planning and/or environmental protection within the ministry of building, tourism within the ministry of industry, ministry of economy, or even within the ministry of interior, or maritime transport within the ministry of transports, communications and maritime affairs. Functions important for transboundary issues are sometimes located in "non-standard" administrative bodies and agencies. A considerable number of ministries and agencies have sub-national or local branches with delegated authority important for Coastal Management and transboundary issues. The "local" level units might have considerable authority, such as urban planning, issuing building permits, inspection, monitoring, control, etc.

The existing institutional arrangements establish a large number of administrative and decision-making instances responsible and or authorized for transboundary issues. Under such conditions, without a good work of the integrating function is not possible to avoid overlapping and/or conflicting decisions, which are neither environmentally sound nor meet the requirements of the sustainable development and in most cases have serious transboundary impacts. That is why the implementation of ICZM procedure and tools relevant for transboundary issues has to be considered as a must and prerequisite for their successful, timely and cost efficient addressing, and has to be secured through an appropriate institutional and legal arrangement.

### **3.8.2.2 International legal arrangements relevant for transboundary related issues**

The international legal arrangements relevant for transboundary issues are of a global, regional or sub regional coverage.

#### **a) Main transboundary relevant legal instruments of a global character.**

A number of legal documents directly or indirectly relevant were adopted; some of them signed by almost all countries. Among the most important ones, the UNCED 1992 documents, the Basel Convention, MARPOL 73 / 78, and the Global Plan of Action for the Protection of the Marine Environment Against Pollution from Land Based Sources have to be mentioned. A list of most relevant global documents is presented in the unabridged version of this Chapter.

#### **b) Legal instruments at regional level**

The following are the ones most relevant for the transboundary context:

##### **b-1) the MAP documents:**

- MAP Convention on the Protection of the Marine Environment and the Coastal Regions of the Mediterranean, and its related Protocols, revised in 1995
- AGENDA 21 for the Mediterranean, adopted in 1994
- MAP Protocol on Protection of the Mediterranean Sea against Pollution from Land Based Sources, revised in 1995

- MAP Protocol on the Prevention of Pollution of the Mediterranean Sea resulting from TB movements of Hazardous Waste and their Disposal, 1995  
The MAP documents and in particular the revised Barcelona Convention and its related Protocols are of utmost importance for institutional and legal aspects of transboundary issues in the region.

The Barcelona Convention establishes MAP as the regional body endorsed, inter alia, to address pollution related issues affecting the marine environment and the coastal region of the Mediterranean. The Convention contains provisions for a number of transboundary issues, such as:

- the Contracting Parties to enter into bilateral or multilateral agreements related to issues of sustainable development, protection of the environment, conservation and protection of natural resources, i. e. implicate also related to transboundary issues
- for the establishment of the Mediterranean Commission for Sustainable Development (MCSD), an institutional arrangement of utmost importance, to be considered as a potential framework for the relevant transboundary related arrangement in the region
- invites the Contracting Parties (CPs) to the Convention to adopt national legislation for implementing the Convention and its related Protocols
- envisages the arbitration procedure related to the application of the Convention and its Protocols, if requested by any CP.

The Protocols related to the Convention regulate / address specific issues, all of them being interrelated or connected with transboundary issues.

Each of the Protocols regulates certain transboundary relevant segments. The LBS Protocol addresses more closely the pollution issues of transboundary relevance, establishing, inter alia, procedures for addressing at MAP level issues which might arise among CPs (Art. 12). **But other transboundary related issues (overexploitation of shared resources for ex.) are not addressed explicitly in any of the Protocols.**

Concluding it might be stated:

- the revised Barcelona Convention and its related Protocols regulate implicitly, and in some cases explicitly, certain transboundary issues affecting the region; the relevant provisions are not comprehensive / consistent / specific enough to constitute a fully efficient and successful legal framework. However, the existing legal structure is an excellent base for it, providing some simple and viable amendments to be done.
- the present MAP institutional arrangement, established by the Programme and based on the revised Barcelona Convention, provides a proven framework institutional arrangement for addressing transboundary relevant issues in the region: some minor organizational changes might be useful
- the newly established MCSD within MAP, primarily oriented at initiatives related to sustainable development in the region, addressing ICZM issues within such a context, offers an excellent opportunity to act as regional Lead Agency for transboundary relevant initiatives, if supported by regular MAP structures.

#### **b-2: EU Programmes, encompassing some transboundary relevant initiatives:**

- MEDSPA - Mediterranean Strategic Plan of Action
- ENVIREG- Environment in the Regions
- MEDALUS - Mediterranean Desertification and Land - use Programme

### **b-3: ECE transboundary related Conventions**

The geographical coverage of these Conventions is restricted to the ECE constituency, including 13 Mediterranean Coastal states and EU. The relevant Conventions are:

- Convention on the EIA in a Transboundary Context, Espoo Convention, 1991
- Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki Convention), 1992
- Convention on the Transboundary Effects of Industrial Accidents, 1992

The 3 ECE Conventions, are strictu sensu transboundary related.

The Convention on EIA is of particular importance and of wide applicability, although the envisaged procedure might seem somewhat complicated. This Convention envisages the application of EIA in all cases which might result with TR impacts, and regulates the procedure of informing the potentially affected country(ies) as well as the bilateral /multilateral assessment and negotiating procedure.

Acceding to the ECE Conventions is restricted to ECE Member States only, encompassing 55 European and Newly Independent States and the EU. Thirteen Mediterranean coastal states are members of ECE. So far, the ECE EIA Convention has been signed by 5 of them and the EU, and ratified by 3; the "industrial accidents" Convention signed by 5 and the EU, and ratified by 2; the "watercourses" Convention signed by 6 and the EU and ratified by 4 and the EU. But the fact is that the Mediterranean coastal states, not members of ECE, can not accede to them.

The format, context and relevant provisions envisaged by these Conventions might be a good example in case of formulating new Mediterranean legal transboundary related documents or amending the existing ones.

### **c) Sub regional TR documents / agreements:**

The following are the most relevant ones:

- RAMOGE Project, involving France, Monaco and Italy - Cote d Azur - Riviera dei Fiori - Regional Cooperative Agreement to control Marine Pollution - Spain, France, Portugal, Morocco, EU, 1990
- the North Adriatic Programme (involving Italian, Slovenian and Croatian institutions)

Very few sub regional documents / programmes are addressing transboundary issues in an explicit way, and are usually implemented either within the EU programmes or on bilateral level outside the MAP framework. With the exemption of RAMOGE, which is a continuous and rather successful programme, few data are available on other ones. The Northern Adriatic programme mentioned earlier, is for example, presently not active at all.

Since the transboundary related issues should be primarily dealt with on a bilateral and multilateral basis as appropriate, **the need for initiating and implementing such type of agreements / programmes to address major transboundary issues in the region is evident.**

### **3.8.3 Assessment of national / transboundary character of identified issues**

With reference to facts presented in preceding points, and in accordance with the TOR and objectives of TDA, the assessment of the character of the above issues has been done having in mind 3 differentiated groups of transboundary issues:

**type A** - issues related to individual single topic impacts, having a *strictu sensu* transboundary character

**type B** - issues, whose cumulative effects result in impacts having a transboundary character, and

**type C** - common issues to be considered of a transboundary character: those of a primarily national / local character, if they are repeated in a number of countries due to similar or identical causes, requiring thus similar approaches.

According to it, the attribution of the character of each identified issue is presented in Tables under 3.8.5.

### **3.8.4 Nature of interventions needed**

According to the issues identified in point 3.8.1 and the analysis presented in point 3.8.2., it seems appropriate to present conditions in the region and cost efficient, to rely as much as possible on present institutional and legal arrangements, improving / amending them where and as necessary. This seems regards in particular the mandate and the legal and institutional arrangement of MAP, taking also into account the hitherto involvement and role of WB - METAP, of the EU, GEF , UNDP and FAO, and their respective mandates.

**In practical words, the needed interventions might be best implemented accepting MAP as the Coordinating Agency for transboundary related issues in the region, MCS D as the Lead Coordinating Body and the existing MAP structures as the relevant logistical support for the interventions needed. At the same time the role of other international agencies and organizations has to be defined and agreed upon.**

On the basis of the above, the following interventions are proposed:

#### **Action area A: Defining and strengthening the regional institutional arrangement for transboundary related issues**

**Problem:** The present regional institutional arrangement for addressing transboundary related issues is not properly defined. There are no formally adopted provisions related to a relevant regional Coordinating Body and Lead Agency. Absence of coordination and precise arrangements between various international organizations and agencies involved in transboundary relevant initiatives in the region, as well as of a harmonized and prioritized programme of action result in their uncoordinated and insufficient involvement in addressing major transboundary issues in the region. Consequently the countries involved, in particular those needing assistance and support when addressing transboundary issues, do not implement proper and timely actions related to assessment, monitoring, mitigation and prevention of those impacts.

#### **Proposed actions:**

##### **Action A-1.: Define MAP as Lead Agency and for TRI in the region.**

Present proposal to the forthcoming Meeting of the CPs of MAP related to: endorsing MAP as the Lead Agency for transboundary related issues in the region, adopt proposals as



appropriate, reformulate and adapt MAP programme and structure if needed and as appropriate.

**Action A-2: Reach Interagency Agreement on role, mandate and involvement in transboundary initiatives in the region among interested and responsible international Agencies and institutions (MAP / UNEP, UNDP, FAO, UNESCO, GEF, WB METAP, perhaps EU)**

Formulate a proposal, consult interested organizations, organize a preparatory meeting, formulate final proposal, adopt agreement. In parallel prepare a prioritized list of transboundary issues and areas and orientative programme proposal to be part of the agreement.

**Action A-3: Designate MCSD as the regional Coordinating Body for transboundary related initiatives in the region and secure logistical support of MAP structures**

**Action A-4: Reformulate MAP Programme and institutional arrangement if needed and as appropriate in order to satisfy the adopted legal and institutional arrangement.**

**Action area B: Strengthening and improving the regional and national transboundary related legal arrangements**

**Problem:** The existing national and regional transboundary related legal arrangements are not CZ and transboundary specific, not comprehensive. These arrangements, if any, lack of clear provisions for actions, procedures and tools to be implemented, of provisions for compulsory participation of the general public and stakeholders; the targets and deadlines are not at all or not clearly defined. The consequence is absence of properly defined and timely implemented actions, confusion related to responsibilities and procedures to be applied, different interpretations and escape opportunities, absence of bi - and multilateral arrangements and programmes.

**Proposed actions:**

**Action B-1: Adopt a transboundary related Annex to MAP Protocol on LBSP**

Prepare proposal, including provisions for all transboundary issues relevant for the region, define procedures, tools and mechanisms, criteria for prioritizing and programme proposals. Organize consultation and adoption procedure as envisaged by the Barcelona Convention, adopt the transboundary related Annex to LBSP Protocol.

**Action B-2.: Strengthen national legal and institutional arrangements for transboundary related issues**

Invite countries to establish National Coordinative Bodies for transboundary initiatives, preferably within National Commissions for Sustainable development or National Commissions for ICZM, if any. Invite countries to adapt, complete national legislation according to Areas for Action A and B. Provide assistance to countries needing it, if asked.

**Action B-3: Invite countries to adapt and or harmonize national legal arrangements according to regional transboundary relevant legal documents**

#### **Action B-4: Establish a Regional Network on transboundary related issues**

Under the guidance of MCSD and with assistance of MAP establish the Regional transboundary related Network, including representatives of national Coordinating Bodies for transboundary issues, representatives of institutions and agencies and of relevant and competent NGOs. Formulate and adopt the Network Programme, secure funds for its regular implementation.

#### **Action Area C: Implement practical actions aimed at establishment of bi- and multi-lateral transboundary related arrangements and implementation of relevant programmes**

**Problem:** So far only few harmonized and comprehensive transboundary related actions were implemented in the region, due to absence of appropriate legal and institutional arrangements, and of a harmonized regional approach and support. The absence of appropriate bi- and multilateral agreements and / or programmes addressing transboundary relevant issues is characteristic for the entire region. The international assistance and support in cases of developing countries involved / affected is weak, often non coordinated or insufficient. The consequences are untimely, unproper and / or partial addressing of transboundary issues, absence of preventive and proactive initiatives, resulting in pollution, degradation of ecosystems and biodiversity decline in affected areas.

#### **Proposed actions:**

##### **Action C- 1.: Prepare and adopt a prioritized list of major TRI and affected areas in the region**

On the basis of TDA, identify priority issues and affected areas, in particular those needing international assistance and support for assessment, monitoring, control and prevention of transboundary relevant impacts. Adopt the list at MAP and Interagency level.

##### **Action C-2.: Recommend / invite countries to conclude bi- or multi - lateral agreements or programmes for addressing priority transboundary related issues, provide support for those identified as high priority and needing international support.**

##### **Action C-3.: Include training and assistance on TRI in regular MAP programme**

#### **3.8.5 Tables**

The interventions proposed, identified issues and their causes are presented in the following Tables:

Table 3.8.1: Issues, relevant causes and interventions proposed

Table 3.8.2: Causes of issues presented in 3.8.1.

Table 3.8.3: Areas for actions and actions proposed

Table 3.8.1 Transboundary related institutional and legal arrangements issues: relevant causes and interventions proposed

No.	Issues	TB elements	Causes	Areas of action*
1	Absence of appropriate Nat. CZ TB related legal, institutional arrangem.	TBE <sub>s</sub> 1, 2, 3 Type C	1, 2, 3, 8	2-d, e), 3-b
2	Absence of legal, institut, arrangem. for participation of general public, NGO <sub>s</sub> and stakeholders	TBE <sub>s</sub> 1, 2, 3 Type C	2, 6,8	2-d, e, f), 3-d, e, f)
3	Absence of legal provisions for monitoring compliance and enforcement of TB commitments and regulations	TBE 1 Type A	2, 3	2-b), 3-d)
4	Insufficient capacity of authorities/ institutions responsible for TRI	TBE 1 Type C	1, 2, 5	3-a, b, d)
5	Absence of appropriate regional legal and institutional arrangements for TRI	TBE <sub>s</sub> 1, 2, 3	3, 8	1-a, b, c, d) 2-a, b, c, d, f), 3-a, c, d)
6	Unclear role and poor coordination of regional institutions involved in TRI	TBE <sub>s</sub> 1, 3 Type A	3, 7	1-a, b, c, d) 2-a, b, c) 3-a, c)
7	Absence of provisions at National / regional level for compulsory application of TR tools and procedures	TBE <sub>s</sub> 1, 2, 3 Type A	2, 3, 4	2-a, b, c, d)

\* indexes in "areas for action" correspond to issue in Tables 2.8.1 and 3.8.3

### TR elements relevant for major identified issue presented in Table 3.8.1

TBE 1	Pollution, disruption of ecosystems, resulting in loss of habitats, decline of biodiversity, degradation of natural resources and loss of development potential, due to absence of relevant legal and institutional TR arrangements as prerequisites for successful and timely implementation of TR initiatives
TBE 2	Impacts of human health, socio economic conflicts, loss of identity, resulting in loss of development potential, due to causes as in TBE 1
TBE 3	Overexploitation of shared resources with impacts on bioproductivity, biodiversity and development potential, due to absence of regional coordination of TR initiatives, and of timely bilateral or multilateral actions resulting from absence of TR relevant legal and institutional arrangements

Table 3.8.2 Causes of issues presented in Table 3.8.1

1	Lack of understanding of the value and complex nature of Czs and of coastal and marine resources, and of the need for CZ TR specific legal and institutional arrangements, different that those for continental areas
2	Lack of understanding of the needs for and benefits from establishing appropriate legal and institutional TR arrangements for CZs
3	National / regional and institutional TR arrangements not precise enough and not specific, without provisions related to enforcement, targets and deadlines, leaving opportunities for escape and different interpretation of obligation adopted
4	Lack of institutional / organizational capacity in various countries for efficient addressing of TRI
5	Insufficient financial / economic potential for successful addressing of TRI within bilatera, multilateral or regional projects
6	Absence of initiatives for and support to TR projects / programmes by the general public, NGOs, the scientific community and involved / affected private groups due to inadequate or non existing legal provisions and institutional arrangements for their participation in TRI
7	Absence of clear regional legal and institutional arrangements regarding the role of international / regional and other institutions and organizations interested and involved in TRI, absence of their harmonized approach and of financial support in case of developing countries involved - a regional coordinating body and regional lead agency not defined, financial assistance not defined nor harmonized
8	Absence of a prioritized list of TRI in the region and of a comprehensive programme for their addressing

Table 3.8.3 Areas for actions and actions proposed

Areas for action*	Actions proposed*
1. Define and strenghten the regional institutional arrangements for transboundary related issues	<ul style="list-style-type: none"> <li>a) Confirm MAP as Regional Lead Agency for transboundary related issues</li> <li>b) Reach Interagency agreement on role and involvement in transboundary related initiatives in the region</li> <li>c) Designate MCSDD as the Regional coordinating Body for transboundary related issues and secure MAP logistical support</li> <li>d) Reformulate MAP monitoring programme and RACs programmes, if needed, and as appropriate, in order to meet requirements under a), b), c)</li> </ul>
2. Strenghten and improve the national and regional legal arrangements related to transboundary issues	<ul style="list-style-type: none"> <li>e) Adopt a Transboundary related Annex to MAP LBS Protocol</li> <li>f) Invite affected and involved countries to establish high level National Coordinative bodies for transboundary related issues, preferably within NCSDD or National Commissions for ICZM</li> <li>g) Invite countries to adopt / harmonize national legislations and procedures with international / regional transboundary related legal documents</li> <li>h) Establish Regional Network for transboundary related issues and provide support for its regular programme</li> </ul>
3. Implement practical actions aimed at establishing bi - and multi - lateral transboundary related arrangements and programmes	<ul style="list-style-type: none"> <li>i) Prepare and adopt at MAP and interagency level a prioritised list of major transboundary related issues and areas in the region, resulting from TDA, and identify priority areas needing international support</li> <li>j) Recommend to countries involved in identified priority areas to conclude relevant arrangements and initiate programmes within the MAP framework</li> <li>k) Introduce training on and provide assistance for transboundary related arrangements and programmes</li> </ul>

\* indexes in areas and actions correspond to those in Table 2.8.1 and 3.8.1

### 3.9 Public Participation

There are no systematic studies or assessments describing the evolution of public participation in the Mediterranean area. The existing rare, scattered articles are very general without references to the institutional provisions, "costs and benefits" or "results" of experiences gained from public participation in the fields of the protection of the Environment and Sustainable Development in the region.

Most of the references available focus on specific cases of public reaction on selected issues, restricted most often, to problems affecting local communities and/or to presentation of positions of organised groups of citizens (NGOs) or "interest" groups. Despite the lack of references one should consider and assess, even broadly, the relatively large number of NGO activities including campaigns, meetings, conferences, etc. verbal, written and other reactions and demonstrations, publications, proposals and projects covering a very wide spectrum of issues related to the Environment and Development.

All participatory actions in the Mediterranean could be classified in two very broad general categories which in many cases should not be viewed as totally separate:

- a. actions related to specific problems usually local, subregional or national. In the majority of the cases known in the Mediterranean these actions are connected to proposed or implemented programmes, projects or policies; and
- b. actions related to the introduction of new ideas and principles and global, or at least international/transboundary, issues.

In the first case one could classify a very large number of "reactions" against announcements or activities of what are frequently considered by the public (local inhabitants, environmental or professional groups etc.) as inappropriate development projects threatening the environment or the viability and sustainability of local ecological or socio-economic systems (e.g. construction of a road, factory, dam, introduction of new species etc, agricultural subsidies etc.). In the same case one could also classify a large number of initiatives aiming at the "restoration" (cleanups etc.) of sites or promotion of education-awareness based on experiences to be avoided.

In the second case a variety of actions could be included most of which are of a rather "proactive" and informative character (such as "capacity building") or of institutional nature elaborating on concepts. This category includes conferences and, in general, efforts to organise public participation at international, national, regional or local level with principal goals the formulation of the opinion of a wide public and the influencing of political priorities and decisions at regional-Mediterranean level (e.g. global warming-energy taxes, sustainability plans, "green" accounting etc.). By their nature most of these actions are the direct or indirect result of the better organised -through NGOs- parts of the Mediterranean society who have formed networks covering the region.

Often the starting point of a public participation initiative might be local or national issues but in many cases very soon the debate expands on transboundary and global issues of economic, social or political nature which are recognised as the "root causes" of the problems or the obstacles inhibiting their efficient and timely solution.

The evaluations about the public reactions and priorities given in this paper might remain eventually open to criticism as "incomplete" or "arbitrary". This is an unavoidable risk due to their "empirical" basis. The same basis is frequently considered by others as the most solid and realistic one.

The followed "empirical" approach includes:

- a. direct knowledge and accumulated personal experience and information acquired by the author who has been deeply involved continuously with the issue of public participation and NGOs activities on environmental matters since the late 60's;
- b. review of the official positions adopted by Mediterranean NGOs in international meetings;
- c. review of a large number of publications, conferences and papers produced over the last 25 years by NGOs occurring, usually, in the so called, "gray-literature";
- d. assessment of replies to questionnaires circulated widely to NGOs by the Mediterranean Committee of the EEB in the 80's and by the MIO-ECSDE in the early 90's and recently;
- e. random review of issues covered by the daily press and other mass media in a number of Mediterranean countries (namely Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Malta, Morocco, Spain, Tunisia and Turkey); and
- f. brief review of the themes covered by international documentary films made mainly for TV stations concerning Mediterranean issues.

The State administrations of most Mediterranean countries often lack staff, means and tools to meet the ever - increasing internal demands and external pressures. The social and political systems have not provided rapid and efficient solution of the problems. The solutions tried in other parts of the world were not easily and safely transferable to the Mediterranean without prior testing. This situation has developed in many cases into a crisis expressed by anarchic, unprogrammed development and environmental deterioration.

The crisis seen positively has offered an opportunity to revisit the modes of governance and in many Mediterranean countries a start of reorganisation of management schemes involving many, until recently, not involved parties is observed. This is closely linked with a general ongoing process of democratisation reflected in greater political and civil freedom, greater participation of women, of local communities and youth and a general "openness" and increase in activities of civil institutions covering a wide variety of issues.

Despite the socio-economic, political and cultural diversities of the region and the differences in the philosophical background and starting points of participating processes in the various countries and subregions, one could talk about a genuine

transformation of the prevailing conditions in the Mediterranean and a general spirit which slowly but gradually favours popular participation in reaching more creative and innovative solutions, in an administratively less rigid and more flexible scheme. Most of these changes have taken place in the period since 1985 and with greater pace in the last five years.

In this context also the Mediterranean Commission on Sustainable Development was established. This Commission which was established in the framework of the Barcelona Convention, became operational in late 1996. Its scope, functioning and synthesis demonstrates the willingness of Mediterranean Governments and the European Union to actively engage, into a partnership, with other socio-economic actors. The decision to include among its medium term priorities, public information and participation as a major theme and entrust the task management of this topic to the representative of NGOs and local authorities, is a further concrete indication about the importance the Committee and its members attach to this issue.

It seems that in most of the Mediterranean countries is observed a fast evolution of the kind of public participation, but the process is still slow, inhibited by several obstacles among which five are the most important:

1. lacking or inadequate legal framework with adequate provisions for public participation (including access to information and justice);
2. inadequate administrative infrastructures with limited resources to cope technically with the requests by the public;
3. lack of coordination among the various administrative sectors, reducing their ability to be efficient and participatory even with other services or agencies;
4. fragmentation of NGOs initiatives and structures, particularly at the national level; and
5. reluctance by the authorities to provide information to the public even when this is technically and legally feasible due to lack of acceptance by many authorities and the majority of civil servants of the NGOs as legitimate "partners". In most Mediterranean countries the representatives of the public do not enjoy yet, in practice, the respect and attention by the Authorities which they should, according to the generous statements and intentional declarations of governments.

This last obstacle has a deeper cultural and mentality root, some times difficult to overcome even if the "institutional" obstacle, no 1, is surpassed.

Talking about the partnership and public participation one should clarify which are the expressions of the Public - the public partners. It is widely accepted that partnership is a bundle of compromise arrangements of mutually binding nature which balance and fulfil better than other relevant alternatives the interest of all parties and on which agreement was reached through a dialogue. The participation in the dialogue of the largest possible number of parties concerned is thought to increase the options of stability and sustainability of these agreements.

A number of constituents are identified as public. Usually as public are considered the population in general; the elected forms of popular representation such as local, district or town councils, neighbourhood committees and People's Assemblies (existing in

some countries); the NGOs and the other popular associations and in some cases public figures such as prestigious individuals.

Other partners for public dialogue and partnership are:

1. the State which includes:
  - 1.1 central Government;
  - 1.2 regional or Prefectural administration;
  - 1.3 district Authorities;
2. the City or town (local) Authorities;
3. the private sector which includes:
  - 3.1 the chambers of commerce and/or industry.
  - 3.2 the private investment sector, important for project financing, though rarely participates in public dialogues in any of the Mediterranean countries;
  - 3.3 "Producers", such as farmers, fishermen etc. usually represented through their local unions or cooperatives;
4. Syndicates such as the Labour Unions etc., rarely active until now on these issues in the Mediterranean countries; and
5. the private consultative sector which in many cases has shown ability to bring together other parties in order to obtain consensus for the success of the project to which its work is related.

Financing Organisations (Particularly the International ones)

Since projects which are not self-financed by beneficiaries are only implemented if they are of acceptable environmental and economic prospects, these organisations play an increasingly important role in stimulating public dialogue.

Universities and Research Institutes

These institutions have high ability to influence other parties due to their usually good reputation and high respect the public and the authorities show to their politically "neutral" work which often covers analytical work or/and recommendations in natural, social and economic issues.

Intergovernmental and other International Institutions

Several such institutions and agencies, particularly of the UN and the EU families, play effective role in participating in and stimulating dialogue and partnerships or providing finance and technical assistance to projects which involve the public.



## Political Parties

In most Mediterranean countries political parties play in a non-systematic way a rather limited role in stimulating public debate on environment and development issues or in effective promotion of multisectorial participation in public dialogues. In some countries the role of the ruling party is often confused with that of the State.

## Religious Groups and Churches

Traditionally they participated rarely in public dialogues on issues related to environmental problems (land based sources etc.) although many of them are becoming increasingly active recently and many of them are keen to participate in a dialogue on sustainable development issues related to moral and ethical values.

In general "participation" could be viewed as an evolving process starting from exchange of information on environmental issues and raising of public awareness and education on conservation issues to full access to justice and credit by NGOs and institutionalised full partnership with governments and other socio-economic partners in a new era of at least supplementing government with "governance". This is a long and difficult road, experienced in the Mediterranean countries as an "upraising curve", very closely linked with widening and deepening of democratisation, education and sensitisation of the wider public on issues of environment, development and culture.

Even today in the eve of the 21st century there are still relatively very few specific binding International Provisions for public participation and access to information concerning the environment or the plans, programmes and projects related to the development.

For the four Mediterranean countries belonging to the EU the directive 90/313/EEC for access to Environmental Information offers a relatively solid legal framework allowing the public to request general and very specific information from National and local administrations which are obliged to provide it with only few exceptions related to confidentiality.

A recent review of the actual situation on the implementation and enforcement of this directive shows that despite a general increase in openness and co-operation by the national administrations there is still a long way to be covered fully and applied properly in all four countries.

There are a variety of provisions about public participation and access to information in the various Mediterranean countries, in most cases not specifically for environmental issues.

In some constitutions the protection of the Environment is a duty of the State and at the same time there are strong constitutional provisions that guarantee the right of access to administrative documents and the right of citizens to obtain information.

In the majority of the non-EU countries one could find a varying spectrum of provisions obliging the Administration to respond to well justifiable requests from individuals or public interest groups. However in most cases these provisions are neither explicit and clear enough nor fully observed by the authorities.

However, the real "root" problem that reduces drastically the efficiency of participatory procedures is the lack of concrete support, institutional and/or financial, to independent citizens' groups which act outside political parties or religious groups.

The main problems related to public participation in the Mediterranean countries associated in one way or another with land-based activities are the following:

1. the still prevailing lack of recognition of the actual role of civil society (organised NGO groups, social partners etc.) by National Authorities;
2. distance between declarations or good intentions and practical commitments of behalf of Governments;
3. in a number of Mediterranean countries the government is relying too heavily on the majority or ruling political party. Groups of people which tend to criticise the government, because of lack of measures or its developmental choices, are quite frequently considered as "opposition" or siding with opposition parties; and
4. in the majority of the Mediterranean countries there are no "prior consultation" procedures and no "consensus" culture.

Funding NGOs is a big problem in the Mediterranean. Most NGOs have no adequate financial means and their financial basis is not sustainable. Membership alone cannot support them and they are dependent on volunteers. Because of the lack of paid, in house expertise the majority of Med NGOs cannot have the continuous input expected in policies and strategies, and the required "professional" approach.

A brief schematic representation of the existing situation of Public Participation in the Mediterranean.

The following list has been the result of combined treatment of questionnaires, NGO literature and articles appearing in newspapers and documentaries. The marine pollution by oil spills is also very high in the agenda of the public but as an issue is rarely related to land-based sources. The six very broad themes identified are mentioned without proper ranking:

1. water scarcity and water quality. This issue is quite frequently interlinked with erosion and desertification or pollution by uncontrolled agricultural and industrial activity;
2. pollution from solid wastes (rubbish and toxic wastes);
3. pollution from liquid wastes;
4. coastline distraction due to lack of management and anarchic development. Reduction of possibilities for healthy swimming and natural recreation activities in general due to less free space;
5. air pollution from urban centres industries and the traffic and their effect to health and monuments; and

6. destruction of wetlands and pressures on ecosystems and Mediterranean species threatened and /or rare.

It is widely believed that participatory processes are expensive. This is based to a combination of the dogma "time is money" and the fact that participatory processes are usually lengthy. The experience, however, of other parts of the world has demonstrated that in many cases these procedures are some of the most cost-effective tools in securing the smooth development of programmes, policies and projects. It is of course difficult to assess the actual cost of participatory processes or lack of them but it has become increasingly apparent, during the last few years, that the uninformed public is frequently much more suspicious and conservative in whatever development proposal and difficult to deal with.

### **3.9.1 Recommendations for action**

The recommendations are classified in themes and depending to whom the recommendation is addressed.

#### Access to information

##### States

To introduce, whenever not available, legislation (laws and/or regulations) making information related to the environment open to the public.

These provisions should be accompanied by:

- a) legal acts identifying categories of information which will remain eventually closed;
- b) legal acts to hold state officials responsible for refusing or not providing information to the public;
- c) rules obliging state officials to meet with the public representatives on the request of the latter and to answer questions on environmental issues; and
- d) training of state officials at critical posts and preparation of the national and regional services in answering questions in order to cope with the provisions for more active participation of the public and access to information (e.g. access databases, public briefings etc.).

##### Local Authorities, NGOs and other partners

- a) Preparation of leaflets and other printed material to inform the various groups and individual citizens, on their rights and on the most appropriate ways to formulate their requests for information from various state agencies and Ministries; and
- b) Preparation of TV spots on the same issues as (i) above.

## Participation

### States

To introduce, expand or amend legislation allowing environmental NGOs and other parties to participate in policy-making bodies and in the implementation of relevant policies.

These provisions should include:

- a) public participation in presentation and debate of EIAs;
- b) public participation in the drafting of sustainability plans, integrated coastal management plans etc; and
- c) setting-up of consultation procedures for NGO networks and other partners with national, regional and local administrations.

### NGOs

To increase the ability and expertise of NGOs in order to participate in a constructive and effective way on equal footing with other parties. This requires capacity building actions, training, institutional support for both local and national groups and federations which can represent NGOs and citizens in a legitimate and efficient way. NGO publications - promoting communication of ideas and positions should be also supported.

## Access to justice

### States

To adopt, expand and further develop liability regimes. To ensure open access of citizens and NGOs to courts of all levels. To introduce and expand systems for Environmental Damage Assessments to include also transboundary damaging activities.

### NGOs

To inform the public and NGOs on the proper procedures to be followed in order to support their legal rights to appeal to courts against decisions of State and Municipal authorities.

Training of NGO leaders and relevant publications are some of the appropriate tools.

A Mediterranean service for local advice to citizens and NGOs could also be considered for a period e.g. of 5 years.

## Funding

Participation and public awareness actions need also some investment of additional funds at national and local level.

NGOs should be supported with adequate "seed" money to be started but mainly on the basis of their proven activities over a relatively long period of existence.

This is a provision preventing "mushrooming" of NGOs but it may act against new dynamic or "promising" groups.

Part of the funds from the lotteries and other forms of national or local systems generating additional income for the State could be redistributed to help NGOs.

Exemptions of private donations to Environmental NGOs is also a useful and effective tool for financial support. In some countries there is a recent drawback, against existing exemptions moving to the opposite direction a tendency which should be reversed urgently.

### Accompanying actions:

- i. A critical review on the existing experience in the EU countries from the introduction of the relevant directive on access to Environmental information could greatly facilitate the development of the legal framework in the non-EU Mediterranean countries as well as its amelioration and adaptation in order to secure its proper implementation.*
- ii) A study could be carried out to identify in each country which are the needed amendments in the existing legislation in order to secure introduction of provisions for access to information and participation.*
- iii) To generate the necessary funds and provisions for an efficient and extended work of the group of the MCSD working on public participation, and further secure, the political, legal and financial means for full implementation of its recommendations.*

## 3.10 Investment Portfolio Framework Analysis

### 3.10.1 Introduction

The aim of the Investment Portfolio is to highlight the economic implications of the preparation and implementation of an environmental action plan for addressing the regional environmental Hot Spots for the Mediterranean Sea. The Investment Portfolio relies on available estimated cost information generated by the country study reports and the sectoral study reports, interpreted and organised in the light of broader cost/benefit approach to outline an investment strategy as a component to support further pre-investment analysis for future priority actions. Despite data and other gaps, which call for more detailed investigation, the Investment Portfolio serves to show the broad resource requirements, outlines funding issues and defines some of the main benefits central to the justification of the proposed environmental investments for addressing the identified pollution Hot Spots in the Mediterranean.

### 3.10.2 Proposed Investments and Actions

A general review of the proposed investments and actions reveal the following investment profile:

1. Wastewater treatment plants (WWTP) represent the predominant remedial action proposed reflecting the predominance of municipal and industrial wastewater as the main land-based source of coastal pollution risk.
2. A more diverse set of proposed actions is put forward for **Italy** due to the broader industrial base of the Italian economy and the greater diversity of activities associated with the Italian harbours. 13 of the 15 Italian Hot Spots are harbour areas while the 4 leading Hot Spots are harbours of regional and international importance (Porto Marghera-Venice, Genova, Augusta and Brindisi). The bulk of the proposed investments for Italy include facilities and measures to improve industrial and harbour operation practices while the municipal wastewater management sector investment is a relatively small part of the package.
3. Generally, cost information on investment actions for municipal wastewater pollution risks is more developed compared with similar information on the industrial sector. The need for research, feasibility studies and costing on industrial sector actions is recognised but does not emerge as a key concern in terms of remedial action. Industrial feasibility studies are proposed for a few countries including **Italy, Greece, Tunisia, Lebanon and Cyprus**.
4. Actions for institutional strengthening and capacity building are support activities for sustainable environmental management. This approach is more clearly reflected in the investment proposals for **Albania, Croatia and Slovenia** and to some extent for **Greece, Lebanon and Syria**. Despite widespread awareness of the importance of monitoring and coastal zone management capacities, project requirements for institutional improvements seem to be under-represented in the proposed investment priorities.

### 3.10.3 Estimated Costs, Uses and Limitations

Table 3.10.1 below summarises the available cost estimates by country, showing also the total estimated cost of 3,970 Million US\$.

Table 3.10.1 Estimated Investment Costs (Million US\$) (Based on the information of the Country Reports)

Country	Investment cost
Albania	133.5
Algeria	NA
Croatia	170.0
Cyprus	6.6
Egypt	NA
France	200.0
Greece	207.4
Italy	1,288.0
Israel	129.0
Lebanon	405.1
Libya	16.6
Malta	48.0
Morocco	54.0
Slovenia	42.0
Syria	197.3
Tunisia	298.0
Turkey	774.5
<b>Total *</b>	<b>3,970.0 Million US\$</b>

#### Type of Investment

Of the total amount of 3,970 Million US\$, about 39 per cent (1,552 Million) is proposed for WWTP construction, reconstruction and extensions, about 6 per cent (230 Million) is proposed for the treatment of industrial effluent, about 27 per cent (1,055 Million) for joint industrial and municipal treatment plants, just under 28 per cent (about 1,108 Million) for the Harbour and Industrial sector in Italy and well under 1 per cent (only 25 Million) explicitly for feasibility studies, management plans and capacity-building actions. The composition of investment reflects partly the focus placed on the municipal and industrial sources and partly the lack of information on industrial sector investments and the diffuse nature of actions understood as comprising "capacity-building investment".

## Geographical Distribution of Investment

The geographical distribution of the total estimated investment cost clearly follows the size and industrial base of the countries involved. **Italy, Turkey and Lebanon** together account for 2,467.6 Million or just over 60 per cent of the total. Italy accounts for a third of the total and Turkey for nearly a fifth of the total. Lebanon, although a small country, accounts for another tenth due to the recent war-related environmental degradation.

## Investment Cost as a Rough Approximations

The estimated costs are very broad approximations base on available country-level sources. The cost information has gaps and possible inaccuracies for rigorous project analysis. However, they serve as a basis for further use to narrow down the subsequent research effort for more focused costing and data refinement required pre-investment appraisals.

## Preliminary Project Identification

More accurate and comprehensive cost data will be needed in follow-up activities in response to the need for closer project identification and a sharper definition of priority actions which are essential elements for strengthening the scope of economic analysis in the formulation and implementation of the environmental action plan for the Mediterranean.

## Focusing on "Resource-consciousness"

These initial cost estimates are a "first-shot attempt" to apply cost considerations to proposed actions and derive guidelines for implementation initiatives. The use first-approximation cost information for the preparation of an Investment Portfolio is to introduce "resource consciousness" in the regional strategic environmental action plan as a context for project identification, definition of cost-effective options and to address the questions of **how** to take investment decisions on options and approaches appropriate to particular country situations.

### **3.10.4 Investment Strategy**

Notwithstanding numerous cost data gaps, costs need to be related to **wider economic and environmental considerations** before used for action planning purposes. The main task at this stage is the interpretation and use of the available cost data to construct elements for integrating the proposed remedial environmental action within an action-oriented investment strategy for future investment decision-making. An investment strategy involves various levels of analysis and increasingly more and better data according to the degree of detail needed. So far, costs show an approximate set of financial requirements added up to give total amounts of estimated investment requirements. Raw cost information needs to be analysed in relation to the impacts of the present pollution risks and the "value" of benefits expected from the proposed investments in terms of the future reduction of these impacts on resources such as human health, aquatic life, economic and social welfare, recreation activity, other beneficial uses and quality of drinking water. This approach is instrumental to effective mobilisation and use of financial resources for a particular action plan.

Benefits accrue from reduction or avoidance of pollution impacts on resources with social,



economic and environmental value. A first step in the definition of benefits will be done below by looking at the reported impacts of the Hot Spots revealed by the graded effects on Human Health, Aquatic Life, Economy and Welfare, Recreation, Other Beneficial Uses and Quality of Drinking Water on which information was collected and reported on the basis of questionnaires.

### 3.10.5 Impacts

Environmental impacts are the triggering factors for environmental investment. Environmental investment, on the other hand, is justified mainly by the impacts which signify degradation of resources which if avoided or reduced will produce benefits to society and to the various stakeholder in society. Because environmental resources are often used (and misused) outside a market context, their value is under-rated and, therefore, the benefits from their conservation or better use practices are often qualitative and, in reality, greater than the streams of monetary revenues arising from the "use value" of resources within a commercial context. This broader definition of benefits to include the conservation of resource for their existence or "non-use value" is central to the justification of environmental investments.

**The environmental impacts** of the identified Hot Spots are analysed in the Country Reports and the Regional Hot Spots Report. It is necessary to bring up and highlight the main conclusions from these data. The relevant information which needs to be highlighted refers to the **effects of the identified Hot Spots on key environmental resources to which remedial actions and investment are proposed to be directed.** This information is put together in two stages:

**First**, in Table 3.10.2 which catalogues all the Hot Spots by country according to the common scoring system applied to identify the most seriously affected Hot Spots, and,

**Second**, in Table 3.10.3 which presents the available information constructed to show the **type and degree of the effects.**

Table 3.10.2 immediately shows two important points: **First** (horizontally) the ranking of Hot Spots in each country and **second** (vertically) the cross-country or regional profile of the most serious Hot Spots classified according to their weighted score. As regards the second point, the Hot Spots standing out as the most serious are:

- With score 25.0-26.1  
**El-Manzala (Egypt) and Izmir (Turkey)**
- With score 20.0-24.9  
**Kastela Bay and Split (Croatia), Abu-Qir Bay (Egypt) Greater Beirut (Lebanon) Hanzur (Libya) Tanger (Morocco), Weid Ghammieh (Malta), Porto Marghera-Venice (Italy), Haifa, Akko, Nahariya (Israel), Tartous, Lattakia, Banias (Syria), Gabes, Lake Tunis (Tunisia), Icel, Antalya, Hatay, Adana, Tarsus, Antakya (Turkey)**
- The other Hot Spots fall in the other 3 categories with descending weighted score.

Table 3.10.2 Catalogue of Hot Spots by country and degree of pollution risk (weighted total score)

Country	25.0 - 29.4	20.0 - 24.9	15.0 - 19.9	10.0 - 14.9	Below 10.0
Albania				Durres, Vlora, Drini river, Mati river, Semani river, Shkumbini river, Durres ex chem. factory	Vlora ex PVC factory
Croatia		Kastela bay, Split	Sibenik, Zadar, Pula, Rijeka refinery, Kaltenberg, Rijeka, Adria, Cokery	Dubrovnik, Tannery, Krka	Neretva river
Cyprus				Limassol old port, Vassiliko cement plant	Limassol sewage outfall, Larnaca ref.
Egypt	El-Manzala	Abu-Qir bay	El Mex bay, Alexandria, Rashied, Damietta		
Greece			Thermaikos gulf, Inner Saronic gulf, Patraikos gulf	Pagazitikos gulf, Heraklion gulf, Elefsis bay	
Lebanon		Greater Beirut,	Jounieh, Saida-Ghaziye, TripoliBatroun-Selaata		
Libya		Hanzur	Tripoli, Benzazi, Zawia, Tobruk		
Morocco		Tager	Tetouan, Nador	Al Hoceima	
Malta		Weid Ghammieq	Cumnija, Ras il-Hobz		
Italy		Porto Marghera (VE),	Genova, Augusta-Mellini, Brindisi, Milazzo, La Spezia, Golfo di Napoli, Ravenna, Taranto, Gela, Rosignano Solvay, Bari-Barletta, Livorno	Manfredonia, Ancona	
Israel		Haifa bay (domestic), Akko, Nahariya	Gush Dan, Ashdod	Haifa bay (industrial)	
Slovenia			Rizana river, Izola	Delamaris, Badasevica river	Dragonja river, Drnica river
Syria		Tartous, Lattakia, Baniyas	Jableh		
Tunisia		Gabes (indus.), Lake of Tunis (indus.)	Lake Bizerte (indus. & munic.), Ghar El Melh, Sfax-South (indus.), Gabes (munic.), Sfax-South, (munic.)		
Turkey	Izmir	Icel, Antalya, Hatay, Adana, Tarsus, Antakya	Iskenderun, Kirikhan, Dortyol, Erdemli, Silifke, Osmaniye		

This is only part of the definition of priority for action. To get closer to the important question of the resource which will be saved by the proposed environmental investment we need to give particular attention to the "effects" parameter revealed by the available information. This is shown in Table 3.10.3 which is an annotated version of information extracted from the country study reports. Although it is very difficult in practice to distinguish among related environmental resources, it is useful to utilise the available data and trace the type of resources on which the pollution effects are most severe. This is shown in Table 3.10.3 below. **The data show that Human Health Effects, Aquatic Life Effects and Economic Welfare Effects are by far the most frequently reported "extremely affected" environmental resources.**

Table 3.10.3 Type of resource on which pollution effect / impact in the identified Hot Spots is shown to be extreme (ranked in terms the frequency of "Extreme Effects")

Public Health	Aquatic Life	Economy & Welfare	Other beneficial Uses	Recreation	Quality of Drinking Water
23	23	21	7	5	2

It is evident that the investment strategy with the highest benefit is likely to be that which directs actions and funds towards the projects addressing the "extreme effects" which are reported to be the Human Health Effects, the Aquatic Life Effects and the Economy and Welfare Effects. These three main effects may be seen to correspond broadly to the social, environmental and economic impacts of pollution.

### 3.10.6 Investment-Portfolio Scenarios

#### 1. "Do nothing"

Taking no action is evidently the highest-cost option from the environmental and social point of view, which should be excluded at the outset. Marine pollution from municipal and industrial wastewater; agricultural runoff, discharges of ships and uncontrolled disposal of solid wastes is a major pollution threat in the Mediterranean. Apart from the environmental costs, the strong economic-environmental linkages underlying the regional economy due to the importance of environment-related sectors such as tourism, fisheries and agriculture also imply direct economic losses in these sectors. Available information<sup>1</sup> for the region as a whole indicates the following:

- More than 70 percent of municipal wastewater is untreated and discharged in coastal areas from short marine outfalls. Hazardous industrial wastes also reach the coastal environment either directly or through municipal sewerage systems. It is estimated that about 25 percent of total pollution in the Mediterranean is located in the north-western part of the sea coming from France, Italy and Spain. Another 35 percent is found in the Adriatic originating from Italy.

<sup>1</sup> The State of the Marine and Coastal Environment in the Mediterranean Region, MAP Technical Report Series No. 100, 1996, and The Environmental Program for the Mediterranean, The World Bank and The European Investment Bank, 1990

The southern part pollution is much less but risks are serious due to the high proportion of untreated discharges.

- A sampling of 150 beaches in France, Italy, Spain and Greece in 1988 showed a quarter of them with pathogens exceeding safe levels. Massive eutrophication in the northern Adriatic Sea occurs from nutrients reaching the coast through rivers. Some of the impacts are already evident; pollution and over-exploitation have reduced fish yields and the region is now a net importer of fish.

- In the next 2-3 years the number of international tourists in the various countries of the Mediterranean is expected to reach 200 million a year. The coastal environment and the quantity of fish are some of the major factors in the comparative advantage of the region in tourism and its significance as a income earner.

- Social consequences are equally important. The increasing population concentration in coastal areas, apart from adding to pollution, means exposure to health hazards affecting mostly the poorer sections of the population and the rural migrants living in the overcrowded "informal" neighbourhoods of coastal settlements without infrastructure services. The Blue Plan estimates that the coastal population of the Mediterranean will double in the next 25 years reaching 150 million, no doubt including a large section of low income families.

- According to a recent study<sup>2</sup> of pollution in the Middle East and North Africa region indicates that in Egypt poor sanitary conditions and hygiene, combined with particulate and lead pollution account for an estimated 6.1 million days of diarrhoea in the Cairo area; up to 5,500 deaths per year would be saved if safe water and sanitation services were provided. In Algeria in areas with iron, steel and fertiliser industries the incidence of respiratory infections among school children is observed to be up to 65 per cent higher than in other non-industrialised regions of the country.

- In the same region, foreign exchange earnings from tourism and travel reached over 10 billion USD in 1993-4, more than double the average yearly earnings of the past decade. Income from tourism and travel, relative to merchandising exports including oil are 60 per cent for Egypt, 35 per cent for Morocco and 30 per cent for Tunisia. Municipal and industrial wastewater discharges combined with other sources of environmental degradation (~~degrading historic~~ monuments, air pollution, poor sanitary conditions and inadequate collection of disposal of urban solid wastes) are likely to reduce tourism earnings by 1-2 billion USD in the near future.

The lack of environmental cost/benefit studies is a major problem accounting for the absence of information on the quantifiable costs of environmental degradation. Published information sources acknowledge the estimation difficulties and resort to qualitative references to environmental damages and impacts which, although they sharpen the awareness of the extent of the sources and consequences of pollution risks, nevertheless confirm the lack of economic costs including the social (distributional) implications of the impacts of these costs.

Given the prevailing cost-of-impacts data limitations, statements concerning the environmental costs of inaction can only be fragmentary and incomplete. One particularly sound report on

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<sup>2</sup> World Bank Environmental Strategy for North Africa and the Middle East. World Bank. 1995.

the Mediterranean fishery sector<sup>3</sup> expresses the point quite clearly illustrating the general situation on this issue: "*Considerable difficulties are associated with estimating losses due to human interventions in the Mediterranean environment, including the costs and benefits of different actions. These mainly stem from the fragmentary nature of the data base, and here fisheries is no exception. One of the priorities for action in the fisheries sector is in fact to collect data that will allow an indicative idea of the benefits of management action, and the losses associated with inaction. In relation to the problems of making financial statements on management issues at this point in time, there is a need for basic analytical tools to support the decision-making process for managing fisheries on the basis of economic and eventually social considerations.*" (Fisheries Transboundary Diagnostic Analysis: Mediterranean Fishery Component, FIRM (FAO, April, 1997).

Despite data and methodological limitations, it is useful to note some broad quantitative information extracted from publications which show in economic terms at least part of the resource losses associated with existing environmental risks in the Mediterranean:

**Tourism:** Estimated cost of environmental impacts 25.0 billion US\$  
-Harmful chemical and biological effects 1.0 billion  
-Air pollution and traffic jams 1.2 billion  
-Nature and biodiversity 2.0  
-Other nature disaster 20.5 billion  
-Social risks 0.2 billion  
(Source: TDA for the Mediterranean, Tourism report, April, 1997)

Estimated loss of foreign exchange earnings due to environmental degradation  
1-2 billion US\$  
(Source: World Bank, Middle East & North Africa Environmental Strategy, 1995)

**Fisheries:** Market value of fishery production at risk if no management actions are taken  
3.8 billion US\$ annually  
(Source: TDA Fishery component report -FAO),  
pollution and over-exploitation have reduced fish yields and the region is now a net importer of fish.  
(Source: The State of the Marine and Coastal Environment in the Mediterranean Region, MAP Technical Report Series No. 100, 1996).

**Human Health:** Estimated 6.1 million days of diarrhoea due to pollution in the Cairo area; up to 5,500 deaths per year would be saved if safe water and sanitation services were provided. In Algeria in areas with iron, steel and fertiliser industries the incidence of respiratory infections among school children is observed to be up to 65 per cent higher than in other non-industrialised regions of the country.  
(Source: World Bank, Middle East & North Africa Environmental Strategy, 1995).

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<sup>3</sup> Fishery Transboundary Diagnostic Analysis, FAO, 1997

## 2. "Try to do everything"

At the other end of the scale, despite the urgency for actions focused on hot spot situations, the high investment cost, the variability of the Hot Spots in terms of source, consequence and transboundary effects, the institutional and legal pre-requisites for the most effective use of national and international financial resources, require definition of priorities. Trying to tackle all the Hot Spots, even over a period of time, is as likely to lead to inaction due to limited justification for an equal attention to all the Hot Spots and the consequent failure to attract investment funds over and above the modest national budget allocations. Screening is essential in order to build up a coherent Investment Portfolio to focus on priorities based on the environmental resources subject to extreme effects and the Hot Spot areas responsible. This approach leads to the more targeted scenario aiming to get at the major effects first as shown below.

## 3. "Focus on major effects first and on tools for sustainable management"

Given the need to **focus on major environmental effects first**, it follows that first actions should be targeted to interventions proposed to address the most urgent impacts on those resources with the highest incidence of "extreme effects" (those with a score 6). Public health, Aquatic Life and Economy and Welfare are the resources most frequently suffering "extreme effects" (Table 3.10.3). This scenario maximises the benefits of investments by saving the most threatened resources. The following prioritisation indicates the target areas by country grouped according to the environmental resource on which action is directed.

**There is an additional merit attached to this prioritisation: Projects and project areas are linked up with identifiable benefits. Otherwise, investments would be seen to address "pollution" without a focus on the specific resource that would benefit from the intervention. It is important to correlate investment costs with the benefits which justify the allocation of funds for such action.**

### **Public Health**

Croatia: Kastela Bay, Split, Cokery, Tannery, Egypt: Damietta, El-Manzala, El-Max, Abu-Qir  
Italy: Porto Marghera (VE), Bari Greece: Thermaikos, Inner Saronic Israel: Haifa Lebanon:  
Greater Beirut Malta: Weid Ghammieh, Cumnija Syria: Lattakia Tunisia: Gabes, Sfax-South  
Turkey: Izmir, Icel, Hatay, Adana

### **Aquatic Life**

Egypt: El-Mazala, Abu Qir Italy: Port Marghera (VE), Genova, Augusta, Brindisi, La Spezia,  
Milazzo, Tanando, Ravenna, Gela, Rosigniano, Livorno Israel: Haifa, Gush Dan Malta: Wied  
Ghammieh Tunisia: Gabes, Sfax-South Ghar El-Melh Turkey: Izmir, Icel, Antalya, Hatay

### **Economy & Welfare**

Croatia: Pula, Rijeka, Rijeka Refinery, Zadar, Sibenik, Split, Kastela Bay, Dubrovnik  
Egypt: Abu Qir Greece: Thermaikos, Elafsis Israel: Haifa, Gush Dan, Ashdod Malta: Weid  
Ghammieh Marocco: Tanger, Tetouan Syria: Baniyas Turkey: Izmir, Antalya, Hatay

## **Other Beneficial Uses**

Egypt: El-Manzala, AbuQir Israel: Haifa, Akko, Hahariya Lebanon: Greater Beirut, Tripoli

## **Recreation**

Israel: Haifa, Akko, Nahariya Lybia: Tripoli, Zanzur

## **Quality of Drinking Water**

Egypt: Rashied, Damietta

The above prioritisation would be difficult to do if it had to rely on the ranked table showing Hot Spots in descending order of total weighted score assigned to each Hot Spot; three main problems would arise:

- **first**, where to draw the line in defining the priority Hot Spots.
- **second**, funding would depend entirely on availability, for example the first 5, or 10, or 15 without taking benefits into account.
- **third**, investment results and justification would be limited to generalities concerning "addressing Hot Spot pollution problems".

**Regional Sustainable Environmental Management Programmes.** The priorities suggested above are only part of the required actions; they all (except for Italy) concern more or less sectoral projects in the form of wastewater facilities. Sustainable management needs to be addressed also. Location-specific, sectoral and discrete wastewater facilities represent "front line" initiatives for addressing risk situations. **Pollution control strategies are most effective when they are planned and implemented within an integrated environmental management programme that includes efforts focused on the need to ensure sustainable resource use and sound management.** The essential elements for sustainable environmental actions should include activities targeted on:

- **Capacity-building**
- **Integrated Coastal Zone Management**
- **Public Participation, and**
- **Investment Planning**

### **3.10.7 Proposed Investment Portfolio Strategy**

#### Two-pronged Investment Portfolio

The proposed Investment Portfolio (Tables 3.10.4 & 3.10.5) comprises two main related clusters of investments:

- **investment projects targeted on Hot Spots, consisting of**
  - . first priority projects
  - . second priority projects

- regional management programmes, consisting of integrated actions related to transboundary actions, such as capacity building, coastal zone management, public participation, tourism, fisheries, tourism

Table 3.10.4 Proposed Investment Portfolio

A. Hot Spot Projects	Est Cost Mill US\$	Expected Benefits
<p><b>First Priority Projects</b></p> <p>Areas</p> <p>CROATIA: Kastela Bay, Split, Cokery, Tannery            EGYPT: Damietta, El-Manzala, El-Max, Abu-Qir            ITALY: Port Marghera, Bari GREECE: Thermaikos, Inner Saronic            ISRAEL: Haifa            LEBANON: Greater Beirut            MALTA: Weid Ghammich, Cumnija SYRIA: Lattakia            TUNISIA: Gabes, Sfax-South TURKEY: Izmir, Icel, Hatay, Adana</p>	1,051.3	Improvement of the marine and coastal environment with main benefits to public health in Hot Spot locations with severe public health impacts
<p>ITALY: Genova, Augusta, Brindisi, La Spezia, Milazzo, Tanando, Ravenna, Gela, Rosignano, Livorno            ISRAEL: Gush Dan            TUNISIA: Ghar El-Melh            TURKEY: Antalya, Hatay</p>	913.5	Improvement of marine and coastal environment with main benefits to aquatic life in Hot Spot locations with severe aquatic life impacts
<p>CROATIA: Pula, Rijeka, Zadar, Sibenik, Dubrovnik GREECE: Elafsis            ISRAEL: Ashdod            MOROCCO: Tanger, Tetouan            SYRIA: Banias</p>	218.9	Improvement of marine and coastal environment with main benefits to economy and welfare in Hot Spot locations with severe economy and welfare impacts
<p>ISRAEL: Nahariya            LEBANON: Tripoli</p>	144.5	Other beneficial use benefits
LIBYA: Zanzur	0.1	Recreational benefits
EGYPT: Rashied	NA	Drinking water quality benefits
Estimated Cost of First Priority Projects	2,328.3	
<p><b>Second Priority Projects</b></p> <p>Areas</p> <p>Tartous, Oran Ville, Roubia, Tangier, Ghazaouet, Alger, Mostaganem, Jounieh, Iskenderun, Bejaia, Saida Ghaziye, Tetouan, Annaba, Lake Bizarte, Patraikos, Ras Hobz, Skikda, Alexandria, Kirikhan, Dortyol, Erdemli, Batroun, Salaata, Silifke, G.of</p>	1,641.7	Improved marine and coastal



<p><b>Napoli, Osmaniye, Tripoli, Izola, Nador, Dubrovnik, Delamaris, Benghazi, Pangasiakos, Durres, Vlora, Manfredonia, Ancona, Limassol, AlHociema, Heraklion, Zawia, Tobruk, Larnaca, NW Saronic, Larymna, Piran, NeaKarvali, Vassiliko</b></p> <p><b>Total Estimate Cost *</b></p> <p><b>* Note: This total is based on the estimates provided. Also it does not include the cost of projects for which information is not available</b></p>	<p><b>3,970.0</b></p>	<p>environment with diverse benefits to human health, aquatic life, economy and welfare, recreation, water quality and other uses</p>
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### B. Regional Management Programmes

Programme	Proposed Action	Est Cost Mill US\$	Benefits
Coastal Zone Management	> Preparation and adoption of a MAP framework protocol on implementation of ICZM	0.280	Strengthening the legal and institutional framework for ICZM at national and regional level
	> Development of regional strategies for ICZM	0.150	
	> Implementation of two regional and sub-regional ICZM projects on transboundary-related issues	0.500	Upgrading, strengthening and harmonising the ICZM implementation machinery in the region
	> One coastal and one insular area cost/benefit ICZM study	0.200	
	> Pilot river basin management project including transboundary affected coastal area	0.400	
	<b>Total Coastal Zone Management</b>	<b>1,530</b>	

Programme	Proposed Actions	Est Cost Mill \$	Benefits
Public Participation	> National studies in all countries to identify amendments to existing legislation to improve information access and participation opportunities	0.090	Adequate access to information and effective participation
	> Introduction of legislation making environmental legislation open to the public	0.090	
	> Preparation of printed material and TV spots on citizen rights and information sources		
	> Critical review of EU experience on scope and use of directives on environmental information access	0.060	
	> Introduction of legislation for NGOs participation in policy-making bodies and implementation	0.020	Ensuring adequate
> Increasing capacity for NGO participation in			

	environmental protection activities		participation of the public in the decision-making process
	> Publications promoting communication on issues and ideas relevant to all actors	0.060	
	> Setting up consultation process on new development projects		
	> Open access of citizens and NGOs to courts of all levels	0.060	
	> Public information on procedures in support of legal rights to court appeals against decisions of State and Municipal authorities		
	> Establishment of Mediterranean legal service for local level advice	0.040	
	> Establishment of funding mechanisms at national and local level for participation activities	0.040	
	> Tax exemptions of private donations to env. NGOs		
	> Funding of the work of the MCSD Working Group on Public Participation	0.040	
	<b>Total Public Participation</b>	0.040	
	0.020	Financial support to NGO activities	
	<b>0.560</b>		

Programme	Proposed Actions	Est Cost Mill US\$	Benefits
Fishery	> Institutional and communication capacity building	0.258	Improved capacity for responsible management communication between fishermen and experts enforcement of regulations sub-regional cooperation research outputs monitoring and evaluation
	> dissemination of information tools	0.100	
	> improvement of policy design methods (reconcile top-down bottom up)	0.140	
	> fisheries monitoring, control and surveillance (MCS) system (nat level)	0.120	
	> info and data collection network	0.120	
	> international organisations schemes for management advice	0.250	
	> international management body	0.400	
	> Coordinated international systems of MCS and registry of fleet	0.120	
	> Research on fisheries	2,550	
	> Research environmental fisheries impacts	0.400	
	<b>Total Fishery</b>	<b>4,458</b>	
<b>All programmes total</b>		<b>6,548</b>	

Table 3.10.5 Summary of estimated investment cost of projects and programme (Million US\$)

A. Hot Spot Projects	
First Priority Projects	2,328.3
Second Priority Projects	1,641.7
Total	3,970.0
B. Regional Management Programmes	6,548.0
<b>Estimated total</b>	<b>10,518.0 Million US\$</b>

### 3.10.8 Benefits

A Cost/Benefit Approach. There are many ways to approach estimated investment costs. The financial approach assesses costs relative to availability of fund, or "can we afford to pay the cost". This is an inappropriate approach mainly because it does not take into account the benefits of allocating the required funds to specific purposes. The economic approach assesses costs in relation to benefits showing "whether it is worth paying the cost". There is still however, the financial question of how to mobilise funds to implement priority actions. The cost/benefit approach is particularly appropriate in the context of environmental actions due to the diverse, long-term and social nature of benefits which are known to exceed by far the costs. In addition, a cost/benefit approach is more effective in mobilising funding sources for environmental actions because it focuses on the justification of environmental investment programmes which is central to the effort to attract funds from donors committed to sustainable environmental management.

Often, it is not possible to show the total value of benefits in money terms due to data and methodological constraints including the facts that benefits from environmental investments are essentially qualitative. They may be quantified on the basis of sufficient data, specific type of analysis and effort needed to unravel specific qualitative, productivity or behavioural changes arising from investment. Quantification is even more difficult when the available information defines investment in general terms. Clear definitions of benefits and, furthermore, estimation of their value also involve **choices of valuation methods** according to local conditions and the quality of socio-economic data.

It is, therefore, not possible to show the monetary value of the benefits to accrue from future investment estimated at 10.5 billion US\$. At this stage of this Project the available data are less than adequate to allow quantification. This task should be looked at more closely in the follow-up stage after the investment options and priorities have taken a shape and form according to the conclusions of this phase of work. It is important to note that **this report does give a focus on the definition of benefits**, as shown in the proposed Investment Portfolio Strategy, a task made possible as a result of a particular treatment of the available data and the particular approach taken to the analysis aimed at the identification of the "severe effects" of the Hot Spots and the environmental resource "severely affected" by pollution. This approach enables correlation of Hot Spot investment actions to defined benefits such as Human Health, Aquatic Life, Economy and Welfare, etc. Deeper work on the evaluation of benefits pre-supposes a more specialised investigation based on the groundwork achieved in this report. A broad outline of some of the analytical concepts and valuation techniques are listed below for better clarification of the scope of the effort

usually required for the estimation of environmental benefits.

It is relevant to refer to environmental cost/benefit data developed from **two case recent studies in the Mediterranean**<sup>4</sup> to show the conclusions reached and some of the broad cost/benefit comparisons estimated by these important studies.

#### Summary of Two Environmental Cost/Benefit Case-Studies in the Mediterranean

**(a) The Island of Rhodes Case Study:** The study of the benefits of measures for the reduction of the environment impacts from land-based sources of pollution on the coastal environment of the Island of Rhodes in Greece demonstrates the uses of the results of a cost/benefit approach to environmental investment.

The Island of Rhodes has experienced rapid tourism growth leading to emerging pressures on the coastal environment. Over 1 million tourists visit the island every year bringing pressure to bear on the northern part of the coastal zone which concentrates over 85% of the Island's tourist accommodation capacity of about 70,000 beds.

The cost/benefit approach used appropriate estimation techniques for assessing the environmental costs from coastal activity and the benefits from investment in wastewater treatment plants and associated coastal zone management and environmental pollution control. The study had to overcome the specific data problems concerning difficulties of identifying, analysing and measuring actual and potential environmental impacts. Despite the elusive character of environmental costs and benefits, monetary measurement has been attempted for the purpose of approximating the size of impacts in terms of a common unit of value.

**On the cost side**, environmental costs were identified in terms of four indicators: (i) loss of tourist revenue, (ii) degradation of the beach, (iii) health hazards, and (iv) reduction of residential amenity. Monetary values were assigned through estimates of market and market-related variables including: (i) changes in production (for losses of tourist revenue), (ii) cost of rehabilitation (for restoring the quality of the beach) (iii) direct household expenditure (for the cost of health treatment), and (iv) changes in urban land productivity (for changes in property values). **The monetary costs were estimated at about \$ 15.2 million a year, within a range of approximation of 25%, representing roughly 3% of the Island's estimated Gross Domestic Product. Loss of tourist revenue amounted to 8.1 million a year, reduction of urban residential land values 3.5 million a year, beach degradation 2.7 million a year, and health costs only 0.9 million a year.**

**On the benefit side**, environmental investment focused on the Central Sewerage System over the period 1988-91 and planned investment up to 1999 and estimated the direct and indirect benefits expected from the investment. The direct benefits comprised two main categories: (i) the expected increase in tourist revenues from improved coastal zone management and (ii) cost savings associated with the pre-investment system of sewage removal and disposal by carrying vehicles. The indirect benefits concerned general improvements in the island's environment and particularly in the level of residential amenities from reduced odour, car traffic and noise expected to have positive effects on property values. The main areas to accrue benefits are the

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<sup>4</sup> Costs and Benefits of Measures for the Reduction of Degradation of the Environment from Land-Based Sources of Pollution in Coastal Areas (Case Study of the Island of Rhodes and Case Study of the Bay of Izmir), MAP Technical Report Series No. 72, 1973.

island's "hot spots" to be served by the Central Sewerage System.

**The Case Study showed that, excluding significant qualitative benefits which are harder to measure, the value of the measurable benefits mentioned above far exceeded the investment cost. From a total investment of 94 million US dollars in the wastewater treatment plants, annual benefits of 21.2 million US dollars were estimated, equal to a present value of 200 million US dollars, reflecting a benefit /cost ratio of well over 2. It was estimated that 45% of the benefits would accrue to expected property value increases, 35% to cost savings and 20% to future tourist revenues.**

**(b) The Izmir Bay Case Study:** Izmir is an important industrial, commercial and cultural focal point. The region around Izmir produces 15 per cent of Turkey's agricultural output with 30 per cent of the land in the region used for agriculture. The harbour's storage capacity is estimated at 200,000 tons with 25 per cent of Turkey's exports and 55 per cent of its imports passing through the port. Tourism is also an important activity with up to 300,000 tourists annually either visiting or passing through Izmir. Urbanisation, industrial activity and agriculture create heavy impact on the water quality of the Bay and the coastal environment. The Bay is heavily polluted.

It was possible to calculate the costs and benefits of two scenarios based on the re-establishment of quality of the Bay's waters with tourism development only but maintaining the existing industrial, transport and agricultural infrastructure of the region. The two scenarios considered are: one conservative with tourism in the future developing slower than the expected tourism growth rate for Turkey as a whole; the second a progressive scenario with future tourism in the region growing in line with national growth rate. Other expected benefits include health, fishing salt production and recreation. In both scenarios the expected stream of benefits, discounted for 1990 values at 8 per cent, exceeded the expected discounted costs. **In the conservative scenario the benefits exceeded the cost by a factor of one and in the progressive scenario by a factor of eight. The total discounted clean-up cost for the period 1990-2025 would amount to 1.5 billion USD. On the other hand, benefits in the conservative scenario would total 4.8 billion USD (3.4 billion USD from tourism, 0.8 billion USD from salt production, 0.2 billion USD from recreation); under the progressive scenario the benefits would be substantially higher of 10.2 billion USD (8.0 billion USD from tourism, 1.4 billion USD from salt , 0.4 billion from recreation).**

**In addition there is the existence value of the clean Bay with its ecology which has a value for the inhabitants and the nation as a whole but for which no generally accepted valuation exist. Using property prices in similar coastal areas with good water quality, allowing for income differences, property prices would double if the Bay's environment is re-established. This value was estimated for 1990 at 10 billion USD.**

Both case studies were able to show that benefits exceeded the estimated investment costs by a factor between two and eight.

### **3.10.9 An agenda for further cost/benefit approach study**

The fact that estimation methods may sometimes give only approximate money value to environmental costs and benefits does not mean that environmental costs and benefits do not exist or that their importance to the planning and policy making process is marginal. Often environmental benefits cannot be directly calculated from market behaviour and several

techniques are used to approximate social losses from pollution and benefits from recovering such losses through people's preferences and responses to changes in environmental conditions. Commonly used valuation techniques fall into various categories as briefly outlined below:

The most frequently used valuation techniques look at how environmental changes affect directly observable behaviour valued in actual markets. They include effects on health, effects on production, avertive investment and penalties.

- Damage Cost Valuation: Reduction in income based on product market prices, increase of medical costs and indirect costs from illness.

- Avertive or Defensive Investment Valuation: The cost of investments made to prevent, remedy or compensate for effects of pollution on victims of pollution.

- Legal Liability Valuation: Damage penalties levied according to law enforcement indicates the value to society of environmental quality.

A second cluster of techniques seek to value intended actions in markets. They mainly include replacement cost and "shadow projects."

- Replacement Cost Valuation: Costs of discharge or emission reduction or costs of "shadow projects" (shadow projects are alternative measures to reduce pollution to the same recipient).

If direct market valuation is impossible, use of indirect information is attempted to arrive at implicit values. They usually include Travel cost measurements and property values.

- Travel Cost Valuation: Travel costs to reach a recreational site reveals its minimum value to the visitors.

- Real Estate Pricing Valuation: Housing prices influenced by the presence of pollution.

When market data cannot be used, a group of techniques aim to collect data through hypothetical market situations using surveys to assess preferences. They include assessments of stakeholder' willingness to pay or to accept compensation.

- Experimental Data Valuation: Field studies data estimating people's preferences for environmental quality through measurements of willingness to pay (WTP) for environmental improvements, or willingness to accept (WTA) compensation for environmental pollution damage.

A further note should be added with regard to the value of environmental resources. Environmental resources are known to have both "use" and "non-use" values. Commonly, environmental valuations may only capture the increase in the "use" values of environmental conditions reflected in, for example, increase in production (fishery, tourism, agriculture), wages, health, house prices, recreation revenues, etc., while "non-use" values such as the existence of clean sea, the existence of a lagoon, aquatic life or biodiversity are sometimes ignored or under-rated. Environmental economics studies should take into account **total value**

comprising use and non-use benefits and values.

### 3.10.10 Funding issues: Basic Elements

Although the first consideration in analysing investment costs is to compare them with benefits, it is crucial to identify some of the main elements for the financial strategy. If a rough classification of the type of actions and their costs is attempted some basic funding and recovery possibilities may become clearer (Table 3.10.6). Investments which are capable of generating money revenues (subject to affordability and other social policies) are opportunities for **private sector involvement** either directly or through cross-subsidisation methods. Private sector participation is not only necessary for funding purposes but desirable as a component of capacity building and public participation. The importance of identifying the projects with capital recovery potential (such as wastewater treatment plants - WWTP) is to suggest funding opportunities and constraints for further consideration. **The total cost of over 10 billion US\$ is misleading if understood as the total requirement for grant finance.** Many investments included in the portfolio may withstand suitably adjusted commercial loan terms or at least selected components of them. Many projects will require concessionary finance and grant funds.

Table 3.10.6 Type of projects and benefits

Type of Projects			
	Public Health Projects	Aquatic Life Projects	Economy & Welfare Projects
Benefit category	Social benefits	Environmental benefits	Economic benefits
Beneficiaries (bens)	<ul style="list-style-type: none"> <li>&gt; residents</li> <li>&gt; national popul</li> <li>&gt; reg popul</li> </ul>	<ul style="list-style-type: none"> <li>&gt; national popul</li> <li>&gt; regional popul</li> <li>&gt; inter community</li> </ul>	<ul style="list-style-type: none"> <li>&gt; industrial and business community</li> <li>&gt; local &amp; nat popul</li> </ul>
Cost Recovery options	<ul style="list-style-type: none"> <li>&gt; partial direct recovery from local bens</li> <li>&gt; govt subsidy</li> <li>&gt; large regional programme assistance</li> </ul>	<ul style="list-style-type: none"> <li>&gt; indirect recovery (tourism)</li> <li>&gt; large inter &amp; reg programme assistance</li> </ul>	<ul style="list-style-type: none"> <li>&gt; large recovery from business sector (charges/levies)</li> <li>&gt; programme assistance to selected countries</li> </ul>

Such considerations should be taken into account in developing a funding strategy because **different costs should be funded differently according to affordability and cost-recovery criteria not possible to define at present.** Not all the costs will be undertaken by public authorities, private capital should be leveraged to various degrees in response to specific conditions and concessions associated with donor sources. The implication is that the capital investment cost of WWTPs may be unaffordable to many poor countries but the implementing authority can repay a loan for the cost out of the stream of user charges. Also, the business sector beneficiaries of WWTPs services which improve economic activities (tourism, industry, recreation) may withstand higher than average charges in order to lower the charges on the poor (cross-subsidisation) or to contribute towards Coastal Zone Management Programmes.

Out of the total estimated investment cost of over 10 billion US\$, an amount of just under 4 billion mainly concerns wastewater treatment plants and associated facilities, and 6 billion regional sustainable management programmes. This means that WWTP investments will at some point recover their cost. Regional programmes are not economic assets and are unlikely to create direct revenues, they should be funded as regional cooperation programmes which themselves will create social benefits and some revenues in tourism and other sectors consuming environmental services.

The matrix shown above puts together some guidelines for the approach to the funding options for the proposed actions. Much further work is needed to flesh out the implications.

### 3.10.11 Use of the Investment Portfolio

#### Main elements for further use

An Investment Portfolio is a framework for guiding investment choices and decisions in changing environmental and socio-economic conditions; it is a process that leads to the integration of the economic implications of environmental actions rather than a final statement for a single use. This present investment portfolio should be used as a guide to ensure that development of those elements that create the scope for deeper environmental-economics analysis in the light of funding and justification requirements at the regional and national level arising at successive stages in the future. The main elements are the following:

- 1. Raw cost information is insufficient to support investment decision-making.** Costs need to be related to wider economic and environmental considerations before used for action planning purposes. The process of developing an Investment Portfolio shows how cost information should be analysed in relation to pollution impacts and benefits expected from the proposed investments to reduce impacts on resources.
- 2. Investment planning has many levels of analysis and data needs.** The framework used in this Investment portfolio demonstrates useful approaches and guidelines adaptable to specific country contexts. It identifies the need for more detailed costing, project identification and evaluation in the context of better awareness of the parameters which have to be taken into account.
- 3. Cost, impact, benefit and funding issues may be brought together** to facilitate the development of locally relevant and nationally specific investment portfolios. It clarifies that benefits are derived from the reduction or avoidance of pollution impacts on resources with **social, economic and environmental value**. This perception allows further work looking at the environmental impacts as they relate to Human Health, Aquatic Life, Economy and Welfare, Recreation, Other Beneficial Uses and Quality of Drinking Water rather than mixing and generalising environmental information rendering difficult the identification of benefits from actions to address pollution risks.
- 4. Investment Portfolio is a tool for resource mobilisation.** The development of Investment Portfolio improve the approach to environmental investment and **the justification for increasing financial resources for the environment**. It is important to remember that environmental resources are often used (and misused) outside a market context and therefore their value is under-rated. The **total benefits** from their conservation through better use



practices should be highlighted (and when possible measured) in justifying the viability of environmental actions. This broader definition of benefits to include the conservation of resource for their existence (or non-use) value is one of the key elements to be used for the development of detailed project proposals. It is explained that environmental planning should focus not only on the availability of fund, or "can we afford to pay the cost of environmental action plans" but primarily on "whether it is worth paying the cost" relative to the expected benefits which are diverse, long-term and often social.

**5. The Investment Portfolio is a tool for Opinion Mobilisation.** Incorporating investment planning in environmental action plans acts as a medium for opinion and stakeholder mobilisation, participation and cooperation at local, national, regional and international level. Alternative scenarios show to the decision-makers, NGOs and international institutions the urgency for actions in pollution risk areas and the respective cost/benefit positions, in addition to the financial constraints, serving the need for a common coherent framework for communication on goals, objectives, constraints and visions essential for gathering official and popular support behind environmental proposals.

### **3.10.12 Gaps, Problems and Follow-up**

Three overlapping areas of work are identified:

**(a) project and programme specification**, including the following tasks:

- to look much more closely and critically at the **first priority projects** with particular attention given to the main regional Hot Spots such as Izmir, Abu Qir, Porto Marghera and Manzala. The proposed interventions should be clearly specified, the technological options involved critically examined.
- to concentrate on the **industrial sector**, on which data are limited, carry out feasibility studies to explore opportunities for market-based incentives and measures in relation to cost-effective pollution abatement methods.
- to focus on the **socio-economic context** of the primary Hot Spot areas and identify the population, employment, social and cultural structure of the areas for better analysis of the impacts and benefits underlying the proposed interventions.
- to examine critically the basic **economic policies** applied in selected groups of countries with important regional Hot Spots (for example, Italy, Turkey, Egypt), such as subsidies, loan priorities, taxes, encouraging directly or indirectly pollution as an unintended result of export incentives, import substitution incentives, rural development supports and assistance programmes to particular development projects in the energy, agriculture, transport and tourism sectors. Economic policy biases and distortions are often serious background sources of pollution behaviour difficult to identify if "point sources" are divorced from the rest of the economic policy context.
- to review opportunities for the **mobilisation of private sector resources** and the scope for the use of incentives, measures and inducements for influencing private sector decisions and behaviour related to the environment.

**(b) appropriate cost/benefit study**, including the following tasks:

- to develop a **practical framework for cost/benefits study** of the main priority projects and programmes based on regionally relevant valuation techniques, issues and data, utilising to the maximum the few existing case studies.
- to derive useful **guidelines and a brief manual** for the application of cost/benefit approaches suitable to the environmental challenges, institutional setting, socio-economic

policies and local/national differences prevailing in the region.

- to prepare more **accurate cost estimates** for priority projects to be used for pre-investment analysis and detailed financing proposals submitted to interested donors.
- to identify more sharply and **measure the main benefits** to accrue from the implementation of the key priority projects, including proposals for overcoming data and specific measurement problems.
- to prepare a more **detailed investment portfolio** for the cluster of priority projects and programmes aiming at the incorporation of elements concerning the social justification for donor support, the beneficiary population, funding and investment recovery mechanisms and national participation capabilities.

**(c) financing capabilities at the regional and national level, including the following tasks:**

- to collect information on the availability of regional multi-lateral and bi-lateral funding sources as well as on national expenditure patterns on environmental programmes for the purpose of identifying "national" and "incremental" investment needs.
- to analyse **affordability and cost-recovery issues** in relation to the diversity of national economic and social conditions which may entail specific country-based social impacts on the poor from the implementation of capital-intensive environmental facilities and the consequent introduction of user charges.