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MEDITERRANEAN ACTION PLAN

Second Meeting of Government-designated Experts to examine a Strategic Action Programme to Address Pollution from Land-based Activities

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DRAFT TRANSBOUNDARY DIAGNOSTIC ANALYSIS FOR THE MEDITERRANEAN SEA (TDA MED)

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BACKGROUND

The Mediterranean, 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 thee 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 (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 and 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 (Annex) 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;

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 and an annex:

- 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 - Analysis of the problems and their root causes

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

  - Problems;
  - Character of impacts;
  - Main stakeholders;
  - Root causes (proximate and ultimate); and
  - Potential transboundary effects.

  This section 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 each of the subjects decided to be included in the TDA MED.

Section 1

Perceived Major Problems

Table 1.1 Perceived Major Problems and their Root Causes

PERCEIVED MAJOR PROBLEMS	TRANSBOUNDARY ELEMENTS	Main root causes*	Action areas
Degradation of coastal and marine ecosystems	• Damage to transboundary ecosystems, including loss in productivity, biodiversity and stability • Reduction of regional values • Decreased quality of life • Degradation due to pollution and eutrophication • Region-wide loss of revenue	2 5 1 3 4	C A B
Unsustainable exploitation of coastal and marine resources	• Impacts on habitats and biodiversity • Impacts of physical changes in coastal and beach dynamics • Loss of existing and potential income from fishing and tourism • Conflicts between user groups	2 5 4 3 1	B C A
Loss of habitats supporting living resources	• Damage to migratory species and their habitat changing patterns of migration • Endangered biotic resources • Loss of values for development • Habitat and food web changes	2 5 4 3 1	B C A
Decline in biodiversity, loss of endangered species and introduction of non-indigenous species	• Loss of regional values • Damage to endangered and endemic species of regional and global significance • Loss of genetic biodiversity	2 5 1 3 4	C B A
Inadequate protection of coastal zone and marine environment and increased hazards and risks (health risks, seismic risk, climate change, pollution, fires, accidents, extreme events)	• Reduction of regional values • Loss of revenues • High costs of curative interventions • Decreased quality of life	2 5 1 3 4	C B A
Worsened human related conditions (lowered quality of life, increased unemployment and poverty, socio-economic decline, increased quality gap in development level)	• Human health impacts • Costs of dealing with human migration • Reduced human and institutional capacity • Reduction of development potential • Increased poverty with transboundary impacts	2 5 1 3 4	C B A
Lack of implementation of existing regional and national legislation	• Ineffective protection of the marine and coastal environment • Inadequate monitoring of pollution and consequently inadequate data interpretation for managerial purposes • Poor public education and awareness regarding scientific and economic values and technical options	1 2 5 3 4	C B A

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

MAIN ROOT CAUSES	
1. Inadequate legal and institutional framework	• Inadequate cooperation on the regional level • Inadequate legislation at the national level relevant to regional problems • Inadequate institutional framework and capacity necessary for the implementation of legislation, ICZM and EIA • Inadequate pollution compliance and trend monitoring • Ineffective coordination between various governmental sectors and local and national level
2. Inadequate planning and management at all levels	• Poorly coordinated intersectorial planning and management • Lack of integrated watershed/coastal zone management plans • Lack of application of ICZM and its tools • Inappropriate harvesting practices in fisheries • Inadequate pollution control strategies with monitoring
3. Insufficient human and institutional capacity	• Inadequate human and institutional capacity (at national and local level) for the implementation of the legislature and ICZM with its tools • Inadequate human and institutional capacity (at national and local level) for compliance and trend monitoring of pollution
4. Insufficient involvement of stakeholders	• Lack of general environmental awareness • Poor identification of stakeholders • Lack of adequate participation of stakeholders in the planning and management of environmental problems
5. Inadequate financial mechanisms and support	• Lack of effective economic instruments • Lack of internalization of environmental costs • Low monetary assigned to environment within national economic policies

AREAS WHERE ACTION IS PROPOSED	
A. Reduction of pollution	• Identification and elimination of pollution hot-spots • Adequate compliance and trend monitoring • Full implementation of relevant regional and national legislation
B. Resource management	• Full implementation of relevant regional and national legislation • Sustainable management of resources • Protection of biodiversity, endangered and endemic species, habitats and sensitive areas • Development of sustainable fisheries, aquaculture and tourism
C. Integrated planning and management	• Improvement of legal and institutional framework at regional and national level for ICZM and its tools • Development of integrated management for river basin/coastal areas and for urban agglomerations • Improved involvement of stakeholders in environmental decision-making

Section 2

Analysis of Problems and their Root Causes

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 Maritime transport and ports
- 2.1.3 Agricultural run-off
- 2.1.4 Airborne pollution
- 2.1.5 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

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

- problem;
- impact (including transboundary);
- stakeholders;
- root causes and possible solutions; and
- potential transboundary effects.

Table 2.1.1.1 Rivers – Problems and their Root Causes

PROBLEMS	IMPACT*	STAKE HOLDERS	ROOT CAUSES AND POSSIBLE SOLUTIONS			POTENTIAL TRANSBOUNDARY EFFECTS
			PROXIMATE	ULTIMATE	POSSIBLE SOLUTIONS	
1. Insufficient and outdated information on actual water discharge to the sea in a fast-changing conditions 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 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 4. Lack of relevant information on micropollutants for many rivers. Lack of information on trends, of contamination at river mouth. 5. Lack of natural background levels 6. Lack of coordinated data bank on human activities 7. Identification of pristine	L – H N – H T – H	• Local institutions • Governme nt agencies • Intergover nmental agencies • Research institutes	• Lack of reliable data on changes in water discharge due to human impacts • Lack of exact data on key rivers (e.g. Nile) • Lack of adequate monitoring for suspended sediment on near all rivers • Very rapid change of sediment transport due to human activities • Extreme events not taken into account • Fluxes of dissolved matter and particulate pollutants are known with uncertainties • 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 • Basic information (as total population, industrial sources of pollution, fertilizer and pesticides use; location of dams and diversions) on river pollutant sources is not	• Inadequate policy of damming of rivers • Subsidies for fertilizers • Failure to internalize cost of nutrient pollution	• Checking long-term trends in water discharge mainly due to irrigation and/or reservoir construction • Developing a regionalized topology of river hydrological regimes (natural and impacted) • Establishing ad hoc monitoring of SS for 20 selected rivers of the Basin, on a long-term basis • Establishing the key impacts of reservoir construction on sediment transport on a long-term basis (sometimes 30 years) and their influence on coastal zone • Programme of sampling and analysis during periods of high water flows • Measurements of extreme flood events of rare occurrence • Measurements of high turbidity periods in surveys • Analysis of heavy metals, persistent organic pollutants and nutrients in deposited sediments • Establishing a data bank on socio-economic indicators related to river quality and pollutants fluxes • The data bank on GIS to be prepared, made available and distributed • Linking socio-economic indicators to water-quality indicators through GIS to check pollution control (Guidelines to be developed) • Setting up: - criteria for selection of pristine rivers; -register of pristine rivers; and -plan to protect pristine river basins and related river mouths • Compile the list and quantities of agrochemicals used in the Mediterranean watershed • Select a short list of organic micro pollutants to be monitored in rivers as indicators of domestic,	• Dramatic reduction of river water discharges input to the Mediterranean by 30-40% • Dramatic reduction of sediment discharge to the Mediterranean by 70% • Pollution of international waters • Degradation of ecosystems and decline in biodiversity in affected areas • Coastal eutrophication and plankton blooms

PROBLEMS	IMPACT*	STAKE HOLDERS	ROOT CAUSES AND POSSIBLE SOLUTIONS			POTENTIAL TRANSBOUNDARY EFFECTS
			PROXIMATE	ULTIMATE	POSSIBLE SOLUTIONS	
Mediterranean rivers and river mouths to be preserved 8. Lack of basin-wide information on pesticides use and river inputs. Lack of basin-wide information on persistent organic pollutants 9. Lack of permanent links between riparian countries concerning river pollutant monitoring and inputs 10. Inadequate reduction of diffuse pollution sources 11. Inadequate reduction of nitrogen and phosphorus inputs 12. Inadequate reduction of industrial and mining sources of pollution within river basins 13. Inadequate reduction of domestic sources of organic pollutants within river basins 14. Riverine eutrophication and algal blooms			presently available and/or distributed per Mediterranean subbasins • River surveys are not harmonized • Inability to predict and control the levels of nitrate and pesticides • Excess discharge of nitrogen and phosphorus		agricultural and industrial pollution • Prepare an optional list of selected pesticides to be surveyed by countries • 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 • Prepare a river quality monitoring manual adapted to Mediterranean conditions • Setting up permanent registers of river water quality and quantity accessible to all riparian countries on selected rivers (about 50) • Prepare a "good practice guide" adapted to Mediterranean conditions for the control of nutrients and pesticides use in agriculture • Prepare a calendar of drastic reduction, or ban, of phosphorus containing detergents in the basin • Prepare calendar for tertiary treatment of phosphorus in existing major sewage treatment plants in the vicinity of identified eutrophic areas • Prepare, by major river basin and/or by countries, plans of activities (2000-2010) to identify and control: - diffuse sources of nutrients and pesticides; - pollutant sources from industries and mines; and - remaining domestic wastes to be treated within the basin	

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

Table 2.1.2.1 Maritime Transport and Ports – Problems and their Root Causes

PROBLEMS	IMPACT*	STAKEHOLDERS	ROOT CAUSES AND POSSIBLE SOLUTIONS			POSSIBLE TRANSBOUNDARY EFFECTS
			PROXIMATE	ULTIMATE	POSSIBLE SOLUTIONS	
1. Control and elimination of the operational pollution 2. Control and elimination of the accidental pollution 3. Control and elimination of the pollution from fishing and pleasure boats 4. Construction of appropriate port reception facilities	L – M N – M T – I	• Ministries for transport • Ministries for environment • International organizations • National and local authorities • Research institutes • General public	• Inadequate port reception facilities • Inadequate facilities and equipment for the intervention in the case of accidents and operational discharges	• Nonexistence of contingency plans • Lack of policy for the protection of the coastal and marine environment form the pollution from operational discharges and accidents • Inadequate institutional structure for the full implementation of international conventions and regulations	• Full implementation of the Dumping Protocol of the Barcelona Convention • Full implementation of the Hazardous Waste Protocol of the Barcelona Convention • Full implementation of the MARPOL Convention • Preparation and full implementation of Contingency Plans for all Mediterranean Countries • Improvement of the Salvage availability	• Pollution of the coastal and marine environment from the discharge of oily water and residues from the bilge waters and deballasting operations • Organotin biocidal pollution by antifouling paints

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

Table 2.1.3.1 Agricultural Runoff in the Mediterranean – Problems and their Root Causes

PROBLEMS	IMPACT*	STAKE HOLDERS	ROOT CAUSES AND POSSIBLE SOLUTIONS			POTENTIAL TRANSBOUNDARY EFFECTS
			PROXIMATE	ULTIMATE	POSSIBLE SOLUTIONS	
1. Pollution of water and sediment through runoff 2. Excessive use of fertilizers 3. Excessive use of pesticides 4. Erosion of soil 5. Spread of desertification 6. Loss of arable land due to urban development	L – H N – M T - L	• Ministries of agriculture • National and local administration • Intergovernmental agencies • Research institutes	• Excessive use of fertilizers • Excessive use of pesticides • Overgrazing	• Inadequate agricultural policy • Inadequate policy of subsidizing agriculture • Social policies that do little to contain destructive marginal agricultural practices • Inadequate pricing policy	• Rational methods for making use of soil and water resources by encouraging farming practices suited to the physical and ecological conditions prevailing in the regions concerned • Development and use of irrigation techniques using less water and appropriate systems of drainage • Controlling the use of chemical that pollute soil and water and increasing use of natural fertilizers • Increasing agricultural productivity and production by means of environment-friendly techniques	• Eutrophication • Pollution by pesticides • Pollution by nutrients • Increased sediment discharge and turbidity • Long-range transport of pesticides • Degradation by sedimentation • Increased erosion

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

Table 2.1.4.1 Airborne Pollution – Problems and their Root Causes

PROBLEMS	IMPACT*	STAKEHOLDERS	ROOT CAUSES AND POSSIBLE SOLUTIONS			POTENTIAL TRANSBOUNDARY EFFECTS
			PROXIMATE	ULTIMATE	POSSIBLE SOLUTIONS	
1. Identification of point and diffuse emission sources 2. Identification of atmospheric transport 3. Identification of direct and indirect effects of transboundary air pollution 4. Inadequate control strategies: - Best Available Techniques (BAT) - Effects based abatement strategies and Integrated Assessment Modeling - Information exchange - International agreements	L – H N – H T – H	• Relevant ministries • Industry • NGOs • Scientific community • International organizations	• Lack of inventories for major point sources of air pollution • Lack of precise knowledge on gas/liquid/solid phase partition, particle size, and dissolved and adsorbed fractions • Lack of knowledge on actual fluxes, dynamic responses, and pathways of air pollution	• Lack of measurements network for monitoring of air pollution • Lack of coordinated network of national focal points relevant to air pollution • Lack of implementation of ECE / LRTAP protocols	• Establish inventory for major point sources following EMEP/CORINAIR guidelines • 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 • Development of the measurements network and its intercalibration and compilation of existing measurements • Establishment of a Network of National Focal Points to meet on a regular basis and adopt reference methods, reference stations and report data • Extension of current ECE/LRTAP/EMEP models to the Mediterranean and development of source receptor relations • Measurements of current levels in biotic and abiotic environment and effects on health and ecosystems	• Degradation of the Mediterranean ecosystems due to air pollution (nitrogen, heavy metals, hydrocarbons) • Nitrogen enrichment of surface waters by atmospheric input and risk of algae blooms

PROBLEMS	IMPACT*	STAKEHOLDERS	ROOT CAUSES AND POSSIBLE SOLUTIONS			POTENTIAL TRANSBOUNDARY EFFECTS
			PROXIMATE	ULTIMATE	POSSIBLE SOLUTIONS	
					• 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 • Identify current best practices, product and process alternatives; BAT for new sources and implement incentives/disincentives • 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 • Improve access to information on process / product alternatives and risks • Ratification of ECE/LRTAP Protocols by ECE countries and development of analogous agreements for the Mediterranean ECE countries to facilitate extension to the Mediterranean of the abatement strategies developed in ECE/LRTAP	

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

Table 2.1.5.1 Exploitation of Seabed and Subsoils – Problems and their Root Causes

PROBLEM	IMPACTS*	STAKEHOLDERS	ROOT CAUSES AND POSSIBLE SOLUTIONS			POTENTIAL TRANSBOUNDARY EFFECTS
			PROXIMATE	ULTIMATE	POSSIBLE SOLUTIONS	
1. Assessment of the scope of the problem associated with the exploitation of the seabed and the long term potential for possible transboundary effects 2. Reduction of acoustic effects 3. Lack of criteria for acceptance of substances listed in annex 2 of the Offshore Protocol 4. Lack of regional guidelines for offshore exploitation to use best industry practice to minimize the risk of oil spills	L – I N – I T - H	• Relevant ministries • Industry • Private sector • NGOs • International organizations	• Lack of funds • Inadequate scientific knowledge on the problem	• Lack of readiness of relevant ministries and industry to approach the problem	• Implement a data collection programme to provide details of pollutant loadings from oil and gas exploration and production activities :Desk study to provide rough estimate of loads • Draft data reporting guidelines and establishment of database for discharges • Development of guidelines for undertaking acoustic operations to minimize environmental impacts and adopt these guidelines as and additional annex to the Offshore Protocol • Establish criteria for assessment of discharges of annex 2 substances of Offshore Protocol • Review response strategies • Design reporting structure and database for spills form offshore exploitation • Develop guidelines for best practice to minimize spills	• Pollution of international waters • Degradation of ecosystems

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

Table 2.2.1 Pollution Hot Spots – Problems and their Root Causes

PROBLEMS	IMPACT*	STAKEHOLDERS	ROOT CAUSES AND POSSIBLE SOLUTIONS			POTENTIAL TRANSBOUNDARY EFFECTS
			PROXIMATE	ULTIMATE	POSSIBLE SOLUTIONS	
1. Control and reduction of Pollution at 115 Priority Hot Spots in the Mediterranean. List of 115 pollution hot spots was prepared on the basis of assessment carried out at the country level by national and local authorities and experts. Hot spots were ranked by weighted factors deter-mined 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. 2. Reduction of eutrophi-cation and excessive algal bloom in areas which are most severely affected by such events	L-H N-H T-H	• National and local authorities • Polluting enterprises • Municipalities • Industry • Tourism • Private sector • Academia institutions • NGOs • General public • International organizations	• High concentra-tion of nutrients locally • Major microbio-logical loads • High concentra-tions of heavy metals and organic pollutants • Deterioration of the organoleptic characteristics of receiving waters • Concentration of population in and around hot spots	• Inadequate/absen ce of domestic waste-water treatment plants • Inadequate/absen ce of industrial waste-water treatment plants • Lack of "before the pipe" approach for industrial waste-water minimization • Lack of measurement network and/or data for monitoring seawater pollution • Lack of integrated management	• Prepare preinvestment studies for each of the Priority Hot Spots • Carry out environmental audits of industries in priority hot spots, revise cost estimates accordingly • Study on approaches in ICZM to clarify and optimize the complex relationship between urbanization and industrialization in the Mediterranean coastal zone • Prepare action plan for remedial actions in order to control pollution at Priority Hot Spots • Implementation of relevant compliance and trend pollution monitoring programmes at the locations of the hot spots • Implement action plan for remedical actions • Revision of methodology used in determination of weighted factors for impact (including transboundary impact) and their comparative analysis	• Eutrophication and concomitant excessive algal bloom • Pollution of the marine environment • Degradation of the coastline with transboundary effects

* L – Local; N – National; T – Transboundary; I – Insignificant; M – Medium; L - Low

Table 2.3.1 Pollution Sensitive Areas – Problems and their Root Causes

PROBLEMS	IMPACT*	STAKEHOLDERS	ROOT CAUSES AND POSSIBLE SOLUTIONS			POTENTIAL TRANSBOUNDARY EFFECTS
			PROXIMATE	ULTIMATE	POSSIBLE SOLUTIONS	
1. Assessment and protection of sensitive coastal areas. Fifty- five sensitive areas were identified but criteria for their selection were not standardized	L-H N-H T-M	• National and local authorities • Polluting enterprises • Municipalities • Industry • Tourism • Private sector • Academia institutions • NGOs • General public • International organizations	• Inadequate/absence of domestic waste-water treatment plants • Inadequate/absence of industrial waste-water treatment plants • Lack of "before the pipe" approach for industrial waste-water minimization • Lack of measurement network and/or data for monitoring seawater pollution	• Lack of coordinated plans for pollution minimization • Lack of implementation of relevant legislation • Lack of integrated management	• Prepare action plan for the remedial actions for identified sensitive areas • Remedial actions for identified sensitive areas, in accordance with preliminary cost estimates • Development of the standardized methodology for the selection of sensitive areas and for the determination of the cost of their protection	• Degradation of a particular sensitive area might have transboundary effect • Degradation of sensitive areas due to pollution

* L – Local; N – National; T – Transboundary; I – Insignificant; M – Medium; L - Low

Table 2.4.1 Tourism – Problems and their Root Causes

TO BE PREPARED

Table 2.5.1.1 Living Marine Resources -Fishery – Problems and their Root Causes

PROBLEMS	IMPACT	STAKE HOLDERS	ROOT CAUSES AND POSSIBLE SOLUTIONS			POTENTIAL TRANSBOUNDARY EFFECTS
			PROXIMATE	ULTIMATE	POSSIBLE SOLUTIONS	
1. Poor capacity for planning for responsible management of fisheries within international waters, including applications of the FAO Code of Conduct for Responsible Fisheries and the UN Agreement on Straddling fish stocks and highly migratory fish stocks 2. Poor communication between policy makers, fishers and fishery scientists 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 4. Inadequate enforcement of national fisheries regulations 5. Inadequate provisions for fisheries monitoring, and statistical data gathering 6. Lack of multidisciplinary approaches to fishery management issues and of co-ordination between fishery researchers and regulatory agencies	L-H N-H T-H	• Governmental and intergovernmental institutions responsible for fisheries management • GFCM • Research institutes • Fisher's / producer's organizations • Scientific national and regional institutions and organizations	• Weak and uncoordinated national approaches at the international level in fisheries research, to support decision-making processes in fisheries management • Lack of understanding of long-term effects of nutrient enrichment and pollutants on fisheries in the Mediterranean • Lack of national source of funding to recruit social scientists in the administration • Reluctance of countries to allow inspections of their fishing vessels by other countries on high seas	• Lack of appropriate institutional and legal framework at national levels needed to encourage sound responsible fisheries management within territorial waters • Inadequate formulation and application of international initiatives concerning transboundary fish resources management and conservation and consequent overexploitation • 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	• Increase institutional capacity: -training in the field of social science; -developing socio-economic analyses and instruments; -developing transparent precautionary and adaptive decision-making mechanisms; -encourage technical cooperation between both competent institutions within countries, and between institutions in countries bordering the Mediterranean • Develop tools for dissemination of information: -publish a newsletter; -organize meetings; -revise administration's procedures to ensure larger dissemination of management-related information • Reconcile "top-down" with 'bottom-up' mechanisms: -revise institutional and legal frameworks to clarify rights and responsibilities concerning access to fisheries; -adapt mechanisms to support management process in partnership; -educate fishermen on the needs and approaches for sustainable development of fishery resources in coastal communities • Improve fishery monitoring, control and surveillance (MCS) systems: -devise cost-effective MCS systems; -fisher's / producer's organizations and relevant administrations should share responsibilities in MCS; -strengthen logistical support to enable concerned administrations to make full use of its prescriptive and enforcement powers • Provide networks for information and develop data collection methods by creating a very basic fishery data	• Overfishing • Excessive by-catch • Human conflicts • Inadequate management regimes • Use of inappropriate gear • Failure to protect habitats for fish at critical life stages

PROBLEMS	IMPACT	STAKE HOLDERS	ROOT CAUSES AND POSSIBLE SOLUTIONS			POTENTIAL TRANSBOUNDARY EFFECTS
			PROXIMATE	ULTIMATE	POSSIBLE SOLUTIONS	
7. 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 overcapitalisation of fleets 8. 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 9. Absence of research work on the impacts of nutrient					elaboration system. These very basic data should be reported (through a standardized schemes designed in advance), on timely basis, to the GFCM secretariat where a common data base has to be created • Revise international organization's schemes to provide advise for Management needs. Collaborate at the national and international levels. The existing international organizations 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 • Strengthen effectiveness of international management bodies: -revise terms of reference and rules of GFCM so as to make it a self running and financing body; -set up several independent and preferably sub-regional commissions that would work as management bodies for local resources coordinated by GFCM; -harmonize management policies; -establish cooperative management systems to share a limited total of standard effort units to adapt the fishery capacity to potential production of resources; -GFCM should encourage member countries to adhere to UN international fishery agreements and to endorse and implement council's formal resolutions • Effective control of fishing effort to set up a registry of fishing boats	

PROBLEMS	IMPACT	STAKE HOLDERS	ROOT CAUSES AND POSSIBLE SOLUTIONS			POTENTIAL TRANSBOUNDARY EFFECTS
			PROXIMATE	ULTIMATE	POSSIBLE SOLUTIONS	
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* 10. *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*					(characterisation of vessels into categories and fishing gears) Setting up cooperative management systems like shares in total number of standard effort units • Establish coordinated international systems of monitoring, control and surveillance (Fisheries patrols, satellite/telemetry systems) • *Provide developing countries with technical assistance, and advice for the establishment of these MCS systems* • *Improve MCS systems to ensure an effective control of fishing effort within international waters:* • *Devise cost-effective MCS systems* • *Establish a registry of fishing boats (characterization of vessels into categories and fishing gears) and keep this register updated*	

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

Table 2.5.2.1 Living Marine Resources -Aquaculture – Problems and their Root Causes

PROBLEMS	IMPACTS*	STAKE HOLDERS	ROOT CAUSES AND POSSIBLE SOLUTIONS			POTENTIAL TRANSBOUNDARY EFFECTS
			PROXIMATE	ULTIMATE	POSSIBLE SOLUTIONS	
1. Poor implementation of proper criteria and methodology while siting aquaculture 2. Shellfish affected by toxic algae 3. Poor diversification and quality of farmed products 4. Inadequate formulation of national aquaculture regulations 5. Inadequate coordination and harmonization of aquaculture production in accordance to market opportunities 6. Inadequate qualification and quantification of incidents in aquaculture 7. Inadequate enforcement of national aquaculture statistics and statistical data gathering on regional level	L – H N – H T – I	• National authorities • International organizations • GFCM through regional networks • Aquaculture Producer's organizations • European Union • Inspectorates • Responsible agencies • Producer's organizations	• Inadequate knowledge and technical skill relevant to aquaculture • Lack of relevant information on target species • Inadequate quality of aquaculture environment and post-harvesting approach • Inadequate training of scientists and technicians • Inadequate research on biology and farming performances of newly selected species • Inadequate information of consumers about characteristics of farmed products	• Unclear jurisdiction over aquaculture sector and lack of adequate regulations • Lack of planning of aquaculture investment according to market opportunities • Lack of national sources of funding • Lack of policy on scientific and technical cooperation on promoting quality of aquaculture product	• Test cases at different scenarios applying CAM guidelines and GIS methodology as a tool • Conduct a preliminary study to review existing information • Training of scientists and technicians • Create a positive image of shellfish product • Strengthening of research on biology and farming performances of newly selected species • Encourage scientific and technical cooperation on promoting quality of aquaculture products • Comparative analyses of the regulation relating to the bureaucratic aspects in the Mediterranean; including a seminar • Support of responsible administration in their planning of aquaculture investments • Initiate a project aiming to develop further European demand of finfish • Develop a methodology for economic risks assessment including a meeting to establish and discuss an updated registry of risks • Create a very basic data elaboration approach and seminar to be organized each year with the responsible persons	• Quality of aquaculture products and health effects • Inadequate offer of the aquaculture products on the market

* 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 Regulator systems – Problems and their Root Causes

PROBLEMS	IMPACT*	STAKEHOLDERS	ROOT CAUSES POSSIBLE SOLUTIONS			POTENTIAL TRANSBOUNDARY EFFECTS
			PROXIMATE	ULTIMATE	POSSIBLE SOLUTIONS	
1. Inadequate national legislation on nature protection in many Mediterranean countries 2. Inadequate transposition of relevant regional and international treaties into the national legislation 3. Weak legal and institutional framework of ICZM 4. Insufficient consideration of conservation issues in coastal zone management schemes 5. Lack of Strategies for the conservation and sustainable use of biodiversity in several Mediterranean countries 6. Poor consideration of marine biodiversity in existing strategies 7. Inadequate legal framework and regulatory systems for addressing the issue of the introduction of non-indigenous species 8. Insufficient enforcement of the legislation due to lack of trained staff and equipment	L – H N – H T – H	• Responsible ministries / governmental agencies • Secretariats of relevant treaties / agreements • Concerned commercial sectors (fisheries, agriculture, aquaria, maritime transport, etc.) • International organizations • General public	• Lack of analytical reviews of existing national legislation on nature conservation • Inadequate development of the ICZM approach • Inadequate policy of preparation of guidelines for addressing conservation and management of marine and coastal zones within ICZM • Lack of guidelines for addressing the issue of the introduction of non-indigenous species in the natural environment • Inadequate training for administration and target groups • Inadequate programmes for the developing of public awareness for target public	• Inadequate elaboration and adoption of national strategies for the conservation and sustainable use of biodiversity • Inadequate policy for preparation of guidelines for the transportation of international treaties into national legislation • Inadequate preparation and adoption of relevant legislation suitable to support the implementation of conservation policies	• Analytical reviews of existing national legislation on nature conservation • Preparation and adoption of adequate legislation suitable to support the implementation of conservation policies • Preparation of guidelines for the transportation of international treaties into national legislations • Development of the ICZM approach (see section 2.7.1) • Preparation of guidelines for addressing conservation and management of marine and coastal within ICZM • Elaboration and adoption of national strategies for the conservation and sustainable use of biodiversity • Sectional studies for the integration of marine issues into existing biodiversity conservation strategies • Guidelines for addressing the issue of the introduction of non-indigenous species in the natural environment • Training programmes on legislation enforcement	• Degradation or loss of habitats • Decline in population of endangered species • Loss of opportunities for environmentally sound development • Replacement of indigenous species with non-indigenous (loss of biological diversity)

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

Table 2.6.2 Critical Habitats and Ecosystems and Endangered Species in the Mediterranean – Conservation and Management – Problems and their Root Causes

PROBLEMS	IMPACT*	STAKE HOLDERS	ROOT CAUSES AND POSSIBLE SOLUTIONS			POTENTIAL TRANSBOUNDARY EFFECTS
			PROXIMATE	ULTIMATE	POSSIBLE SOLUTIONS	
1. Marine turtles threatened by the degradation or loss of critical habitats and by fishing activities 2. Mediterranean monk seal threatened by intentional and incidental killing, disturbance, fishing activities and pollution 3. Other marine mammals threatened by pollution and fishing activities 4. Other endangered species threatened by pollution, habitat loss and other activities	L – H N – H T – H	• Ministries /departments concerned with environment, fisheries, coastal planning, tourism • Secretariats of international agreements or conventions such as UNEP/MAP, FAO/GFCM, Council of Europe (Bern Convention) • International organizations • Research institutions • Coastal developers • Fisherman • General public	• Deliberate or accidental killing of marine turtles, Mediterranean monk seals, cetaceans and other endangered species • Overfishing which reduces the fish stocks on which some of the endangered species feed • Industrial and urban pollution • Lack of coordinated research programmes on population dynamics and migration patterns • Inadequate research on improved fishing gear to minimize by–catches • Inadequate research on habitat requirements and monitoring of the status of insufficiently known threatened species • Inadequate	• Lack of enforcement of the existing action plans for the protection of marine turtles, Mediterranean monk seal, cetaceans, and other endangered species • Inadequate policy for creation and management of protected areas for the most important nesting beaches and adjacent sea areas for marine turtles, and priority caves and feeding grounds for monk seal • Lack of competent regional instruments, fishery policies and regulations for fisheries in international waters aimed at minimizing the impact of fisheries on the conservation status of cetaceans • Lack of inventories of marine endangered species at the national level	• Enforcement of the existing action plan (MAP): - Coordinated research programme on population dynamics and migration patterns of Mediterranean populations - Research on improved fishing gear to minimize by-catches - Creation and management of protected areas for the most important nesting beaches and adjacent sea areas - Training for concerned administrations and nesting beach managers - Information and awareness campaign for target groups (fishermen, coast developers, tourists) and the public at large • Enforcement of the existing action plan (MAP): - Assessment and monitoring of remaining populations - Creation and management of protected areas for priority caves and feeding grounds - Training for administration and protected areas managers - Information and awareness campaign for target groups (fishermen, coast developers, tourists) and the public at large • Enforcement of the existing action plan (MAP) and other relevant instruments: - 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 - Elaborate and adopt within the competent regional instruments (FAO/GFCM) fishery policies and regulations for fisheries in	• Degradation or loss of habitats critical for marine turtles, Mediterranean monk seal, cetaceans, and other endangered species • Decline in population of marine turtles, Mediterranean monk seal, cetaceans, and other endangered species • Loss of biological diversity

PROBLEMS	IMPACT*	STAKE HOLDERS	ROOT CAUSES AND POSSIBLE SOLUTIONS			POTENTIAL TRANSBOUNDARY EFFECTS
			PROXIMATE	ULTIMATE	POSSIBLE SOLUTIONS	
			training for administration and target groups • Inadequate programmes for the developing of public awareness for target public		international waters aimed at minimizing the impact of fisheries on the conservation status of cetaceans - Research programme aimed at the shaping of fishing gear and practices in order to prevent/reduce by- catches of cetaceans - Creation of marine protected areas including the main feeding, breeding and calving grounds for cetaceans in the Mediterranean - Information and awareness campaign for target groups (fishermen, law enforcement bodies) and the public at large • Inventories of marine endangered species at the national level • Research on habitat requirements and monitoring of the status of insufficiently known threatened species ($ 200,000/year for 5 years) • Research on the impact of fisheries and introduced species on Mediterranean threatened species (cfr. Table "living marine resources, 2.6.3) • Development of guidelines for the elaboration and adoption of adapted regulations for fisheries in national waters • Elaboration of guidelines for addressing introduction of non-indigenous species ($ 100,000) • Creation & management of fishery or marine reserves encompassing the critical habitats or threatened species (see table 2.6.3) • Training for administration for implementing regulations • Public awareness campaign for target groups, e.g. fishermen and divers	

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

Table 2.6.3 Critical Habitats and Ecosystems and Endangered Species in the Mediterranean – Habitat Conservation and Management – Problems and their Root Causes

PROBLEMS	IMPACT*	STAKE HOLDERS	ROOT CAUSES AND POSSIBLE SOLUTIONS			POTENTIAL TRANSBOUNDARY EFFECTS
			PROXIMATE	ULTIMATE	POSSIBLE SOLUTIONS	
1. Sea grass meadows degradation and dwindling due to pollution, coastal development, fishing activities 2. Wetlands loss due to changes in water use, reclamation, pollution and overexploitation of resources 3. Beaches degradation (erosion) due to changes in sediment flow, degradation of sea grasses, coast development and sand extraction 4. Disappearance of biogenic construction due to pollution and physical alteration 5. Loss and degradation of habitats critical to endangered species	L - H N - H T – H	• Ministries – departments concerned with environment, fisheries, agriculture, coastal planning, tourism • Secretariats of international agreements of conventions (Ramsar, Barcelona, Bern) • Coastal developers • Fishermen • General public	• Industrial and urban pollution • Alterations to the flows of sediment • Change in hydrological regime and drainage • Eutrophication • Lack of sufficiently detailed data on sea grass meadows coverage in most areas of the Mediterranean • Week enforcement of relevant fishery regulation (trawling) • Inadequate elaboration of guidelines for beach management and dune restoration • Inadequate preparation of inventories of critical habitats at the national level • Inadequate training for administration and target groups • Inadequate programmes for the developing of public awareness for target public	• Inadequate elaboration and adoption of ICZM plans for main wetland areas and important beach areas • Inadequate policy of creation of protected areas for the conservation of sea grasses and the conservation of wetlands • Inadequate policy of creation of protected areas including representative examples of biogenic constructions • Inadequate policy of establishment and management of marine and coastal protected areas	• Elaboration and adoption of ICZM plans for: - areas of special importance for the conservation of sea grass meadows; - main wetland areas; and - important beach areas • Creation of protected areas for: - the conservation of sea grasses; - the conservation of wetlands; and - examples of biogenic constructions • Establishment of a network for the monitoring of sea grasses evolution, as a sea quality indicator • Preparation of guidelines for sustainable use and restoration of sea grass meadows • Training for administration and target groups, in particular for protected areas and wetland managers & technician • Information and awareness campaign for target groups (admin., fishermen, farmers, coast developers) and the public at large • Elaboration of guidelines for beach management and dune restoration • Preparation of inventories of critical habitats at the national level • Monitoring programmes of identified critical habitats • Establishment and management of marine and coastal protected areas Development of a Mediterranean networks of managers of coastal and marine protected areas (reinforcement, coordination)	• Degradation or loss of habitats • Decline in population of endangered species • Loss of opportunities for environmentally sound development • Replacement of indigenous species with non-indigenous (loss of biological diversity)

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

Table 2.7.1 Coastal Zone Management and Planning – Problems and their Root Causes*

PROBLEMS	IMPACT**	STAKEHOLDERS	ROOT CAUSES AND POSSIBLE SOLUTIONS			POTENTIAL TRANSBOUNDARY EFFECTS
			PROXIMATE	ULTIMATE	POSSIBLE SOLUTIONS	
1. Weak and inconsistent legal and institutional framework of ICZM at regional and national levels 2. Weak and unharmonized implementation of ICZM in the region 3. Poor implementation of the transboundary segment of ICZM in the region 4. Absence of specific islands related ICZM segment 5. Poor implementation of the coastal urban-related ICZM segment 6. Low human and institutional capacity for the implementation of transboundary related projects	L – H N – H T – H	• Responsible national, sub-national and local authorities • Competing sectors • Local affected population • Interested groups • General public • International organizations	• Absence of application of the ICZM concept • Insufficient geographical coverage of the implementation of ICZM in the region • Insufficient attention given to transboundary issues within ICZM • Weak enforcement of adopted plans and regulations • Lack of local/national funds for implementing ICZM projects • Insufficient institutional capacity for the implementation of ICZM	• Absence of clear and well defined legal and institutional ICZM related framework at regional level • Absence of integrated management • Unsustainable development • Development pressure and population growth • Still dominating classical sectorial / single topic approach to decision making and management • Poverty	• Preparation and adoption of a MAP framework protocol on implementation of ICZM (A1)** • Development of regional strategy for ICZM (B1) • Implementation of two regional and/or sub regional ICZM pilot projects on transboundary related issues (B2) • One coastal and one insular areas study on cost/benefit when implementing ICZM (B3) • Implementation of a pilot project on integrated river basin management including transboundary affected coastal areas (B4)	• Degradation of ecosystems • Pollution • Loss of natural habitats • Over-exploitation of natural resources • Decline in biodiversity • Economic impact due to degradation of resources and amenities

* For more detailed information see 3.7. and Table 3.7.1; the "problems" related numbers in 2.7.1. correspond to those of "issue" related numbers in 3.7.1.
** L – Local; N – National; T – Transboundary; I – Insignificant; M – Medium; H - High

Table 2.8.1 Institutional Arrangements – Problems and their Root Causes*

PROBLEMS	IMPACT**	STAKEHOLDERS	ROOT CAUSES AND POSSIBLE SOLUTIONS			POTENTIAL TRANSBOUNDARY EFFECTS
			PROXIMATE	ULTIMATE	POSSIBLE SOLUTIONS	
1. Inadequate regional and national institutional arrangements for *transboundary* related issues 2. Inadequate regional and national legal arrangements regarding transboundary issues 3. Absence of adequate bilateral and multilateral transboundary related arrangements and programmes	L – M N – M T – H	• International and UN agencies (MAP-UNEP, MAP MCSD, UNDP, FAO, UNESCO, WB-METAP, GEF), EU • Responsible authorities of Mediterranean coastal states • General public, NGOs • Interested competing sectors	• Present regional institutional arrangements for addressing transboundary related issues are not properly defined • No relevant regional coordinating body and lead Agency • Uncoordinated and insufficient involvement in addressing major transboundary issues in the region • Lack of clear provisions for actions, procedures and tools to be implemented • Lack of funds needed for mitigation of transboundary impacts • Insufficient institutional capacity	• Lack of interagency agreements on role, mandate and involvement in transboundary initiatives in the region among interested and responsible international agencies and institutions • Existing national and regional coastal zone management and environment related legal arrangements are not transboundary specific	• Confirm MAP as the regional Lead Agency for transboundary related issues • 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 • Designate MCSD as the regional Coordinating Body for transboundary related issues and secure the logistical support by MAP structure • Reformulate MAP monitoring programme and other RAC's programmes if needed and as appropriate, to meet requirements related to above points	• Absence of properly defined and timely implemented actions • Confusion related to responsibilities and procedures to be applied • Degradation of ecosystems due to pollution and biodiversity decline in affected areas

* For more detailed information see 3.8. and table 3.8.1; order number of "problems" in 2.8.1 corresponds to "issue" numbers in Table 3.8.1.
** L – local; N – national; T – transboundary; I – insignificant; M – medium; H - high

Table 2.9.1 Public Participation in Environmental Decision–making - Problems and their Root Causes

PROBLEMS	IMPACTS*	STAKEHOLDERS	ROOT CAUSES AND POSSIBLE SOLUTIONS			POTENTIAL TRANSBOUNDARY EFFECTS
			PROXIMATE	ULTIMATE	POSSIBLE SOLUTIONS	
1. Inadequate access to information 2. Limited participation of the public in the decision – making process 3. Limited access to justice 4. Inadequate mechanisms and practices to keep public informed and involved 5. Inadequate funding 6. No access to credit by NGOs and public groups	L – H N – H T - H	• State • Local authorities • NGOs • Private sector • Mass media • Other partners	• Nonexistent or lengthy and complex legislative process • Lack of funds for the implementation of activities • Inadequate capacity of NGOs to prepare relevant materials • Local authorities not prepared to take active role in initiating broad consultations • National authorities not ready to finance public participation in the decision – making process	• Lack of recognition by national authorities of the importance of the role of public participation in decision-making process • Lack of legal provisions in many countries	• 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 • Introduction of legislation making information related to the environment open to the public • 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 • Critical review of the existing experience in the EU countries of the introduction of the relevant directive on access to environmental information	• Environmental decision-making without the adequate public participation and consensus

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

Section 3

Relevant Data and Information and Detailed Analysis of Problems

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 Mediterranean 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 83km^3/yr (2600m^3/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 2km^3/yr (65m^3/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 (2.87km^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_5 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_5 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_5 and COD levels, as for the Rhone river (1.5 and 5mg/L respectively) and to 50% of the discharge higher BOD_5 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_5 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 NO_3 and more for NH_4 and 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 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-NO_3 (expressed in nitrogen), 99,000 for N-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 that 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 of deteriorating.

Pollution of heavy metals can be appreciated 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 (Rhone, Tevere, Herault, Brenta, Martil), for Zn (Adige, Herault, Martil, Po, Tevere), for Hg (Po, Rhone), for Cu (Ebro, Herault, Orb, Rhone, 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^{-1} for Cd, 125 for Cr, 100 for Cu, 0.5 for Hg, 100 for Pb and 200 for Zn, compared to 0.4mg.g^{-1} 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 Mediterranean 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^3 and 18 are between 50 and 100 Mm^3
Spain	For the whole Spanish territory 1,000 reservoirs exceeding 8 km^2 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^3/yr	Area 10^3 km^2	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
CHELIFF	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^3/s.

Table 3.1.1.4

Water and nutrients inputs from rivers to the Mediterranean subbasins

	Terrestr. watershed area (1) 10^3 km^2	Total river discharge (1) km^3 / yr	Total load estimates N (2) 10^3t/yr	Total load estimates P (2) 10^3t/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
(2) Nutrient balance from Vollenweider *et al.* 1996
(3) Combination of (2) and (1)
(?) Questioned values

Table 3.1.1.5

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

Rivers	Msnatural Mt/yr	Area 10^3 km^2	Sub Basin	Country	Ts t km^{-2} yr^{-1}
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
VIJOSE	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

Oued Zeroud. 8,950km^2 (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^3/ 2 months of water and 240 millions tonnes of sediments corresponding to a transport of 40,000t/km^2 during this period. The maximum water discharge reached 17,000 m^3/s and river velocity was up to 10m/s. The occurrence of such event is once every 20 years (Colombani and Olivry 1984).
Oued Medjerdah. 23,300km^2 (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^2. 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^3/s. The occurrence of the event is once every 200 to 300 years. (Claude, Francillon, Loyer 1977).
Rhone river. 96,500 km^2 (France)	In November 1994 the Rhône reached 9,760m^3/s (#5th flood since 1856) during 77 days of floods (Q> 3,000m^3/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.
Ebro river. 85,550 km^2	In 1907 (23 October) the maximum discharge at Tortosa, last gauging station, was 23 484m^3/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 10^3 km^2	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^3/yr	BOD_5 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^3/yr	N - NO_3^- mg/L	N - NO_2^- mg/L	N - NH_4^+ mg/L	N k mg/L	P - PO_4^{-3}	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	NO_3	NO_2	NH_4	DON	PN	$P\text{-}PO_4$	DOP	PP	TP	DOC	POC	TOC
	mg/L	%	%	%	%	%	%	%	%	mg/L	%	%	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-Enviromental 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^2	BOD_5 mg/L	COD mg/L	$N\text{-}NO_3$ mg/L	$N\text{-}NH_4$ mg/L	$P\text{-}PO_4$ 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 Maritime Transport and Ports

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 feedering 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%). General cargo category only totals 9.4 million tonnes (5.4%).

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 "Containerisable" 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 of 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 "containairisable" 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 containairisable 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 exists 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 form 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.

Another grey area is the current rate of discharge of oily bilge water accumulated in the machinery space of all ships. Here again, this rate should be nil for a "Special area" like the Mediterranean Sea but the quantities produced by all the ships operating on its waters is important and it is doubtful that all these wastes find their way to reception facilities.

IMO Manual on the disposal of ship wastes, considers that, depending of many factors, such as ship's type, age and maintenance conditions, the daily quantity of oily bilge water resulting from the operation of a middle-sized to large vessel is in the range of 1 to 15 m^3. If,

admitting an average volume of 7.5 m^3, we multiply this value by the estimated number of merchant vessels operating in the Mediterranean we get 10,500 cubic meters per day or 3,832,500 cubic meters per year. This figure should be substantially increased by the total output of bilge water produced by the unknown, but very high, number of small coasters, passenger launches, fishing vessels, pleasure motor boats and harbour craft operating along the Mediterranean shores. Considering this huge pollution potential, one has to wonder what is the actual volume ultimately finding, willingly or not, its way to the sea water.

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 passengers vessel –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. About 30,000 fishermen can be added to this figure.

The above calculations result in a total garbage output by merchant ships calling at Mediterranean ports of about 614,000 tonnes of which only 43.5% 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 curatives 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 Morrocan 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.

In order to determine, for the purpose of drafting the present chapter, what is the current situation in the field of adequate port reception facilities, an enquiry was launched by the Greek non-governmental Organization HELMEPA.

123 Mediterranean ports, located in 19 countries, were selected and classified into five categories:

- Crude oil port, subdivided into loading and unloading one;
- Oil products port, subdivided into loading and unloading one;
- Ship Repairing port;
- Commercial port;
- Other port.

HELMEPA has divided the existing port reception facilities in two main categories:

- The first one comprises the facilities answering the requirements of MARPOL Annexes I and II and designed to receive oil and chemical liquid wastes: dirty ballast water, oily slops, sludge, oily bilge water and chemical slops;

- The second one, concerns the facilities corresponding to the provisions of Annex III and V for solid wastes; domestic wastes, cargo-associated waste, maintenance and repairs wastes.

Despite that several existing facilities have not been evaluated and some, even, probably have not been identified, the HELMEPA enquiry constitutes an interesting document. It shows that the provision of reception facilities in the main Mediterranean ports has been much improved as compared with the situation prevailing at the end of the eighties. At present, also, the quality of operation of most of the facilities is considered as satisfactory by their users: out of the 218 evaluations expressed, nearly 80% have resulted in a "good" mark.

Consequently, one can consider that for the time being the provision of the mandatory port reception facilities is no more an issue in the Mediterranean area. However, the problem of sewage wastes remain to be solved at the international IMO level.

Generally speaking, it appears that the international rules and regulations adopted, in the framework of IMO, are covering very well the regional marine pollution prevention and fighting requirements and that their sole drawback is their huge volume and extreme complexity which present a real problem to the shipowners and port managers that have to comply with them as well to the governmental authorities and organizations in charge of their control.

Consequently, it does not seem necessary to complement this intricate international regulation framework by a regional one intended to take into consideration some specific Mediterranean issues, which may result more from some political compulsion than from an ecological requirement.

At the end of the present chapter, one should consider that the marine pollution risks generated by maritime transport activities in the Mediterranean waters and ports, has considerably receded, during the last decade, owing specially to the growing implementation of SOLAS and MARPOL regulations by the shipowners whose vessels are operating in the area and by a constant improvement of navigation aids provided in the region. Also, the consciousness of the maritime environment issues has steadily progressed among the Mediterranean ship's crews.

Nevertheless, the battle for safer ships and cleaner seas never ends, as new commercial and technical developments, such as fast ferries, combined with the constant economical pressure for lesser transport costs, shall not fail to imply new risks for the marine and coastal environment. A special reason for remaining alert in this field of Maritime transport-generated pollution in the Mediterranean Sea, is the ageing process of the world oil and chemical tankers fleet, particularly if and when it should be increased, for the ships calling in the ports of the region, by the indirect effect of the US 1990 Oil Pollution Act.

3.1.3 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 3.1.3.1.

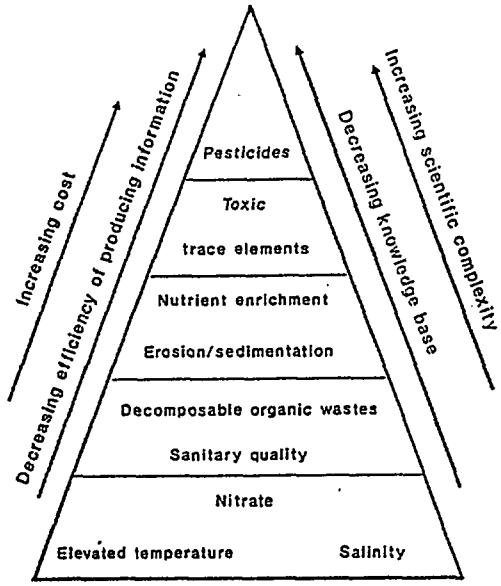

Figure 3.1.3.1 Hierarchical complexity of agriculturally-related water quality problems (Rickert, 1993).

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
Fertilizing	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, fertilizers, 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

Degradation by sedimentation has two major dimensions. One is the physical/mechanical impact: 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. 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 fertilizer at considerable cost to the farmer in order to maintain soil productivity. 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 hydrological cycle.

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^2, not counting the Upper Nile basis, 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^2) 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^3/year against 477 km^3/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.

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/m3 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 thw 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.

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 3.1.3.1), particularly on a narrow coastal strip bordered by desertic regions on the Southern coast. Moreover, urbanization 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 specialized 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 equation most widely 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).

An insignificant 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^{-1} $year^{-1}$	none or slight
II.	11 - 50 t ha^{-1} $year^{-1}$	weak to moderate
III.	51 - 100 t ha^{-1} $year^{-1}$	moderate to high
IV.	101 - 200 t ha^{-1} $year^{-1}$	high
V.	> 200 t ha^{-1} $year^{-1}$	very high

Basing on this classification figures for agricultural runoff shown in Table 3.1.3.2 can be derived. The country by country analysis 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 former 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 3.1.3.3 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 were 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 3.1.3.4, 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).

At 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).

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

As a consequence, a 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-fertilization, 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 mineralized N, also preventing it discharge during runoff events;

3. manage the period between crops: organic residues produced by harvesting are easily mineralized. 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. optimize other cultivation techniques: highest yields with minimum water quality impacts require optimization of practices such as weed, pest and disease control, liming, balanced mineral fertilizers including trace elements, etc.;

6 agricultural planning: implement erosion control techniques that complement topographic and soil conditions.

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

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 fertilization 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 fertilizer application, and loss of soil productivity is very direct in many countries. In the Brazilian state of Paranà (Andreoli 1993) erosion has led to extensive loss of top soil, large-scale gullying, and silting of ditches and rivers. The use of fertilizers 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 Costarica, 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 modeled 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 fertilizer 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 3.1.3.1

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 3.1.3.2

Discharge to Mediterranean from agricultural land

Country	Area	Soil	P 10^3 t			N 10^3 t			Org C 10^3 t			Soil t ha^{-1}			P kg ha^{-1}			N kg ha^{-1}			Org. C kg ha^{-1}			Erosion class		
	Km^2	10^6 t	Tot	Max	Min	Tot	Mx	Mn	Tot	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Av	Mx	Mn
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	II	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.	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.	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.	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.	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.	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.	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.	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.	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.	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.	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.	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 3.1.3.3

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^{-1}	Country	P kg ha^{-1}	Country	N kg ha^{-1}	Country	C kg ha^{-1}
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

Table 3.1.3.4

Nitrogen and P_2O_5 balance (10^3 t)

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 Herzegovina	70.73	43.8	-26.9	0.62	24.1	7.7	-16.4	0.32
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

3.1.4 Airborne Pollution

3.1.4.1 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_x) include two main pollutants - nitrogen dioxide (NO_2) and nitric oxide (NO). The NO_x emissions are strongly dependent on fossil fuel combustion. The CORINAIR inventory indicates that 93% of the total NO_x 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_3) emissions are produced by the microbiological decomposition of wastes from domestic animals. About 10% of NH_3 atmospheric input is related to application of nitric fertilizers. The remaining 10% of NH_3 emissions originates from other sources, including the industrial production of nitric fertilizers.

An estimate of the emissions of nitrogen (NO_x and NH_3) into the atmosphere from the Mediterranean countries for 1991 is given in Table 3.1.4.1.

Table 3.1.4.1

Emissions of nitrogen (NO_x, NH_3 and N_{tot}) into the atmosphere from the territories of the Mediterranean countries in kt of N / year in 1991 (Erdman *et al*, 1994)

Country	NO_x kt of N/yr	NH_3 kt of N/yr	N_{total} 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
Total	1,854	2,190	4,044

* 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 (NO_x, NH_3 and N_{tot}) originated from individual Mediterranean countries have been estimated (Erdman *et al*, 1994) and are given in Table 3.1.4.2. 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 3.1.4.2

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 (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	NO_x		NH_3		N_{tot}		N_{tot} %
	kt N / yr	% of national emmision	kt N / yr	% of national emmision	kt N / yr	% of national emmision	% 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
Egipt	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 3.1.4.3 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 3.1.4.4 and 3.1.4.5.

Table 3.1.4.3

Comparison of inputs of nitrogen to the Mediterranean Sea subbassins 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
Total Mediterranean	1,011.5	1,067.3	51.3

Table 3.1.4.4

Deposition and inputs of N for the Mediteranean 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 3.1.4.5

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_t)	182	1,000	750
Total input in kt/y $I_t = R_t + D$	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).

3.1.4.2 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).

3.1.4.3 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).

Emmission of heavy metals into the atmosphere from the territories of the Mediterranean countries are presented in Table 3.1.4.6.

Table 3.1.4.6

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)
Total Mg/yr	918.3	325.53			31,043	12,627.2

* 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 3.1.4.3 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 3.1.4.7

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 0.1 t/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 desposited in the M.Sea	% of total dep to M.Sea	Total deposition to the Sea t/year	% of total emission desposited in the M.Sea	% of toal 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

Country	Zn			As		
	Total deposition to the Sea t/year	% of total emission desposited in the M.Sea	% of total dep to M.Sea	Total deposition to the Sea t/year	% of total emission desposited in the M.Sea	% of toal dep to M.Sea
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, Ukranie, Romania and some other countries. The highest atmospheric deposition flows of Pb, Cd, Zn and As ($g/m^2/yr$) are in the Adriatic, Aegean, South-western, Tyrrheninan and North-western regions. Rough estimates of atmospheric deposition on the Medtiterranean 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 3.1.4.8 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 3.1.4.8

Summary table of deposition fluxes on the 10 Mediterranean subbasins in 1991. For each compound the subbbasins 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/m²	rank	NHy mg/m²	rank	Pb mg/m²	rank	Zn mg/m²	rank	Cd mg/m²	rank	As mg/m²	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

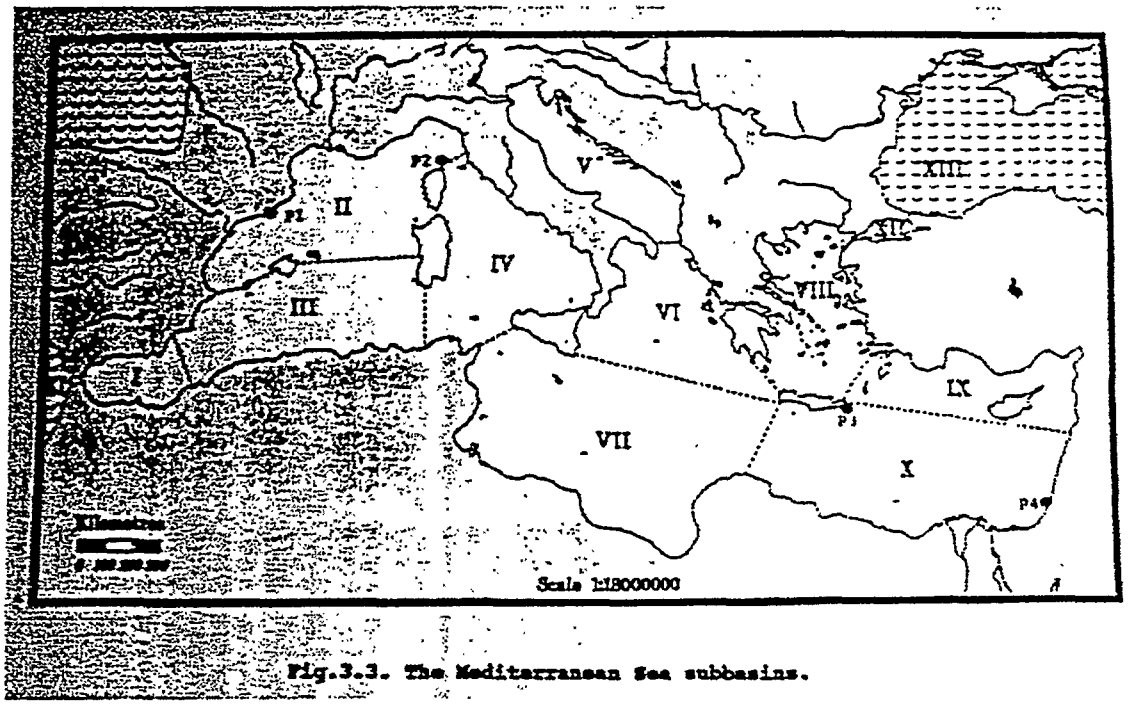

Figure 3.1.4.1

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 3.1.4.2.

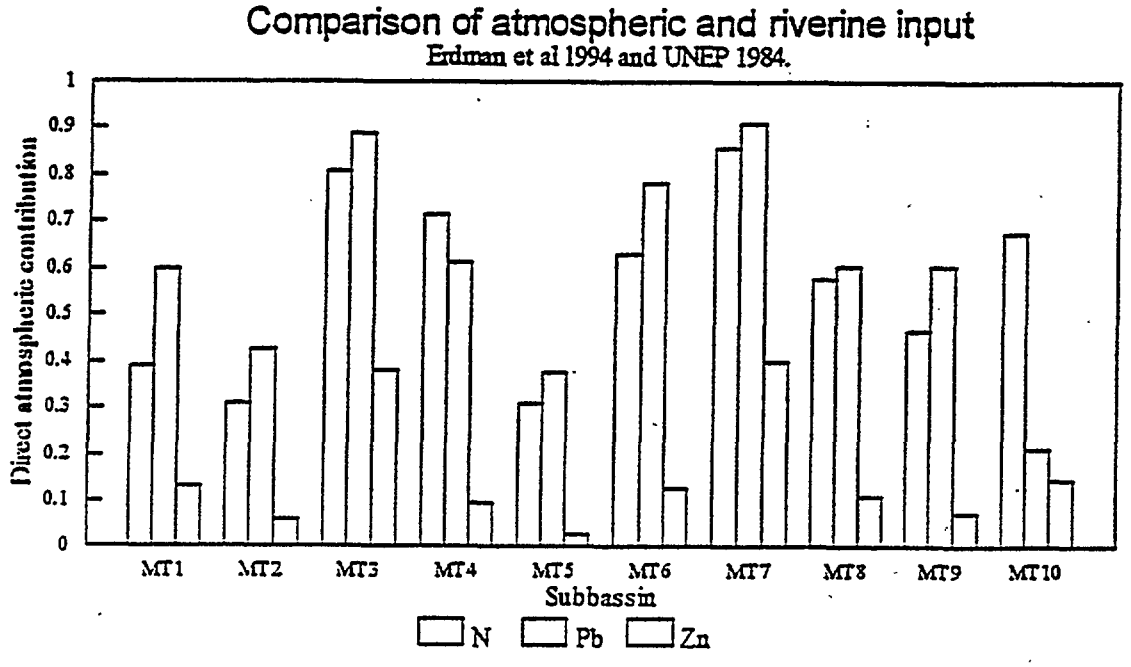

Figure 3.1.4.2

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 3.1.4.7 and 3.1.4.8 derived from Erdman *et al*, 1994 have been used.

3.1.4.4 Persistent Organic Pollutants

Major sources of anthropogenicaly released POPs from statonary 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 emisions of lindane, benzo(a) pyrene, HCB, PCB and PAH for some mediterranean countries are given in Table 3.1.4.9 (Axenfeld *et al* 1992, Van den Hout 1994).

Table 3.1.4.9

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_{tot} (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_{tot}, 95% of HCB, 91% of dieldlrin, 98% of DDT, 85% of Chlordane and 80% of PCB total input.

3.1.4.5 Radionuclides

Radionuclides are present in trace amounts in the Mediterranean from natural (^{210}Po, ^{210}Pb) and anthropogenic sources (^{137}Cs, $^{239,240}Pu$, ^{214} Am).

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

Table 3.1.4.10

Estimates of total atmospheric POPs depostion 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 Mediterraean Sea in total	GESAMP, 1989 Villeneuve, 1986
HCB	0.2	NW Mediterranean	GESAMP, 1989
DDT	0.3 =<1.3	NW Mediterranean Mediterraean Sea in total	GESAMP, 1989 Villeneuve, 1986
Dieldrin	0.6	NW Mediterranean	GESAMP, 1989
HCH_{tot}	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 ^{137}Cs and $^{239,240}Pu$ 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 ^{137}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).

3.1.4.6 Emission reduction cost

Table 3.1.4.11

Cost (10^6 Ecu)estimates for the currently agreed emission reductionn plans as calculated by LRTAP/TFIAM in January 1997 (EB.AIR/WG.5/R.69)

	SO_2				NOx			
	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 3.1.4.11 some values for emission reduction costs for mediterranean countries are given for ilustrative purposes. The values have been obtained from the preliminar calculations under consideration in the negotiations of the new protocol on acidification, eutrophication and photochemial oxidants under the ECE/LRTAP convention.

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3.1.5 Exploitation of seabed and its subsoils

3.1.5.1 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 3.1.5.1) and offshore production is taking place in Italy, Egypt, Greece, Libya, Tunisia and Spain (Table 3.1.5.1). 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 3.1.5.1

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

3.1.5.2 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; Leuterman *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 localized 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 3.1.5.2). 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 3.1.5.2

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_2	5440	0.4
CO	12	0.04
NOx	36	0.7
SO_2	1.8	0.03
CH_4	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 3.1.5.3). 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 3.1.5.3

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 industrial	 160,000 110,000
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*).

3.1.5.3 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 3.1.5.4). The following sections discuss the importance of these impacts in a regional context and the possibility for cumulative effects resulting in regional problems.

Table 3.1.5.4

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_2, NOx, SOx, 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 localized. 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.

3.1.5.4 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 3.1.5.5).

Table 3.1.5.5

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.

3.1.5.5 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 authorized 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 minimize the potential for severe impacts (e.g. low frequency acoustic sources, slow start-up).

Possible Intervention Measures: Develop guidelines for undertaking acoustic operations to minimize 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 specific 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 maximizing 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 minimize the risks of oil spills. Particular attention should be paid to preventing small spills which may result from operational activities such as fuel transfer.

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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 analysing 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).

The following table explains the criteria for ranking the effects:

Public Health	
extreme effects (6)	Domestic wastewater loads of more than 30 tons BOD/day with no disinfection and having a high probability of direct contact to human beings. Wastewater containing more than 50 mg/L of heavy metals and having a possible contact to the public at the discharge point. Wastewater containing radioactivity or hazardous substances above WHO limitation.
severe effects (5)	Domestic wastewater loads of more than 15 tons BOD/day with no disinfection and having a high probability of direct contact to human beings. Wastewater containing more than 20 mg/L of heavy metals and having a possible contact to the public at the discharge point.
major effects (4)	Domestic wastewater loads of more than 10 tons BOD/day with no disinfection and having a high probability of direct contact to human beings. Wastewater containing more than 10 mg/L of heavy metals and having a possible contact to the public at the discharge point.
moderate effects (3)	Domestic wastewater or water containing heavy metals with no direct effect to human beings.
slight effects (2)	Any discharge which contains toxic substances or pathogens and is not mentioned in (3) - (6).
no effects (1)	Discharge with no effect.

Drinking Water Quality	
extreme effects (6)	Any wastewater directly discharged to a water body which is used as drinking water.
severe effects (5)	Any wastewater directly discharged to a water body which is not used as drinking water but is potentially a drinking water source.
major effects (4)	Indirect discharges to water sources with improper filtration.
moderate effects (3)	Indirect discharges to a water body with proper infiltration.
slight effects (2)	Discharge representing a potential risk in emergency situations (flood, earthquake).
no effects (1)	Discharge with no effect.

Recreation	
extreme effects (6)	Discharges with more than 300 mg/L of oil which may cause a significant odour that directly affects a recreational area from a distance of 100 m.
severe effects (5)	Discharges which may cause a significant odour that directly affects a recreational area from a distance of 500 m.
major effects (4)	Discharges with no odour at a distance of 1000 m from the recreational area deteriorating the aesthetic quality of waters.
moderate effects (3)	Discharges at a distance of 5000 m from the recreational area.
slight effects (2)	Discharges causing a potential risk to the environment.
no effects (1)	No effect.

Other Beneficial Uses	
extreme effects (6)	Discharges containing a high level of solid wastes or odours which can cease the present beneficial use of the water body (transportation, sport activities, aquaculture).
severe effects (5)	Discharges containing a high level of solid wastes or odours which can potentially cease the present beneficial use of the water body (transportation, sport activities, aquaculture).
major effects (4)	Discharges containing a high level of solid wastes or odours which can harm the present beneficial use of the water body (transportation, sport activities, aquaculture).
moderate effects (3)	Discharges containing a high level of solid wastes or odours which can potentially harm the present beneficial use of the water body (transportation, sport activities, aquaculture).
slight effects (2)	Discharges containing a high level of solid wastes or odours which may harm the present beneficial use of the water body (transportation, sport activities, aquaculture).
no effects (1)	Discharge with no effect.

Aquatic Life (including biodiversity)	
extreme effects (6)	Any discharge which may reduce the oxygen content of the receiving body below 0.5 mg O_2/L. Any discharge which contains a heavy metal concentration of more than 50 mg/L. Any discharge which contains an oil concentration of 400 mg/L.
severe effects (5)	Any discharge which may reduce the oxygen content of the receiving body below 1 mg O_2/L. Any discharge which contains a heavy metal concentration of more than 30 mg/L. Any discharge which contains an oil concentration of 200 mg/L.
major effects (4)	Any discharge which may reduce the oxygen content of the receiving body below 2 mg O_2/L. Any discharge which contains a heavy metal concentration of more than 20 mg/L. Any discharge which contains an oil concentration of 100 mg/L.
moderate effects (3)	Any discharge which causes oxygen depletion.
slight effects (2)	Any suspicious discharge.
no effects (1)	Discharge with no effect.

Economy and Welfare	
extreme effects (6)	Shutting down of discharging industries would have significant effect on the economy. Investment needed for environmental sound solution more than 20 million dollars.
severe effects (5)	Shutting down of discharging industries would have severe effect on the economy. Investment needed for environmental sound solution more than 10 million dollars.
major effects (4)	Shutting down of discharging industries would have major effect on the economy. Investment needed for environmental sound solution more than 5 million dollars.
moderate effects (3)	Discharging industries having little effect on the economy.
slight effects (2)	Discharging industries having no effect on the economy.
no effects (1)	Discharging industries having no effect on the economy, and already non-feasible for investment.

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[1]. 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 draft report on Priority Pollution Hot Spots (UNEP(OCA)/MED WG.130/4) which was presented to the meeting of Government-designated Experts to examine a Strategic Action Programme to address Pollution from Land-based Activities, which was held in Ischia, Italy, 15-18 June 1997. Following the comments and corrections made during the meeting, the present chapter was formulated.

3.2.3 Analysis of Results

The results of the country analyses are given in the report on hot spots for each of the 18 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.

115 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.

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[1] In fact, only one country referred to the establishment of an inter-ministry working group

Table 3.2.1

Hot Spots distribution of weighted total impacts

	Number of Hot Spots	% of Total
Hot Spots scoring > 25	2	1.7 %
Hot Spots scoring 25-20	25	21.7 %
Hot Spots scoring 20-15	54	47 %
Hot Spots scoring 15-10	30	26.1 %
Hot Spots scoring < 10	4	3.5 %
Total	**115**	**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	28	27	60
% of total	24.3 %	23.4 %	52.3 %

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 (753,715 t/yr) four hot spots contribute more than 40,000 t/yr each. They account for no less than (414,773 t/yr) or 55 % 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).

Table 3.2.3

Major Hot Spots by BOD load

Hot Spot	BOD load (t/yr)
El-Mex Bay (Egypt)	219,498
Abu-Qir Bay (Egypt)	91,701
Inner Saronic Bay (Greece)	59,386
Izmir (Turkey	44,188
Totals	414,773

- COD loads: Six hot spots are responsible for COD loads of more than 100,000 t/yr. Together they account for 66.7 % of the total COD loads (2,063,843 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)
Abu-Qir Bay (Egypt)	575,490
Iskendrun (Turkey)	222,080
Haifa Bay (Israel)	183,770
El-Mex Bay (Egypt)	175,654
Inner Saronic Bay (Greece)	118,735
Silifke (Turkey)	100,290
Total	1,376,019

- One hot spot (Abu Qir Bay) is responsible for more than one quarter of the total COD load.
- Two hot spots in Alexandria account for 36.4% of the total COD loads. They are the same two hot spots responsible for 41.3% 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

TPB (Kg/yr)	Hg	Cd	Pb	Cr	Cu	Zn	Ni	POPs	Others (t/yr) mainly hydro-carbons
Hot Spot									
Abu Qir Bay Egypt)		31+	193+	362+	2,669+	3,394+	859		1,906 (oil)
Haifa Bay (Israel)		2,600			3,250	58,500			50,000 (oil)
Tartous (Syria)		54	2,703	1,784	5,406	5,163	2,649		
Lattakia (Syria)		85.4	4,271	2,135	4,271	7,686	2,562		
El-Mex Bay (Egypt)	1278(*)	1,562		530	25,430	46,524			1,319 (oil)
Gush Dan (Israel)	60	430	1,670	11,400	19,000	54,000	2,500		
Sfax South (Tunisia)					3,456	17,000			
Larymna Bay (Greece)						313,170			
Totals	1338	4762.4+	8837+	16211+	63,482+	505,737 +	8570		53,225
% of total TPB discharges	93.%	81.4%	48.2%	70.1%	96.3%	82.15	75.1%		97.2%

- 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.

(*) A caustic soda plant at this location, using mercury cells, has been dismantled and is buried in a secure landfill in the desert south of Alexandria.

Table 3.2.6

Population around Hot Spots

Population	> 1,000,000	1,000,000 - 500,000	500,000 - 250,000
No. of cities	12	11	14
Total population for the group	25,479,864	7,714,566	3,837,588
% of total	**60.5%**	**18.3%**	**9.1%**

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.
- **Inner Saronic Gulf** in Greece, with a population of over 3 million is also a significant source of BOD and COD.

There are **eleven cities** with populations between one million and half a million. They house just under 8 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.

Fourteen 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 14 cities, Tartous in Syria and Sfax South in Tunisia 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	27	60	115
% of total number		24.3%	23.4%	52.3%	100%
BOD load	t/yr	121,027	21,976	610,712	753,715
	% of total	16%	2.9%	81.1%	100%
COD load	t/yr	509,896	77,705	1,476,242	2,063,843
	% of total	2.7%	3.8%	71.5%	100%

The sixty hot spots having mixed sources of pollution account for 81.4% 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.

Table 3.2.8 lists the 115 priority hot spots identified in the country reports ranked in descending order by country 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.

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

Table 3.2.10 compiles the data in the national reports on Toxic, Persistent and liable to Bioaccumulate substances (TBPs) (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.

Table 3.2.8

Priority Hot Spots (ranked in descending order by country of their weighted total impacts)

Country	Hot Spot	Source of pollution	Weighted Total Impact	Economic Costs for Remedial Actions (Mln US$)
Albania	Durres	d	13.3	48
Albania	Vlore	d	13.3	48
Albania	Durres (Chemical factory)	i	11.4	2 to 3
Albania	Vlore (PVC Factory)	i	9.3	2
Algeria	Oran Ville	m	21.0	35+
Algeria	Rouiba	m	21.0	2+
Algeria	Ghazaouet	m	20.8	30+
Algeria	Alger	m	20.2	1.5+
Algeria	Mostaganem	m	20.0	25+
Algeria	Bejaia	m	19.4	0.9+
Algeria	Annaba	m	18.7	0.6+
Algeria	Skikda	m	17.8	20+
Croatia	Kastela Bay	m	21.7	*See Split*
Croatia	Split	m	21.1	66
Croatia	Sibenik	m	18.8	30
Croatia	Zadar	m	18.5	35
Croatia	Pula	m	17.5	30
Croatia	Rijeka (Oil Refinery)	i	16.9	8
Croatia	Kastela Bay (Kaltenberg)	i	16.0	2
Croatia	Zadar (Adria)	i	15.9	2
Croatia	Rijeka	d	15.2	25
Croatia	Bakar (ex Cokery)	i	15.2	1.5
Croatia	Dubrovnik	d	14.5	6
Croatia	Zadar (Tannery)	i	12.1	1.5
Cyprus	Limassol	m	13.0	32.75
Cyprus	Larnaca	m	11.9	0.5
Cyprus	Larnaca	i	8.1	1
Cyprus	Dhekelia (Desalination Plant)	i	7.5	na
Egypt	El-Manzala	m	26.1	na
Egypt	Abu-Qir Bay	m	24.9	101.2+
Egypt	El-Mex Bay	m	19.1	61.6
Egypt	Alexandria	d	17.8	in implementation
France	Marseille	d	11.9	110
France	Gardanne	i	10.9	na
France	Toulon	d	10.4	40
France	Cannes	d	10.4	32
France	Frejus	d	10.4	18
Greece	Thermaikos Gulf	m	19.5	40.6
Greece	Inner Saronic Gulf	m	18.8	130

Country	Hot Spot	Source of pollution	Weighted Total Impact	Economic Costs for Remedial Actions (Mln US$)
Greece	Patraikos Gulf	m	17.9	15
Greece	Pagasitikos Gulf	m	13.7	8
Greece	Heraklio Gulf	m	12.9	na
Greece	Elefsis Bay	i	12.6	0.6
Greece	NW Saronic Gulf	i	11.2	0.3
Greece	Larymna Bay	i	11.2	0.3
Greece	Nea Karvali Bay	i	9.5	0.3
Israel	Haifa Bay	m	24.9	80 + 0.65
Israel	Nahariya	d	21.4	18
Israel	Akko	d	21.4	10
Israel	Gush Dan	m	18.8	0.7
Israel	Ashdod	i	15.8	20
Israel	Haifa Bay	i	13.8	0.45
Italy	Porto Marghera (VE)	m	21.9	120
Italy	Genova	m	16.7	d=10 i=80
Italy	Augusta-Melilli	m	16.6	70
Italy	Brindisi	m	16.5	40
Italy	Gela	m	16.4	35
Italy	La Spezia	m	16.0	65
Italy	Milazzo	m	16.0	45
Italy	Golfo di Napoli	m	15.9	60
Italy	Ravenna	i	15.9	na
Italy	Taranto	m	15.8	na
Italy	Rosignano Solvay	i	15.6	40
Italy	Bari-Barletta	d	15.5	100
Italy	Livorno	i	15.2	na
Italy	Manfredonia	m	13.3	25
Italy	Ancona-Falc	i	13.1	60
Lebanon	Gt Beirut Area	m	20.6	140
Lebanon	Jounieh	m	19.9	62.6
Lebanon	Saida-Ghaziye	m	19.3	44
Lebanon	Tripoli	m	18.9	126.5
Lebanon	Batroun Selaata	m	16.8	5.9
Libya	Zanzur	i	17.0	0.1
Libya	Tripoli	d	15.3	12
Libya	Benghazi	d	13.8	1
Libya	Zawwia	d	12.0	2
Libya	Tobruk	d	12.0	1.5
Malta	Weid Ghammieq	m	21.9	36
Malta	Cumnija	m	18.1	8
Malta	Ras il-Hobz	m	17.9	4
Morocco	Tangier	m	21.0	28

Country	Hot Spot	Source of pollution	Weighted Total Impact	Economic Costs for Remedial Actions (Mln US$)
Morocco	Tetouan	m	19.0	19.6
Morocco	Nador	m	15.0	na
Morocco	Al-Hociema	m	13.0	na
Slovenia	Koper (incl. Rizana river)	m	18.2	16
Slovenia	Izola	m	15.3	12
Slovenia	Delamaris	i	14.2	2.5
Slovenia	Piran Submarine Outfall	d	10.7	8.5
Spain	Barcelona	m	16.6	na
Spain	Tarragona	m	15.2	na
Spain	Valencia	m	14.2	na
Spain	Cartegena	d	13.6	na
Spain	Algeciras	d	12.6	na
Syria	Tartous	m	23.6	41
Syria	Lattakia	m	22.5	73
Syria	Banias	m	20.0	35.6
Syria	Jableh	m	18.8	41.7
Tunisia	Gabes	m	22.2	132.5
Tunisia	Lake of Tunis	i	21.2	55
Tunisia	Lake of Bizerte	i	18.5	77
Tunisia	Sfax-South	i	18.1	30+
Turkey	Izmir	m	25.8	78.5+
Turkey	Icel City	m	24.6	97
Turkey	Antalya	d	23.8	136
Turkey	Hatay	i	23.6	na
Turkey	Adana	d	23.1	99.8
Turkey	Tarsus	d	21.3	76.4
Turkey	Adana	i	21.2	na
Turkey	Iskenderun	d	19.7	13.4
Turkey	Kirikhan	d	17.3	35.9
Turkey	Dortyol	d	17.1	41.7
Turkey	Erdemli	d	17.1	52.2
Turkey	Silifke	d	16.4	40.5
Turkey	Osmaniye	d	15.6	22.7

Table 3.2.9

Main Pollution Loads

Country	Hot Spot	Population	BOD	COD	Total-N	Total-P	TSS
Albania	Durres	120.000	2.864	-	477	96	4.300
Albania	Vlore	110.000	2.628	-	438	88	3.942
Albania	Vlore (PVC Factory)	-	-	-	-	-	-
Algeria	Oran Ville	1.230.000	269	449	67	27	162
Algeria	Rouiba	120.000	72	106	56	16	75
Algeria	Ghazaouet	535.000	117	195	29	12	87
Algeria	Alger	1.957.334	429	714	107	43	227
Algeria	Mostaganem	631.000	138	230	35	14	57
Algeria	Bejaia	859,000	188	314	47	19	33
Algeria	Annaba	890,000	195	325	49	19	122
Algeria	Skikda	747.000	164	273	41	16	98
Croatia	Kastela Bay	See Split	5.006	11.095	594	129	8.481
Croatia	Split	350.000+	1.643	3.286	411	115	1.232
Croatia	Sibenik	60.000+	201	410	89	20	240
Croatia	Zadar	85.000+	1.056	3.940	154	26	1.410
Croatia	Pula	63.979+	329	513	-	4	259
Croatia	Rijeka (Oil Refinery)	-	32	121	-	-	25
Croatia	Kastela Bay (Kaltenberg)	-	35	1,287	6	2	149
Croatia	Zadar (Adria)	-	67	121	2	1	18
Croatia	Rijeka	206.229+	1.927	4.614	201	33	1.728
Croatia	Bakar (ex Cokery)	-	-	-	-	-	-
Croatia	Dubrovnik	50.000+	160	310	79	19	139
Croatia	Zadar (Tannery)	-	23	68	5	0	15
Cyprus	Limassol	130.000	1.181	2.185	39	15	336
Egypt	El-Manzala	-	-	-	-	-	-
Egypt	Abu-Qir Bay	-	91.701	575.490	4.966	8.248	120.035
Egypt	El-Mex Bay	-	219.498	175.654	2.081	2.628	286.645
Egypt	Alexandria	4.000.000	1.632	-	1.520	2.266	8.831
France	Marseille	900.000	13.700	24.800	4.700	300	3.100
France	Gardanne	-	-	-	-	-	31.600
France	Toulon	310.000	1.300	5.000	1.500	150	1.000
France	Cannes	144.000	1.900	3.800	600	150	1.000
France	Frejus	175.000	650	1.700	400	40	400
Greece	Thermaikos Gulf		297	1.043	-	15	142
Greece	Inner Saronic Gulf	3.345.000	59.386	118.735	-	-	42.815
Greece	Patraikos Gulf	155.180	127	473	110	29	110
Greece	Pagasitikos Gulf	77.907	657	1.095	-	-	-
Greece	Heraklio Gulf	117.167	84	141	-	-	29
Greece	Elefsis Bay	-	61	446	-	-	70
Greece	NW Saronic Gulf	-	22	22	-	-	5
Greece	Larymna Bay	-	-	7.516	-	-	2.505
Greece	Nea Karvali Bay	-	295	739	625	126	-
Israel	Haifa Bay	-	28.940	183.770	11.055	1.272	6.800
Israel	Haifa Bay (industrial)	-	800	-	-	-	1.400
Israel	Naharaiya	37.500	2.900	6.200	122	86	2.250
Israel	Akko	46.000	2.000	4.400	330	53	2.200

Blank cells mean no information available.
+ signs after figures mean more pollution loads, but quantified

Country	Hot Spot	Population	BOD	COD	Total-N	Total-P	TSS
Israel	Gush Dan	1,100,000	-	-	2,900	1,200	44,000
Israel	Ashdod	-	2,630	12,150	600	7	258
Italy	Porto Marghera (VE)	309,422	9,988	39,953	3,746	2,497	19,977
Italy	Genova	678,771	15,796	63,184	5,923	3,949	31,592
Italy	Augusta-Melilli-Priolo	57,311	1,808	7,232	678	452	3,616
Italy	Brindisi	95,383	2,077	8,308	779	519	4,154
Italy	Gela	72,535	2,144	8,578	804	536	4,289
Italy	La Spezia	101,422	3,949	15,796	1,450	940	7,346
Italy	Milazzo	31,541	616	2,464	231	154	1,232
Italy	Golfo di Napoli	1,540,814	16,251	65,005	6,094	4,063	32,502
Italy	Ravenna	135,844	6,363	25,453	2,386	1,591	12,727
Italy	Taranto	232,334	2,484	9,937	932	621	4,968
Italy	Rosignano Solvay	30,021	187	747	70	47	373
Italy	Bari-Barletta (Global)	1,200,000	7,707	30,827	2,890	1,927	15,413
Italy	Livorno	167,512	2,698	10,792	1,012	674	5,396
Italy	Manfredonia	58,318	1,272	5,087	477	318	2,543
Italy	Ancona-Falc	101,285 + 30,105	2,990	11,959	1,121	747	5,979
Lebanon	Gt Beirut Area	-	29,235	-	-	-	14
Lebanon	Jounieh	200,000	4,280	-	-	-	80
Lebanon	Saida-Ghaziye	205,000	5,134	-	-	-	293
Lebanon	Tripoli	353,000	7,446	-	-	-	-
Lebanon	Batroun Selaata	51,000	1,077+	-	-	-	-
Libya	Zanzur	-	-	-	-	-	-
Libya	Tripoli	1,200,000	3,100	4,650	740	-	4,300
Libya	Benghazi	750,000	2	2,100	306	-	1,226
Libya	Zawwia	-	-	-	-	-	-
Libya	Tobruk	-	-	-	-	-	-
Malta	Weid Ghammieq	270,085	10,250	16,021	135,415	12,447	124,538
Malta	Cumnija	59,224	2,412	3,599	1,914	1,495	14,240
Malta	Ras il-Hobz	25,957	1,273	3,318	1,777	2,233	28,165
Morocco	Tangier	526,215	9,401	22,076	928	150	9,651
Morocco	Tetouan	367,349	6,861	15,304	723	114	7,143
Morocco	Nador	246,113	1,888	4,435	83	100	1,433
Morocco	Al-Hociema	112,588	519	1,073	-	-	452
Slovenia	Koper (incl. Rizana River)	46,221	485	5,111	76	8	250
Slovenia	Izola	13,770	1,092	-	90	21	414
Slovenia	Delamaris	(See Izola)					
Slovenia	Piran Submarine Outfall	17,000	125	290	23	26	116
Spain	Barcelona	4,680,000	-	-	-	-	-
Spain	Tarragona	110,000	-	-	-	-	-
Spain	Valencia	2,143,000	-	-	-	-	-
Spain	Cartagena	168,000	-	-	-	-	-
Spain	Algeciras	85,000	-	-	-	-	-
Syria	Tartous	319,152	18.5+	-	73.5+	34.3+	-
Syria	Lattakia	746,851	530	-	-	-	168
Syria	Banias	142,564	163	316	-	-	-
Syria	Jableh	166,779	542	-	-	-	225

Blank cells mean no information available.
+ signs after figures mean more pollution loads, but quantified

Country	Hot Spot	Population	BOD	COD	Total-N	Total-P	TSS
Tunisia	Gabes	150,000	1,732	-	320	724	4,860
Tunisia	Lake of Tunis	400,000	2,243	4,384	300	26	1,210
Tunisia	Lake of Bizerte	250,000	2,687	-	476	118	2,329
Tunisia	Sfax-South	395,277	843	1,900	100	40	345
Turkey	Izmir	2,017,711	44,188	73,647	11,047	4,419	66,285
Turkey	Icel City	694,867	15,218	25,363	3,804	1,522	22,830
Turkey	Antalya	505,862	11,078	18,463	2,769	1,108	16,620
Turkey	Adana	1,066,005	23,346	38,910	5,837	2,335	35,025
Turkey	Tarsus	333,302	7,299	12,165	1,825	730	10,950
Turkey	Antakya	317,725	6,958	11,597	1,740	696	10,440
Turkey	Iskenderun	276,163	10,047	222,080	115,512	76,005	9,075+
Turkey	Kirikhan	120,472	2,638	4,397	660	264	3,960
Turkey	Dortyol	116,380	2,549	4,248	637	225	3,825
Turkey	Erdemli	108,927	2,386	3,977	597	239	3,585
Turkey	Silifke	128,509	9,084	100,290	57,604	38,481	4,215
Turkey	Osmaniye	139,116	3,047	5,078	761	305	4,575

Blank cells mean no information available.
+ signs after figures mean more pollution loads, but quantified

Table 3.2.10

Pollutants Discharges

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
Albania	Durres	-	-	-	-	-	-	-	-	-
Albania	Vlore	-	-	-	-	-	-	-	Lindane (1.7 micro g/kg) DDT (5.4 micro g/kg)	-
Albania	Durres (ex Chem Factory)	-	-	-	-	-	-	-	-	-
Albania	Vlore (PVC factory)	-	-	-	-	-	-	-	-	-
Algeria	Oran Ville	-	-	-	-	-	-	-	-	-
Algeria	Rouiba	-	-	-	-	-	-	-	-	-
Algeria	Ghazaouet	-	-	-	-	-	-	-	-	-
Algeria	Alger	-	-	-	-	-	-	-	-	-
Algeria	Mostaganem	-	-	-	-	-	-	-	-	-
Algeria	Bejaia	-	-	-	-	-	-	-	-	-
Algeria	Annaba	-	-	-	-	-	-	-	-	-
Algeria	Skikda	-	-	-	-	-	-	-	-	-
Croatia	Kastela Bay	-	23.3	555.1	-	-	3,499	-	-	-
Croatia	Split (See Kastela Bay)	-	-	-	-	-	-	-	-	-
Croatia	Sibenik	-	75	315	-	-	179	-	-	-
Croatia	Zadar	-	23	358	-	-	726	-	-	-
Croatia	Pula	-	0.4	11	-	-	279	-	-	Oil (8.4 t/yr)
Croatia	Rijeka (Oil refinery)	-	-	-	-	-	-	-	-	Oil (8.09 t/yr) Phenols (172 kg/yr)
Croatia	Kastela Bay (Kaltenberg)	-	-	-	-	-	-	-	-	
Croatia	Zadar (Adria)	-	-	-	-	-	-	-	-	-
Croatia	Rijeka	-	146	150	-	-	1,420	-	-	

Blank cells mean no information available

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
Croatia	Bakar (ex Cokery)	-	-	-	-	-	-	-	-	Phenols 100 Kg Cyanides 600 Kg
Croatia	Dubrovnik	-	5.5	1,916	-	-	151	-	-	-
Croatia	Zadar (Tannery)	10.1	-	3.2	3,932	-	-	-	-	Oil (0.113 t/yr)
Cyprus	Limassol	-	-	-	-	-	-	-	-	-
Cyprus	Larnaca	-	-	-	-	-	-	-	-	-
Cyprus	Larnaca	5 (micro g/L)	-	0.4 (micro g/L)	-	80 (micro g/L)	75 (micro g/L)	-	-	Oil (0.018 t/yr)
Egypt	El-Manzala	-	-	-	-	-		-	-	-
Egypt	Abu-Qir Bay	-	31+	193+	362+	2,669+	3,394+	859	-	Oil (1,906 t/yr)
Egypt	El-Mex Bay	1,278	1,562	-	530	25,430	46,524	-	-	Oil (1,319 t/yr)
Egypt	Alexandria	-	-	-	-	-	-	-	-	-
France	Marseille	-	-	-	-	-	-	-	-	-
France	Gardanne	-	-	-	-	-	-	-	-	-
France	Toulon	-	-	-	-	-	-	-	-	-
France	Cannes	-	-	-	-	-	-	-	-	-
France	Frejus									
Greece	Thermaikos Gulf	-	-	-	-	-	-	-	-	Oil (38 t/yr)
Greece	Inner Saronic Gulf	-	-	-	-	-	-	-	-	-
Greece	Patraikos Gulf	-	-	-	-	-	-	-	-	Oil (18.2 t/yr)
Greece	Pagasitikos Gulf	-	-	-	-	-	-	-	-	-
Greece	Heraklio Gulf	-	-	-	-	-	-	-	-	-
Greece	Elefsis Bay	-	-	-	-	-	-	-	-	Oil (17 t/yr)
Greece	NW Saronic Gulf	-	-	-	-	-	-	-	-	Oil (5.4 t/yr)
Greece	Larymna Bay	-	-	-	-	-	313,170	-	-	Oil (940 t/yr)
Greece	Nea Karvali Bay	-	-	-	-	-	2,586	-	-	-
Israel	Haifa Bay	-	2,600	-	-	3,250	58,500	-	-	Oil (50,000 t/yr)
Israel	Naharaiya	-	-	-	-	-	-	-	-	-
Israel	Akko	-	-	-	-	-	-	-	-	-
Israel	Gush Dan	60	430	1,670	11,400	19,000	54,000	2,500	-	-
Israel	Ashdod	-	-	-	-	-	-	-	Herbicide (140 t/yr) Phenols (16 t/yr)	Oil (11 t/yr)
Israel	Haifa Bay (Industrial)	68	-	-	-	-	-	-	-	-

Blank cells mean no information available

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
Italy	Porto Marghera	-	-	-	-	-	-	-	-	13,860
Italy	Genova	-	-	-	-	-	-	-	-	34,830
Italy	Augusta-Melilli	-	-	-	-	-	-	-	-	26,833
Italy	Brindisi	-	-	-	-	-	-	-	-	2,697
Italy	Gela	-	-	-	-	-	-	-	-	-
Italy	La Spezia	-	-	-	-	-	-	-	-	-
Italy	Milazzo	-	-	-	-	-	-	-	-	10,000
Italy	Golfo di Napoli									6,777
Italy	Ravenna	-	-	-	-	-	-	-	-	6,700
Italy	Taranto	-	-	-	-	-	-	-	8,000	-
Italy	Rosignano Solvay	-	-	-	-	-	-	-	-	-
Italy	Bari-Barletta	-	-	-	-	-	-	-	-	-
Italy	Livorno	-	-	-	-	-	-	-	-	10,000
Italy	Manfredonia	-	-	-	-	-	-	-	-	-
Italy	Ancona-Falc	-	-	-	-	-	-	-	-	5,800
Lebanon	Gt Beirut Area	-	-	-	-	-	-	-	-	-
Lebanon	Jounieh	-	-	-	-	-	-	-	-	-
Lebanon	Saida-Ghaziye	-	-	-	-	-	-	-	-	-
Lebanon	Tripoli	-	-	-	-	-	-	-	-	-
Lebanon	Batroun Selaata	-	-	-	-	-	-	-	-	-
Libya	Zanzur	-	-	-	-	-	-	-	-	-
Libya	Tripoli	-	-	0.088 (ppm)	0.038 (ppm)	-	-	-	-	-
Libya	Benghazi	-	-	-	-	-	-	-	-	-
Libya	Zawwia	-	-	-	-	-	-	-	-	-
Libya	Tobruk	-	-	-	-	-	-	-	-	-
Malta	Weid Ghammieq	-	-	-	-	-	-	-	-	-
Malta	Cumnija	-	-	-	-	-	-	-	-	-
Malta	Ras il-Hobz	-	-	-	-	-	-	-	-	-
Morocco	Tangier	-	-	-	-	-	-	-	-	-
Morocco	Tetouan	0.38	14.66	307.59	75.75	572.23	1,379	-	-	-
Morocco	Nador	-	-	-	-	-	-	-	-	-
Morocco	Al-Hociema	-	-	-	-	-	-	-	-	-

Blank cells mean no information available

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
Slovenia	Koper (Incl. Rizana River)	-	752	5,727	2,778	1,767	48,806	2,807	-	-
Slovenia	Izola (with Delamaris)	-	9.3	90.5	28.9	43.4	483.3	18.3	-	-
Slovenia	Delamaris (see Izola)	-	-	-	-	-	-	-	-	-
Slovenia	Piran	-	4.26	60.96	8.43	27.26	703	9.8	-	-
Spain	Barcelona	-	-	-	-	-	-	-	-	-
Spain	Tarragona	-	-	-	-	-	-	-	-	-
Spain	Valencia	-	-	-	-	-	-	-	-	-
Spain	Cartagena	-	-	-	-	-	-	-	-	-
Spain	Algeciras	-	-	-	-	-	-	-	-	-
Syria	Tartous	-	54	2,703	1,784	5,406	5,163	2,649	-	-
Syria	Lattakia	-	85.4	4,271	2,135	4,271	7,687	2,562	-	-
Syria	Banias	-	-	-	-	-	-	-	-	Oil (438 t/yr)
Syria	Jableh	-	-	-	-	-	-	-	-	-
Tunisia	Gabes	-	13.6	80+ (ppm)	36.2	-	91.6+	-	-	-
Tunisia	Lake of Tunis	-	0.15	0.6	70	23.4	11.3	4.4	-	-
Tunisia	Lake of Bizerte	-	-	100 (ppm)	120 (ppm)	70 (ppm)	300 (ppm)	-	-	-
Tunisia	Sfax-South	-	-	-	-	3,456	17,000	-	-	-
Turkey	Izmir	-	-	-	-	-	-	-	-	-
Turkey	Icel City	-	-	-	-	-	-	-	-	-
Turkey	Antalya	-	-	-	-	-	-	-	-	-
Turkey	Hatay	-	-	-	-	-	-	-	-	-
Turkey	Adana	-	-	-	-	-	-	-	-	-
Turkey	Tarsus	-	-	-	-	-	-	-	-	-
Turkey	Antalya	-	-	-	-	-	-	-	-	-
Turkey	Iskenderun	15.4	19.21	-	-	-	-	-	-	-
Turkey	Kirikhan	-	-	-	-	-	-	-	-	-
Turkey	Dortyol	-	-	-	-	-	-	-	-	-
Turkey	Erdemli	-	-	-	-	-	-	-	-	-
Turkey	Silifke	-	-	-	-	-	-	-	-	-
Turkey	Osmaniye	-	-	-	-	-	-	-	-	-

Blank cells mean no information available

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[1]. 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 draft report on Priority Pollution Hot Spots (UNEP(OCA)/MED WG.130/4) which was presented to the meeting of Government-designated Experts to examine a Strategic Action Programme to address Pollution from Land-based Activities, which was held in Ischia, Italy, from 15-18 June 1997. Following the comments and corrections made during the meeting, the present chapter was formulated.

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 55 sensitive areas in 15 countries, as shown in the Table 3.3.1.

Table 3.3.1

Sensitive areas in the Mediterranean countries

Country	*Albania*	*Algeria*	*Croatia*	*Cyprus*	*Egypt*	*France*	*Greece*	*Italy*	*Lebanon*	*Malta*	*Slovenia*	*Spain*	*Syria*	*Tunisia*	*Turkey*	*Total*
No. of Sas	3	6	5	1	1	3	2	7	2	3	2	8	5	1	6	**55**

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).

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[1] In fact, only one country referred to the establishment of an inter-ministry working group

Table 3.3.2

Sensitive areas in the Mediterranean countries

Country	Sensitive Area	Estimated Costs of Protective Action
Albania	Kuna-Vain Lagoons	26
	Karavasta Lagoon	1-2
	Narta Lagoon	3-5
Algeria	Golfe de Ghazaouet	-
	Golfe de Arzew-Mostaganem	-
	Baie d'Alger	-
	Baie d'Annaba	-
	Golfe de Skikda	-
	Baie de Bejaia	-
Croatia	Malostonski	1.2
	Limski Channel	0.7
	Kornati	0.9
	Mljet	0.2
	Krka est.	1.5
Cyprus	Vassilikos Bay	
Egypt	Lake Bardawil	-
France	Collioure- Cap Leucate	-
	Cap Leucate-L'Espiguette	-
	Rhone Mouth	-
Greece	Amvrakikos Gulf	11
	Lagoon of Mesologgi	
Italy	Vado Ligure-Savona	-
	Secche della Meloria	-
	Isola d'Elba	-
	Pesaro-Cervia	-
	Mouth of Po	-
	Venezia and its lagoon	-
	Panzana Bay	-
Lebanon	Sour	19
	Jbail (Byblos)	7.5
Malta	Weid Ghammieq	3.6
	Cumnija	8
	Ras il-Hobz	4

Country	Sensitive Area	Estimated Costs of Protective Action
Slovenia	Koper Bay	(included in Rizana River)
	Piran Bay	(see Piran)
Spain	Albufera de Valencia	-
	Delta del Llobregat	-
	Delta del Ebro	-
	Mar Menor	-
	Alcudia	-
	Cabo de Gata	-
	Aigumolls de l'Alt Emporda	-
	Lagunas de la Mata y Torrevieja	-
Syria	Umit Tiur	-
	Azwad island	-
	Wadi Qandeel	-
	Lattakia beach (southeast)	-
	Rasl Fassouri	-
Tunisia	Ghar El Melh	4
Turkey	Köycegiz Dalyan	-
	Göksy Deltast	-
	Fethiye-Gocek	-
	Mersin-kazanh	-
	Hatay-Samandag	-
	Carus Island - South Aegean	-

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 LIVING MARINE RESOURCES

3.5.1 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; root causes (proximate and ultimate) and possible solutions and potential transboundary effects (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);
- problems categorized by key resource type (Table 3.5.1.2);
- key fishery "hot spots" (Table 3.5.1.3); and
- Mediterranean landings by key resources and their indicative values (1992) (Table 3.5.1.4).

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 organizations. 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 million 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 recognizing 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 fertilizers. In the Black Sea, a previous GEF-sponsored Trans-Boundary Analysis summarized 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 localized 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,[1] making the fishery sector a major contributor to the whole Mediterranean economy (Table 3.5.1.4) 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 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. [2] 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.

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[1] 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.

[2] This was done using a hypothetical yield curve which do not represent a fitting to the fishery, but is purely for indicative purposes.

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

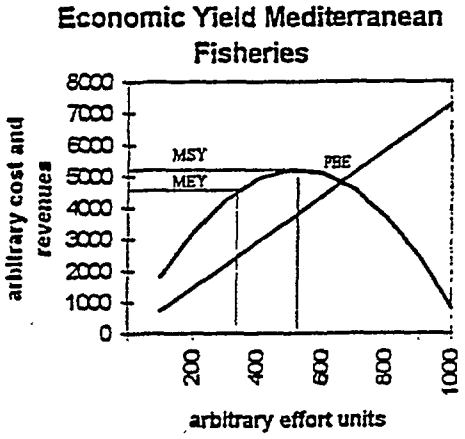

Figure 3.5.1.1

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. 3.5.1.2) 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

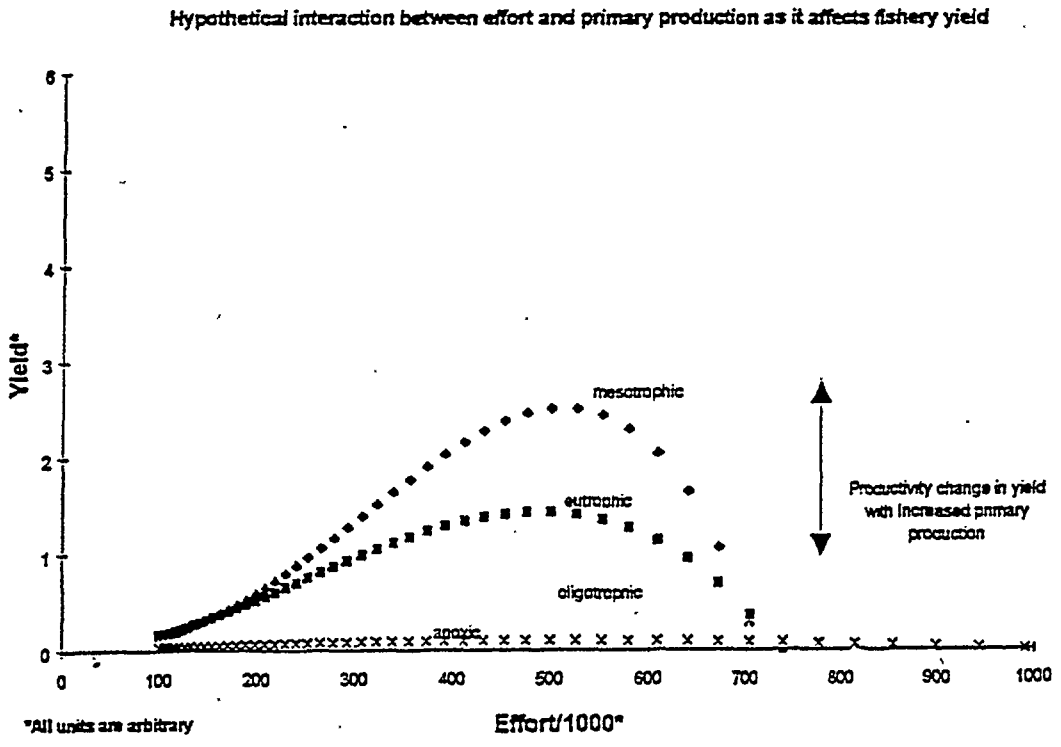

Figure 3.5.1.2

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
A. Lack of appropriate institutional and legal frameworks at national levels needed to encourage sound responsible fisheries management within territorial waters	1. Poor planning capacity for responsible management of fisheries 2. Poor communication between policy makers, fishers and fishery scientists 3. Inadequate formulation of regulations and in particular, poorly defined rights and responsibilities of those with local access to resources within national legislation 4. Inadequate fishery regulation enforcements in territorial waters
B. Weak and uncoordinated national approaches at the international level in fisheries research, to support decision making processes in fisheries management	5. Inadequate provisions for fisheries monitoring and statistical data gathering 6. Lack of multidisciplinary approaches to fishery management issues 7. Lack of coordination between fishery researchers and regulatory agencies
C. Inadequate formulation and application of international initiatives concerning transboundary fish resources management and conservation and consequent overexploitation	8. Weak subregional cooperation and insufficient role of the competent fisheries regional organizations 8.1 Inadequate coordination and harmonization of national measures for fisheries in international waters and on shared, straddling and highly migratory stocks 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 8.3 Inadequate fisheries regulation enforcement, weak and uncoordinated fishery control and surveillance in international and national waters, including in port control 9. Overexploitation of resources and overcapitalization of fleets
D. Lack of understanding of long-term effects of nutrient enrichment and pollutants from dumping and from incoming on fisheries in the Mediterranean	10.1 Absence of research work on the impacts of nutrient enrichment and pollutants on fisheries 10.2 Inadequate quantification of nutrient and pollutant input rates and quantities into Mediterranean catchment basins 10.3 Poor communication between research groups working on fisheries and on pollution issues in the Mediterranean
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	11.1 Insufficient research on incidental impacts of trawling and other non selective gears on marine ecosystems 11.2 Lack of monitoring systems to detect introduced species 11.3 Inadequate regulations and enforcement regarding trawling and dredging on critical habitats, nursery/spawning and inshore/estuarine and vegetated areas

Table 3.5.1.2

Living marine resources (fishery) – problems categorized by key resource type

RESOURCE CATEGORY	STATE OF STOCKS	ECOLOGICAL/ENVIRONMENTAL CONTROLS	FISHERIES MANAGEMENT MEASURES	OPERATIONAL TARGETS
Estuarine, anadromous and catadromous resources	Eel populations declining in The Mediterranean. Other estuarine species affected *Landings: 31,263 MT* *Value: US$ 95,666,000*	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
Benthic Shelf Resources	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 *Landings: 234,018 MT* *Value: US$ 1,220,276,000*	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
Demersal Shelf Resources	Key stocks fully to Overfished *Landings: 198,136 MT* *Value: 1,032,485,000 $*	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

RESOURCE CATEGORY	STATE OF STOCKS	ECOLOGICAL/ENVIRONMENTAL CONTROLS	FISHERIES MANAGEMENT MEASURES	OPERATIONAL TARGETS
Pelagic Resources	Some potential for Expansion, except anchovy *Landings 493,604 MT* *Value: US$ 549,824,000*	Monitor changes to ecological condition of pelagic environment due to nutrient enrichment, and invasions by jelly predators	Encourage conversion of fishing effort from demersals, anchovy and large pelagic fish to sardines and other small pelagics	Promote consumer acceptance of sardines and other low value species present in abundance
Slope Resources	Red coral resources/lobsters Overfished or seriously overfished. Offshore Spawning concentrations of Hake need protecting from recruitment overfishing *Landings: 85,256 MT* *Value: US$ 646,273,000*	Monitor health of slope ecosystems	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	A management system for slope resources is called for, at least initially on a species by species basis. Effective monitoring, and control is essential
Migratory Resources	Bluefin tuna stocks Depleted, and swordfish in some areas are overfished, and dominated by very young fish *Landings: 56,468 MT* *Value: US$ 248,604,000*	General monitoring of Mediterranean environment needed	Fishing with long drifting gear should be controlled, and prohibited in the vicinity of straits where migration routes pass	Apply provisions of UN agreement on highly migratory species, and ICCAT and GFCM resolutions on minimum sizes and effort control

Table 3.5.1.3

Living marine resources (fishery) – key fishery "hot spots"

DIVISIONS	ECOLOGICAL/ENVIRONMENTAL CONTROLS	FISHERIES MANAGEMENT MEASURES	OPERATIONAL TARGETS
1. *Alboran Sea*	None	Need for fisheries agreement on research and management of shared pelagic resources between coastal States	Seek basis for agreement through GFCM
2. *Gulf of Lions*	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. *Adriatic*	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. *Sicily Channel and Gulf of Gabes*	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. *Aegean*	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. *Levant*	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 3.5.1.4

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
TOTAL	**1098745**	**709036**	**389709**	**3211535**	**581592**	**3793128**

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

TOTAL CATCH = 1.09 million metric tons
TOTAL VALUE = US$ 3.793 billion

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

3.5.2 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 (Table 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	
Year	92	96	92	96	92	96	92	96	92	96	92	96	92	96	92	9
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		
TOTAL FISH	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								
TOTAL MOLLUSKS	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		
CRUSTACEA			2.20	2.20	0.05	0.05	0.05	0.05								
ALGAE					5.00	5.00										
COUNTRY TOTAL	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); IFREMER (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	EGYPT		ISRAEL		MALTA		MOROCCO		TUNISIA		TURKEY		OTHERS*	
Year	92	96	92	96	92	96	92	96	92	96	92	96	92	96
Species														
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	0.04	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	0.07	0.10						
Turbot						0.01								
Other fishes	0.50	1.00							0.13	0.20				
TOTAL FISH	39.16	74.85	14.23	14.55	0.30	1.75	0.51	1.67	0.39	0.80	9.88	16.1	2.92	3.37
Mussel									0.14	0.04				
Oyster							0.12	0.15						
Clam										0.03				
TOTAL MOLLUSKS										0.07				
CRUSTACEA								0.01				0.04		
ALGAE														
COUNTRY TOTAL	39.16	74.85	14.23	14.55	0.30	1.75	0.71	1.83	0.53	0.87	9.88	16.14	2.92	3.37

Sources: GAFRD (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
TOTAL FISH	**271 070**	**978.00**
Mussel	284 040	199.00
Oyster	157 050	550.00
Clam	64 130	151.00
TOTAL MOLLUSKS	**505 220**	**900.00**
CRUSTACEA	2 350	70.50
ALGAE	5 000	2.00
AQUACULTURE TOTAL	**783 640 tons**	**1 950.50 million USD**

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).

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* 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	• Sewage (-) • Organic matter (-) • Bacteria and viruses (-) • Nutrients (+/-)
Industry and harbor	• Organic matter (-) • Pollutants (-) • Ballast waters (-) • Heated waters (+/-)
Tourism and recreation	• Sewage (-) • Anti-fouling paints (-) • Specific organic-detergents (-)
Agriculture	• Pesticides (-) • Suspended solids • Fertilizers (+/-) • Organic matter (+/-) • Freshwater input (-)

(-) 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 kg/ $ha^{-1}yr^{-1}$) 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 information is 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 problem s 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, Montpelier-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
Total		3.64		

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 anthropogenic 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.

Possible interventions

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 interventions 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 lows 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 interventions 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 confectionery 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 bellow 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 interventions

- 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 interventions:

- 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.

<u>Proposed intervention at regional level</u>

* 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 stabilization, 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 3.6.2

Threatened species in the Mediterranean - Ecology, Distribution, Status, Threats and Current Protection

Species	Ecology/Distribution	Status/Threats	Protection
Magnoliophyta			
Posidonia oceanica	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 *P. oceanica* meadows is irreversible.	Protected by law in several Mediterranean countries. Listed in Appendix I to the Bern Convention (limited to the Mediterranean) (*).
Zostera marina	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) (*)
Zostera noltii	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 (*)
Chlorophyta			
Caulerpa ollivieri	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) (*)
Phaeophyta			
Cystoseira amentacea	Infralittoral Endemic to the Mediterranean. Species with three varieties: *amentacea* (eastern Mediterranean), *spicata* (Adriatic) and *stricta* (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) (*)
Cystoseira mediterranea	Infralittoral Endemic to the Mediterranean. Species replacing *C. amentacea* (phenomenon of vicariousness) in certain regions of the western Mediterranean.	Status and threats are the same as for *C. amentacea*; however *C. mediterranea* is rarer and more localized than *C. amentacea*.	Listed in Appendix I to the Bern Convention (limited to the Mediterranean) (*)

Species	Ecology/Distribution	Status/Threats	Protection
Cystoseira sedoides	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 *C. sedoides* a threatened species. Probably sensitive to pollution and overgrazing.	Listed in Appendix I to the Bern Convention (limited to the Mediterranean) (*)
Cystoseira spinosa	Endemic to the Mediterranean, with a subspecies in the Adriatic, *C. spinosa adriatica*.	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 *C. spinosa* 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) (*)
Cystoseira zosteroides	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) (*)
Laminaria rodriguezii	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 eutrophization and/or increased turbidity.	Listed in Appendix I to the Bern Convention (limited to the Mediterranean) (*)
Rhodophyta *Goniolithon byssoides*	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) (*)
Lithophyllum lichenoides	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) (*)
Ptilophora mediterranea	Endemic to a limited area of the Mediterranean (between mainland Greece and Crete).	The threat is mainly from reduction of water transparency, either from eutrophization and/or turbidity.	Listed in Appendix I to the Bern Convention (limited to the Mediterranean) (*)

Species	Ecology/Distribution	Status/Threats	Protection
Schimmelmannia schousboei	Algae of a rare beauty. Species with highly localized sites (Southern Italy, and Libya).	The very rare sites of *Schimmelmannia schousboei* are susceptible of destruction by coastal development.	Listed in Appendix I to the Bern Convention (limited to the Mediterranean) (*)
Porifera *Asbestopluma hypogea*	Small *Cladorhizidae* 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) (*)
Aplysina cavernicola	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) (*)
Axinella cannabina	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 *Axinella* species, the growth is very slow making the species unsustainable on bottoms where trawling is regular.	(*)
Axinella polypoides	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) (*)
Geodia cydonium	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.	(*)
Ircinia foetida	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.		(*)
Ircinia pipetta	Encrusting species living is semi-dark caves. Endemic to the Mediterranean.	Rare species.	(*)

Species	Ecology/Distribution	Status/Threats	Protection
Petrobiona massiliana	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) (*)
Tethya sp. plur.	Small round species, mainly living in sciaphilous infralittoral biotopes.	Rare species.	(*)
Cnidaria			
Astroides calycularis	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 aesthetic 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) (*)
Errina aspera	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) (*)
Gerardia savaglia	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) (*)
Echinodermata			
Asterina pancerii	Small starfish dependent on deep *Posidonia oceanica* 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 *Posidonia oceanica* meadows	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
Centrostephanus Longispinus	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) (*)

Species	Ecology/Distribution	Status/Threats	Protection
Ophidiaster ophidianus	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) (*)
Bryozoa *Hornera lichenoides*	Colony-forming species on muddy coastal sites. Found in Northern Atlantic and in North-Western Mediterranean.	Colonies are susceptible to be damaged by trawling.	(*)
Mollusca *Charonia lampas lampas*	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) (*)
Charonia tritonis variegata	Gasteropoda 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, *Ch. tritonis tritonis* is included in the IUCN invertebrate red data book Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
Dendropoma petraeum	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 Gasteropoda 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.	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.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)

Species	Ecology/Distribution	Status/Threats	Protection
Erosaria spurca	In the Mediterranean its number has been strongly diminished during the last decade	The species of this family are among the most appreciated by shell collectors all over the world. Collection is the main origin of threat.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
Gibbula nivosa	Endemic species of Malta. Lives in shallow water (0-10 m), in bottoms with algae or marine phanerogames (*Cymodocea nodosa* and *Posidonia oceanica*). It presents nocturnal habits.	Due its very restricted geographical range, *G. nivosa* 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.	This species is protected by law in Malta. Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
Lithophaga lithophaga	Rock-boring bivalve drilling tunnels in calcareus 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.	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.	Protected by law in Italy and France. Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
Luria lurida	This species ranges throughout Mediterranean and west African coast. It lives mainly in shallow water (0-20 m), and more rarely deeper.	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.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
Mitra zonata	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.	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.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)

Species	Ecology/Distribution	Status/Threats	Protection
Patella ferruginea	At the present times *P. ferruginea* 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.	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.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
Patella nigra	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).	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 *P. ferruginea*, which would make it illusory to protect only one of the two species. Populations of both species overlap in the Mediterranean.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
Pholas dactylus	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.	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.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
Pinna nobilis	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.	Its populations have been continuously decimated during the last decades along with the decline of *Posidonia oceanica* 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. *Pinna nobilis* have disappeared in wide areas, but is still common in a few unaltered zones.	Fan shell is protected by law in Croatia and France. Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)

Species	Ecology/Distribution	Status/Threats	Protection
Pinna rudis	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.	Rare and vulnerable in the Mediterranean. *Pinna rudis* is very appreciate by shell collectors.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (as *Pinna pernula*) (*)
Ranella olearia	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) (*)
Schilderia achatidea	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) (*)
Tonna galea	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 appreciate for decorative purposes. Therefore, decoration and trawling are the main threats	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
Zonaria pyrum	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) (*)
Crustacea *Ocypode cursor*	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) (*)
Pachylasma giganteum	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) (*)

Species	Ecology/Distribution	Status/Threats	Protection
Pisces			
Acipenser naccarii	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	(*)
Acipenser sturio	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) (*)
Aphanius fasciatus	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) (*)
Aphanius iberus	Endemic to the Mediterranean: south and southwest of Spain and west of Algeria. Lives in fresh and brackish waters and feed on small invertebrates.	The threat comes from its rarity, its extremely restricted geographical area and and the reduction of its habitat.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
Carcharodon carcharias	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: *vulnerablela lbcd+2cd*	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
Cetorhinus maximus	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: *vulnerablela lad+ 2d*	(*)

Species	Ecology/Distribution	Status/Threats	Protection
Hippocampus hippocampus	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 *H. ramulosus* makes it necessary to associate them in the protection.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
Hippocampus ramulosus	Lives at the infracoastal level, in rock alga populations and especially in *Posidonia oceanica* 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) (*)
Huso huso	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) (*)
Lethenteron zanandreai	Fresh water lamprey species endemic to Po basin	Rare and vulnerable.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)
Mobula mobular	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	(*)
Pomatoschistus canestrini	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) (*)
Pomatoschistus tortonesei	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) (*)
Valencia hispanica	Lives in fresh and brackish waters. Endemic to eastern part of Spain and French Catalonia.	Rare species with very restricted range.	(*)

Species	Ecology/Distribution	Status/Threats	Protection
REPTILES			
Caretta caretta	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. (*)
Chelonia mydas	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. (*)
Dermochelys coriacea	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 *C. mydas*. (*)
Eretmochelys imbricata	Occurring only occasionally in the Mediterranean.	Catches in fishing gears are reported	Protected in a few Mediterranean countries. Concerning international treaties, same as *C. mydas*. (*)
Lepidochelys kempii	Its occurrence in the Mediterranean is exceptional.	Catches in fishing gears are reported	Protected in a few Mediterranean countries. Concerning international treaties, same as *C. mydas*. (*)
Trionyx triunguis	Lives in Nile basin and coastal hydrographic networks of the eastern Mediterranean (from Israel to Turkey). *Trionyx triunguis* 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.	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 y fishermen, (v) collisions with boats.	Listed in Appendix II to the Bern Convention (limited to the Mediterranean) (*)

Species	Ecology/Distribution	Status/Threats	Protection
Mammalia *Balaenoptera acutorostrata*	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.	There have been some cases of accidental capture in driftnets in the Mediterranean IUCN status: *Lower risk: near threatened.*	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. (*)
Balaenoptera borealis	Extremely rare in the Mediterranean, where this species is vagrant from the North Atlantic	No viable population of this species exists in the Mediterranean. IUCN status: *Endangered/A1abd.*	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. (*)
Balaenoptera physalus	The second largest cetacean, reaching 27 m (southern hemisphere) and 75 t. In the Mediterranean, reliable length measurements are considerably smaller (< 22 m) Abundant in the western and central (Ionian Sea) Mediterranean, rare in the eastern region.	Recent genetic evidence supports the hypothesis that fin whales in the Mediterranean are a resident population, reproductively isolated from the Atlantic. IUCN status *Endangered/A1abd.*	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. (*)
Delphinus delphis	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.	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.	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. (*)
Eubalaena glacialis	The species is exceptional in the Mediterranean, certainly reflecting its status of near extinction in the eastern North Atlantic.	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: *Endangered/C1, D1.*	The species is listed in Appendix II of the Bern Convention, in Appendix I of the Bonn Convention, in Appendices I and II of the Washington Convention and in Annex IV of the EU Habitats Directive. (*)

Species	Ecology/Distribution	Status/Threats	Protection
Globicephala melas	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. (*)
Grampus griseus	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: *Data deficient.*	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. (*)
Kogia simus	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. (*)
Megaptera novaeangliae	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: *vulnerable/A1ad.*	The species is listed in Appendix II of the Bern Convention, in Appendix I of the Bonn Convention, in Appendices I and II of the Washington Convention and in Annex IV of the EU Habitats Directive. (*)
Mesoplodon densirostris	Only one certain occurrence of the species in the Mediterranean	No viable population of Blainville's beaked whales in the Mediterranean. IUCN status is: *Data deficient.*	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. (*)

Species	Ecology/Distribution	Status/Threats	Protection
Monachus monachus	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: *Critically endangered/C2a.*	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. (*)
Orcinus orca	Uncommon in the Mediterranean, where it is considered an occasional visitor from the North Atlantic	No viable population of killer whales in the Mediterranean. The species is known to have been accidentally captured in fishing gear IUCN status is: *Lower risk: conservation dependant.*	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. (*)
Phocoena phocoena	Despite its regular occurrence in the Black Sea (*P. p. relicta*) and in the eastern North Atlantic (*P. p. phocoena*), this species is virtually absent from the Mediterranean.	The presence of the harbour porpoise in the Mediterranean is highly questionable IUCN status is: *Vulnerable/A1cd.*	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. (*)
Physeter macrocephalus	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	Considered common in the Mediterranean in the older literature, sperm whales are currently infrequent	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. (*)
Pseudorca crassidens	Quite rare in the Mediterranean, as a vagrant from the North Atlantic	No viable population in the Mediterranean.	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. (*)

Species	Ecology/Distribution	Status/Threats	Protection
Stenella coeruleoalba	Today the commonest pelagic cetacean in the Mediterranean, the striped dolphin is found throughout the region in deep waters.	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: *Lower risk: conservation dependant.*	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. (*)
Steno bredanensis	Rare in the Mediterranean Sea, where it is considered a vagrant from the North Atlantic.	No viable population in the Mediterranean IUCN status is: *Data deficient.*	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. (*)
Tursiops truncatus	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: *Data deficient.*	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. (*)
Ziphius cavirostris	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: *Data deficient.*	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. (*)

(*) 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 the column concerning protection.

Table 3.6.3

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

Country	Coastal Biodiversity Hot Spots	Marine Bioversity 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-Toxeftra) – Larnaca - 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 Brusc - 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 – Zakinthos - Portolagos – Kephalonia	Sporades - Zakinthos – Kephalonia
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

Country	Coastal Biodiversity Hot Spots	Marine Bioversity Hot Spots
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 Torrevieja - 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 – Ichkeul - 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 Straight (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) * *Karaburuni-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 Cetacean	Caprera - Castellabate - Ciclopi - Egadi - Maremma - Miramare - Montecristo - Archipelago Toscano Tremiti - Ustica - Orosei - Maddalena Marsala - Stagnone - Taormina - Messina Straight - Sinis - Pontines Archipelago

Country/Number of endangered species	Main Critical Habitats	Specific sites quoted * if not protected
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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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 behaviour, increased risk of forest fires due to uncontrolled tourism activities, aggressive behaviour 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 behaviour, 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 behaviour 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 favours 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 s 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 IMMI...) (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:

Intervention 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 interventions:

Intervention 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.

Intervention 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 interventions :

Intervention 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.

Intervention 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 ..)

Intervention 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...)

Intervention B-4.: Preparing in selected areas case studies on C/B when applying ICZM (one coastal, one insular area)

Intervention 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.

Interventions proposed:

Intervention 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)

Intervention C-2.: Preparing Regional Guidelines for addressing TB related issues within ICZM

Intervention 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 interventions:

Intervention 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...

Intervention 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...

Intervention 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...
Interventions proposed:

Intervention 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

Intervention 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

Intervention 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 id 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.

Interventions proposed:

Intervention 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 possible solutions related to Integrated Coastal Zone Management and Planning when dealing with transboundary problems, see Table 2.7.1. The justification for proposed interventions has been presented in sections 3.7.1 & 3.7.2 of this Chapter. The interrelations between identified major issues, their causes and interventions proposed are presented in the following Tables:

Table 3.7.1: presenting issues, transboundary elements, causes and intervention areas
Table 3.7.2: presenting causes of issues listed in Table 3.7.1
Table 3.7.3: presenting areas for interventions and interventions proposed.

Table 3.7.1

ICZM related transboundary (TB) issues, relevant causes and interventions proposed*

Issues	TB elements	Causes	Areas for intervention
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 senso.*

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 6	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 intervention and interventions proposed

Areas for intervention	Interventions 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	B1: Developing regional strategy for ICZM, to be included later in the regional strategy for sustainable development B2: Developing and implementing regional/subregional ICZM projects including transboundary issues (N. Adriatic, NW Med, NE Med, Gulf of Gabes) B3: Preparing case studies on cost/benefit when implementing ICZM in selected areas (one coastal, one insular area) B4: Preparing case studies on Integrated River Basin and ICZM for affected coastal areas including transboundary issues (Po, Rhone/Ebro, or Evros)
3. Upgrading/strengthening the TB related segment of ICZM	C1: Implementing sub regional pilot projects addressing transboundary issues only, applying ICZM C2: Preparing Regional Guidelines for ICZM of transboundary related issues
4. Upgrading/strengthening the islands related ICZM segment, Integrated Management of Mediterranean Islands (IMMI)	D1: Implementing pilot projects in selected groups of islands, applying IMMI (one archipelago, for example Dodecanese, or Dalmatian Islands – Croatia D2: Preparing Regional Guidelines for IMMI
5. Upgrading/strengthening the implementation of the coastal urban related ICZM segment	E1: Implementing case studies for selected coastal insular urban agglomerations 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)
6. Upgrading the human and institutional capacity for the implementation of ICZM transboundary related projects in countries needing assistance	F1: Organizing 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 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. implicite 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 arose 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 senso* 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 continuos 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 senso*** **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, MCSD 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:

Intervention 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 interventions:

Intervention 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 .

Intervention 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.

Intervention A-3: Designate MCSD as the regional Coordinating Body for transboundary related initiatives in the region and secure logistical support of MAP structures

Intervention A-4: Reformulate MAP Programme and institutional arrangement if needed and as appropriate in order to satisfy the adopted legal and institutional arrangement.

Intervention 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 interventions:

Intervention 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.

Intervention 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 Intervention A and B. Provide assistance to countries needing it, if asked.

Intervention B-3: Invite countries to adapt and or harmonize national legal arrangements according to regional transboundary relevant legal documents

Intervention 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.

Intervention Area C: Implement practical interventions 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 interventions:

Intervention 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.

Intervention 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.

Intervention 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 and relevant causes
Table 3.8.2: Causes of issues presented in 3.8.1.
Table 3.8.3: Areas for interventions and interventions proposed.

Table 3.8.1

Transboundary related institutional and legal arrangements issues: relevant causes and interventions proposed

No.	Issues	TB elements	Causes	Areas of intervention*
1	Absence of appropriate Nat. CZ TB related legal, institutional arrangem.	TBE_S 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_S and stakeholders	TBE_S 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_S 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_S 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_S 1, 2, 3 Type A	2, 3, 4	2-a, b, c, d)

* indexes in "areas for intervention" 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	Overesmploitation 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 istitutional TR arrangements for CZs
3	National / regional ind 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 comunity 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 interventions and interventions proposed

Areas for intervention*	Interventions proposed*
1. Define and streghten the regional institutional arrangements for transboundary related issues	a) Confirm MAP as Regional Lead Agency for transboundary related issues b) Reach Interagency agreement on role and involvement in transboundary related initiatives in the region c) Designate MCSD as the Regional coordinating Body for transboundary related issues and secure MAP logistical support d) Reformulate MAP monitoring programme and RACs programmes, if needed, and as appropriate, in order to meet requirements under a), b), c)
2. Strenghten and improve the national and regional legal arrangements related to transboundary issues	e) Adopt a Transboundary related Annex to MAP LBS Protocol f) Invite affected and involved countries to establish high level National Coordinative bodies for transboundary related issues, preferably within NCSD or National Commissions for ICZM g) Invite countries to adopt / harmonize national legislations and procedures with international / regional transboundary related legal documents h) Establish Regional Network for transboundary related issues and provide support for its regular programme
3. Implement practical actions aimed at establishing bi - and multi - lateral transboundary related arrangements and programmes	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 j) Recommend to countries involved in identified priority areas to conclude relevant arrangements and initiate programmes within the MAP framework k) Introduce training on and provide assistance for transboundary related arrangements and programmes

* indexes in areas and interventions 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 intervention

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 of 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 interventions:

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.*