UNITED NATIONS ENVIRONMENT PROGRAMME

REGIONAL SEAS

Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL)-Phase I: Programme Description

UNEP Regional Seas Reports and Studies No. 23

Prepared in co-operation with

FAO UNESCO IOC WHO WMO IAEA

UNEP 1984

Note: This document is a review of the projects carried out, or planned to be carried out, during the pilot phase of MED POL, as well as of the institutional arrangements and other supporting measures used in the implementation of these projects. The annexes of the document contain the "operational documents" for seven of the projects and the project descriptions of the remaining six projects.

The projects described in this document were planned and co-ordinated jointly by UNEP and the Food and Agriculture Organization of the United Nations (FAO), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the Intergovernmental Oceanographic Commission (IOC) of UNESCO, the World Health Organization (WHO), the World Meteorological Organization (WMO) and the International Atomic Energy Agency (IAEA) under UNEP's overall co-ordination as part of the Mediterranean Action Plan under projects FP/1301-74-07, FP/1106-75-06, FP/0503-75-06, FP/0503-75-07, FP/0503-75-08, FP/0503-76-01, FP/0503-76-03, FP/0503-76-04, FP/0503-76-05, FP/0503-76-09, and implemented by eighty-three officially designated national research centres from sixteen Mediterranean States and the EEC.

For bibliographic purposes this document may be cited as:

FAO/UNESCO/IOC/WHO/WMO/IAEA/UNEP: Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL) - Phase I: Programme Description. UNEP Regional Seas Reports and Studies No. 23. UNEP, 1983.

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PREFACE

The Regional Seas Programme was initiated by UNEP in 1974 with the launching of the Mediterranean Action Plan (MAP). Since then the Governing Council of UNEP has repeatedly endorsed a regional approach to the control of marine pollution and the management of marine and coastal resources and has requested the development of regional action plans.

The Regional Seas Programme at present includes ten regions and has over 120 coastal States participating in it. It is conceived as an action-oriented programme having concern not only for the consequences but also for the causes of environmental problems through the management of marine and coastal areas. Each regional action plan is formulated according to the needs of the region as perceived by the Governments concerned. It is designed to link assessment of the quality of the marine environment and the causes of its deterioration with activities for the management and development of the marine and coastal environment. The action plans promote the parallel development of regional legal agreements and of action-oriented programme activities.

The Intergovernmental Meeting on the Protection of the Mediterranean convened by the United Nations Environment Programme (UNEP) in Barcelona from 28 January to 4 February 1975 adopted an action plan for the Mediterranean covering four main aspects (see section on Background below).

Furthering the recommendations made by the Barcelona meeting, a number of expert meetings took place with the aim of defining the operational documents for the implementation of the Co-ordinated Mediterranean Pollution Monitoring and Research Programme (thereafter called MED POL).

The pilot phase of MED POL was developed between 1975 and 1980 and constitutes the most extensive co-ordinated environmental study ever made on the Mediterranean Sea, contributing to the management activities (including legislative) undertaken in the framework of the action plan. MED POL has now been extended into a long-term phase that will cover the next ten years at least and should provide additional information on the sources, levels and effects of pollutants in the Mediterranean basin.

The present document is a review of the projects carried out, or planned to be carried out, during the pilot phase of MED POL, as well as of the institutional arrangements and other supporting measures used in the implementation of the projects. The annexes of the document contain the "operational documents" for seven of the projects and the project descriptions of the remaining six projects.

This document is part of the series that also includes the final report on the pilot phase of MED POL and the individual reports of about 200 principal investigators who participated in MED POL - PHASE I.

The document was prepared by UNEP's Co-ordinating Unit for the Mediterranean Action Plan which acknowledges the assistance of all those persons and organizations on whose contributions the success of MED POL depended.

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I BACKGROUND

Following the adoption by the United Nations Conference on the Human Environment (Stockholm, 5-16 June 1972) of the Action Plan for the Human Environment, including the General Principles for Assessment and Control of Marine Pollution, the United Nations General Assembly decided to establish the United Nations Environment Programme (UNEP) to "serve as a focal point for environmental action and co-ordination within the United Nations system." 1/

The organizations of the United Nations system were invited "to adopt the measures that may be required to undertake concerted and co-ordinated programmes with regard to international environmental problems" and the "intergovernmental and non-governmental organizations that have an interest in the field of the environment" were also invited "to lend their full support and collaboration to the United Nations with a view to achieving the largest possible degree of co-operation and co-ordination".

The Governing Council of UNEP chose "Oceans" as one of the priority areas in which it would focus efforts to fulfil its catalytic and co-ordinating role. While it was recognized that the environment has deteriorated considerably in many areas of the globe, the Mediterranean region was selected by UNEP as a "concentration area" where it would attempt, through the Regional Seas Programme Activity Centre, created in 1974, to assist the coastal States in the implementation of an ambitious and consistent Action Plan.

Concern had been expressed on numerous occasions during the late 1960s over the state of the Mediterranean Sea and in 1972 as part of their joint programme of Co-operative Investigations in the Mediterranean (CIM), the Food and Agricultural Organization of the United Nations (FAO), through its General Fisheries Council for the Mediterranean (GFCM), the International Commission for the Scientific Exploration of the Mediterranean Sea (ICSEM) and the Intergovernmental Oceanographic Commission (IOC), prepared the first comprehensive review of the state of marine pollution in the Mediterranean. As a follow-up, in 1974 FAO (GFCM) organized two consultation meetings on the protection of living resources and fisheries from pollution in the Mediterranean. Proposals for a study of the impact of human activity on the development of the coastal marine environment in the Eastern Mediterranean had meanwhile been drawn up at an International Biological Programme (IBP)/UNESCO meeting in 1973 (Malta).

1974 proved to be an important turning point for the Mediterranean. It was by then obvious that fisheries were not the only interests likely to be affected. In September, an International Workshop on Marine Pollution in the Mediterranean was held in Monaco. This workshop, sponsored by FAO (GFCM), IOC, ICSEM and UNEP, reviewed major pollution problems of the area and recommended co-operative projects. At a meeting of the GFCM working party on Marine Pollution, which immediately followed this workshop, plans were drawn up for the implementation of four of these pilot projects dealing with protection of living resources and fisheries. These

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1/ United Nations General Assembly Resolution 2997 (XXVII).

were subsequently included in the environmental assessment component of the Mediterranean Action Plan (see Outline of the Programme below).

In late 1974 UNEP established a "task force" of selected scientists, experts and government officials who joined with representatives of FAO, the World Health Organization (WHO), the Inter-Governmental Maritime Consultative Organization (IMCO), and IOC to draw up the elements of an action plan for the region. An Intergovernmental Meeting was convened by UNEP in January 1975 which 16 coastal States attended. The action plan was approved[2/] and plans were made for its implementation, which included four main aspects:

(i) Integrated planning of the development and management of the resources of the Mediterranean Basin;

(ii) Co-ordinated programme for research, monitoring, and exchange of information and assessment of the state of pollution and of protection measures (MED POL);

(iii) Framework convention and related protocols with their technical annexes for the protection of the Mediterranean environment;

(iv) Institutional and financial implications of the Action Plan.

All components of the action plan were interdependent and provided a framework for comprehensive action to promote both the protection and the continued development of the Mediterranean region. No component was an end in itself. Each activity was intended to assist the Mediterranean Governments in improving the quality of the environmental information on which formulation of their national development policies was based. Each activity was also intended to improve the ability of Governments to better identify options for alternative patterns of development and to make better rational choices for allocation of resources.

Furthering these recommendations, a second meeting took place in Barcelona early in 1976 at which the 16 participating States and the European Economic Community (EEC) adopted the Convention for the Protection of the Mediterranean Sea against Pollution, a Protocol for the Prevention of Pollution of the Mediterranean Sea by Dumping from Ships and Aircraft and a Protocol concerning co-operation in Combating Pollution of the Mediterranean Sea by Oil and other Harmful Substances in Cases of Emergency. This became known as the Barcelona Convention and entered into force in 1978. UNEP was designated as the secretariat of the Action Plan and the Barcelona Convention. On 17 May 1980, in Athens, a third protocol, Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources, was adopted and signed by twelve Mediterranean States and the EEC.

The meeting which took place in Barcelona in 1976 approved seven pilot projects (see Outline of the Programme below), which became the basis for the Co-ordinated Programme for Research and Monitoring of Pollution in the Mediterranean (MED POL). Later on, six other projects were defined and some of them implemented to broaden the scope of the Programme, or to provide support. The Programme was co-ordinated by UNEP's Regional Seas Programme Activity Centre until it was handed over to a separate Co-ordinating Unit for the Mediterranean Action Plan (MAP), which was

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2/ Mediterranean Action Plan and the Final Act of the Conference of Plenipotentiaries of the Coastal States of the Mediterranean Region for the Protection of the Mediterranean Sea (Barcelona, 1 - 16 February 1976). UNEP 1978.

established by the decision of the First Meeting of the Contracting Parties to the Barcelona Convention (Geneva 1979). Day-to-day co-ordination of the MED POL activities was carried out by FAO, WHO and IOC.

More than 200 scientific groups belonging to 83 institutions from 16 countries bordering the Mediterranean participated in the programme's activities. The data produced were submitted to the agencies where they were processed, taking into account the results of the intercalibration exercises co-ordinated by the International Atomic Energy Agency (IAEA) from its International Laboratory for Marine Radioactivity (ILMR), at Monaco. The achievements of the Programme are described in detail in the Final Report and in the Scientific Reports of the Participants.

The Programme's pilot phase activities that started in 1975 came to their end in 1980. The experience gained through them allowed UNEP to prepare, in close collaboration with FAO, WHO, IOC, UNESCO, WMO and IAEA, a proposal for a Long-term Pollution Monitoring and Research Programme (MED POL - PHASE II) endorsed at the Second Meeting of the Contracting Parties to the Barcelona Convention (Cannes, March 1981). This long-term programme covers four different and complementary monitoring activities: monitoring of sources of pollution; monitoring of coastal areas including estuaries; monitoring of open-sea reference areas; monitoring of transport of pollutants through the atmosphere; and twelve research projects ranging from the development of reference methods and of environmental quality criteria to studies on basic oceanographic processes and on toxicity, carcinogenicity and epidemiology of selected pollutants of special relevance to the Mediterranean region.

This second phase of MED POL will last from 1981 to 1991. The activities will be carried out by national laboratories designated by the Mediterranean Governments and will be co-ordinated by the Co-ordinating Unit for MAP in close co-operation with FAO, WHO, IOC, UNESCO, WMO and IAEA. The experience gained under the pilot phase of the Programme should be the guaranty for the success of the Long-term Programme in fulfilling the overall objectives of the environmental assessment component of the MAP, namely:

- to assess, on a continuing basis, the state of pollution of the Mediterranean Basin;

- to identify the sources, pathways, amounts and effects of pollutants entering the Mediterranean Sea;

- to establish temporal trends in the levels of pollution;

- to provide the basis for building models for the biogeochemical cycle of pollutants including their possible effects;

- to present the information thus obtained in such a way that it could be used as a management tool in the control of pollution;

- to help the riparian countries in making proper decisions with respect to environmentally compatible socio-economic development strategies; and

- to suggest methods for pollution control, including their cost-benefit analysis.

II OUTLINE OF THE PROGRAMME

A MED POL Pilot Projects

The Mediterranean Pollution Monitoring and Research Programme (MED POL) consisted of the seven pilot projects approved at the 1976 Barcelona meeting:

MED POL I : Baseline Studies and Monitoring of Oil and Petroleum Hydrocarbons in Marine Waters

MED POL II : Baseline Studies and Monitoring of Metals, particularly Mercury and Cadmium, in Marine Organisms

MED POL III : Baseline Studies and Monitoring of DDT, PCBs and other Chlorinated Hydrocarbons in Marine Organisms

MED POL IV : Research on the Effects of Pollutants on Marine Organisms and their Populations

MED POL V : Research on the Effects of Pollutants on Marine Communities and Ecosystems

MED POL VI : Problems of Coastal Transport of Pollutants

MED POL VII : Coastal Water Quality Control

Each pilot project was defined in its Operational Document (see annexes I to IV) which contained the description of a minimal work programme, mandatory for all participants, and an extended programme recommended as desirable for the more advanced research centres.

MED POL I : Baseline Studies and Monitoring of Oil and Petroleum Hydrocarbons in Marine Waters (IOC/WMO/UNEP)[3/]

The pollution of the Mediterranean by oil or petroleum hydrocarbons is a serious problem on beaches and other coastal recreational areas. As yet, too little is known about the present levels of hydrocarbon pollution and about its effects on the Mediterranean ecosystem. The measurement of present levels of petroleum in all its manifestations in the Mediterranean assumes greater importance because of the increase of oil tanker traffic resulting from the re-opening of the Suez Canal.

The pilot project includes the visual observation of oil slicks and other floating pollutants, sampling of tar ball, surveys for tar on beaches and the determination of dissolved and dispersed hydrocarbons in sea-water.

The aim of the pilot project is to develop a capability to assess the present level and the short- and long-term trends of pollution of the Mediterranean by petroleum hydrocarbons. This assessment could be achieved by using accessible, agreed techniques, verified by a carefully co-ordinated intercalibration exercise. The results will contribute substantially to the formulation of contingency plans to be

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3/ See Operational Document in annex I.

developed by the Regional Oil Combating Centre in Malta (ROCC) for dealing with important oil spills and with effects of localized operational spills.

The pilot project is considered to be a contribution to the Integrated Global Ocean Station System (IGOSS) organized by the Intergovernmental Oceanographic Commission (IOC) of UNESCO in co-operation with the World Meteorological Organization (WMO).

The rationale for initiating a pilot project based on IGOSS methodology in the Mediterranean region rests mainly on three facts:

- the IGOSS observational methodology is available at the initiation of MED POL I and can easily be adapted to suit the purposes of the pilot project thereby avoiding the necessity of taking time to establish new methods. In addition, the methodology could be further developed during the first phase of the project bearing in mind the desirability of providing data that would be fully comparable to that produced by the IGOSS pilot project;

- by using common methods and strategy throughout the Mediterranean, the comparison of the effects of accidental and operational discharges from tankers and shore facilities in the various parts of the Mediterranean Sea would be possible;

- by adopting a methodology already in use in other regions of the world, the Mediterranean could be truly compared with other sea areas having quite different oceanographic regimes, e.g. the North Atlantic, in which the possibilities for dispersion and dilution are greater and evaporation lower.

MED POL II : Baseline Studies and Monitoring of Metals, particularly Mercury and Cadmium, in Marine Organisms (FAO(GFCM)/UNEP)[4/]

Metals, particularly heavy metals like mercury, are toxic to man and to most marine organisms. They can reach man directly or indirectly through food-chains and one of the sources of greatest concern is seafood. It is therefore important to determine the concentration of such metals in fish, shellfish and other edible marine organisms.

It is recognized that the Mediterranean is, tectonically speaking, an active region and that, as a result, some metals may have high natural levels and great variations in their concentrations in sea-water and sediments. The bluefin tuna, as well as other tuna, is known to accumulate mercury and Mediterranean tuna seem to have much higher levels than those from the Atlantic.

The pilot project deals primarily with the concentration of selected metals, particularly mercury and cadmium, in marine organisms. In addition to these elements, the measurement of the levels of copper, lead, manganese, selenium and zinc is recommended, particularly when detection methods providing for multi-elemental analysis are available. The striped mullet, the Mediterranean mussel and the bluefin tuna represent three different ecotypes which have been selected as indicator species for the monitoring programme. The sampling frequency recommended is seasonal.

Although the information on levels of selected metals in representative marine organisms is being collected primarily to assess the health risks stemming from consumption of seafood, data collected through the project will help to clarify

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4/ See Operational Document in annex II.

whether the relatively high concentrations of some metals observed in Mediterranean organisms are due to natural phenomena or anthropogenic inputs.

During the course of the project a proposal was generated to test within the framework of MED POL II and MED POL III the "mussel watch" global experiment (annex II, appendix IV), taking advantage of the existing institutional infrastructure and of the well-organized intercalibration exercises (MED POL XI). Due to a number of reasons, however, the exercise never came to a successful end.

MED POL III : Baseline Studies and Monitoring of DDT, PCBs and other Chlorinated Hydrocarbons in Marine Organisms (FAO(GFCM)/UNEP)[5/]

Similar arguments to those advanced for the monitoring of metals (MED POL II) apply to chlorinated hydrocarbons. They are usually accumulated by marine organisms, and are potentially harmful to man either directly or indirectly through the marine organisms he consumes. In addition, many chlorinated hydrocarbons are very persistent and, as a result, tend to accumulate with time. Furthermore, even less is known about the present concentration of these chemicals in the Mediterranean than about the concentrations of metals. Since most chlorinated hydrocarbons are produced by man, natural background levels of these substances do not present such a great problem in baseline studies as metals.

The pilot project is concerned with determining the levels of organochlorine compounds which are considered to be especially harmful, either directly or indirectly, to representative components of the Mediterranean ecosystem. DDT and its metabolites, PCBs and dieldrin were singled out as falling into this category. Whenever possible, other persistent organic compounds were identified and quantified in samples. The organisms selected for monitoring are striped mullet, Mediterranean mussel and pink shrimp. These organisms are not only important economically but are almost ubiquitous throughout the Mediterranean. The sampling frequency recommended is seasonal.

Although there is no present evidence of harm to man caused by the current levels of chlorinated hydrocarbons in marine organisms from the Mediterranean, it is reasonable to expect that, because of the nature of these substances, their build-up may lead to damage of certain components of the marine ecosystem and as a result to consumers.

The results of the project should greatly contribute to the assessment of the present distribution of chlorinated hydrocarbons in the Mediterranean Sea and thus to a better understanding of the eventual risk to which the marine ecosystems may be exposed.

MED POL IV : Research on the Effects of Pollutants on Marine Organisms and their Populations (FAO(GFCM)/UNEP)[6/]

The marine environment is characterized by relatively constant physical and chemical conditions. As a result, marine organisms are not adapted to sudden changes in their environmental conditions, to certain substances not normally present in sea-water, or to unusually high concentrations of substances which are normally present as microconstituents.

5/ See Operational Document in annex II.
6/ See Operational Document in annex II.

The project deals mainly with long-term experiments that aim to investigate the sub-lethal effects of potential pollutants, including functional as well as morphological changes. If organisms cannot be kept long enough under culture conditions to allow long-term toxicity tests, acute toxicity experiments are carried out.

The experiments are not limited to individual organisms but also cover populations where subtle changes in the behavioural pattern could serve as early warning signs and lead to the possibility of predicting the moment at which the organisms will be harmed at the population level. Influences transmitted through the trophic levels, particularly in experiments on populations, are also studied.

Work will be carried out to establish the most sensitive stages in the life-cycle of the organisms tested. Physiological and biochemical studies will be conducted in order to provide information on the mechanisms involved in the effects and transport of pollutants. The functional and structural damage to the genetic material of individuals and their populations will also be studied.

The project should provide the biological background for monitoring and generate data required as the scientific basis for the development of water quality criteria in general. Naturally, these criteria cannot be based solely on biological tests, but the results should provide the basis for understanding potential hazards to the ecosystems, including man, caused by increased levels of pollutants in the marine environment.

MED POL V : Research on the Effects of Pollutants on Marine Communities and Ecosystems (FAO(GFCM)/UNEP)[7/]

Theoretically, several types of marine communities and ecosystems could be studied in the framework of this pilot project. For practical purposes, the project focuses on natural communities and ecosystems in coastal waters, including lagoons and brackish coastal lakes, where changes may be anticipated as a consequence of man's activities. In addition, ecosystems in relatively unpolluted areas such as marine parks are studied for reference. In order to detect long-term changes, particular emphasis is laid on studying ecosystems in areas that have been studied previously.

To the largest possible extent, the ecosystems are studied as integral units, taking into account the dynamic interactions among their various components. Special attention is given to the transfer of pollutants between trophic levels by those organisms that are used in the monitoring projects (MED POL II and MED POL III).

The parameters and the effects under study vary, depending on the community and ecosystem. Community structure, functional indices and body burden of pollutants are given particular attention.

The project should provide information about the structural and functional state of Mediterranean marine communities and ecosystems which can then be used as the basis for analysing trends in their changes. Furthermore, it is expected that through this project, methods will be developed and tested which can be used for observing community and ecosystem modifications and in determining the waste-receiving capacity of various parts of the Mediterranean, as well as perhaps, the Mediterranean Sea as a whole. In connexion with these objectives the project will directly contribute to the development of principles and guidelines for the selection and management of specially protected marine areas.

7/ See Operational Document in annex II.

MED POL VI : Problems of Coastal Transport of Pollutants (IOC/UNEP)[8/]

Sea surface transport in the Mediterranean is generally cyclonic (counter-clockwise) in both the eastern and western basins, but coastal currents are very complex and manifest a strong variability. Owing to the large ratio of coastline to the sea surface in the Mediterranean Sea, the water circulation has an important longshore component. Therefore pollutants discharged into coastal waters tend to be transported along the coasts.

Water leaves the Mediterranean at depth and is replaced by Atlantic water at the surface through the Strait of Gibraltar. The majority of pollutants enter the sea in the upper layers. However, due to the vertical mixing, and to strong convective motions in some areas during the winter, they can be spread into the deep Mediterranean water, and flow slowly through the Strait. On the basis of the general hydrography of the Mediterranean and of mass transport measurements in the Strait, the residence time of entering water is estimated to be about 100 years.

Although the general nature of the mass transport of sea-water in the Mediterranean is reasonably well understood, the knowledge of local circulation patterns is still meagre. The former may serve in studies of the distribution of pollutants entering the sea via the atmosphere, but the latter is much more important in studies of the distribution of pollutants entering the sea via rivers and effluent outfalls.

The main aim of the pilot project is the investigation of water circulation and stratification in coastal areas and the exchange of water between the coastal and offshore regions, in order to provide the necessary information on one of the main physical processes contributing to the coastal transport of pollutants in the Mediterranean Sea. Special attention is given to the movement of the surface layer since this contributes considerably to the rapid spread of certain pollutants, e.g. floating litter or petroleum hydrocarbons.

The information provided by this project will be useful in the assessment of all the aspects of marine pollution covered by the other pilot projects. The information is also necessary for the formulation and testing of models of the biogeocyles of pollutants in the Mediterranean Sea.

MED POL VII : Coastal Water Quality Control (WHO/UNEP)[9/]

The serious and rapidly growing pollution of the coastal waters of the Mediterranean is having an increasing impact on the social and economic well-being of the countries bordering it. In addition to the millions of inhabitants living along the coastline of the Mediterranean, millions of tourists spend their holidays on the shores of this sea, and there is a considerable potential for spreading of disease-causing micro-organisms.

The present situation constitutes a significant health hazard in many places. Salmonellosis, dysentery, viral hepatitis and poliomyelitis have all been endemic in the Mediterranean area, and during recent years there have been a number of cholera outbreaks. There is a distinct need for better epidemiological data concerning correlation between diseases and coastal water pollution. There is ample evidence that contaminated shellfish are an important concern to public health. The risk of infection from swimming and other recreational activities in coastal waters is

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8/ See Operational Document in annex III.
9/ See Operational Document in annex IV.

increased in certain areas by the absence or inadequacy of beach sanitary facilities. Thus, actual and potential health effects are of prime importance.

Using commonly agreed methods, the project is intended to initiate a sanitary and health surveillance of coastal recreational waters and of shellfish-growing waters in selected areas. Microbiological indicators are used as the most significant criteria of the sanitary quality of coastal waters and organisms living in them, particularly the most commonly eaten raw molluscs.

Scientific studies on the epidemiological evidence of effects on health caused by inadequate sanitary conditions in coastal areas are carried out. They include a review of epidemiological factors and health criteria on which quality standards for coastal waters are based, and the development of a methodology for epidemiological research programmes.

The project should produce statistically significant data, scientific information and technical principles which are required for the assessment of the present levels of coastal pollution as it concerns human health. This is considered to be indispensable for the rational design and efficient implementation of national programmes to control coastal pollution from land-based sources in the Mediterranean area.

B MED POL-Related Projects

In addition to the original seven pilot projects, a number of related projects were also proposed to broaden the scope of the programme, or to provide the necessary support:

MED POL VIII : Biogeochemical Studies of Selected Pollutants in the Open Waters of the Mediterranean

MED POL IX : Role of Sedimentation in the Pollution of the Mediterranean Sea

MED POL X : Pollutants from Land-Based Sources in the Mediterranean

MED POL XI : Intercalibration of Analytical Techniques and Common Maintenance Services

MED POL XII : Input of Pollutants into the Mediterranean Sea via the Atmosphere

MED POL XIII : Modelling of Marine Systems

These additional projects, some of which were never fully implemented, are described in this document in the corresponding project descriptions (see annexes V to X).

MED POL VIII : Biogeochemical Studies of Selected Pollutants in the Open Waters of the Mediterranean (IAEA/IOC/UNEP)[10/]

Heavy metals and chlorinated hydrocarbons are two types of pollutants identified in most oceanic areas. Although the coastal zones of the oceans are generally the most polluted, being the areas most affected by man's activities, the levels in the open Mediterranean are probably more important because the open waters comprise a larger volume of water than the coastal zones and therefore probably contain the bulk of

10/ See Project Description in annex V.

the total pollutant load. Furthermore, knowing off-shore concentrations of pollutants in the Mediterranean is important for comparison with other seas and oceans and with the levels found in coastal waters to ascertain the degree of degradation of the Mediterranean as a whole.

In addition to pollution load assessment, by measuring the amounts of heavy metals and chlorinated hydrocarbons in water, sediments, biota and, in some cases, the air, one can define transport pathways and reservoirs in the open Mediterranean. This provides the unifying concept that will help understand the results obtained through MED POL II and MED POL III in the coastal area as well as complement information obtained in MED POL IV and MED POL V.

Data obtained through the project, combined with those which will be collected through the other MED POL projects, will provide a sound basis for a model on the biogeochemical cycle of pollutants in the Mediterranean (MED POL XIII).

The immediate goal of the project is to obtain data on levels of metals and chlorinated hydrocarbons in open waters of the Mediterrranean in order to assess the total present load of these pollutants and in order to understand their dynamics (entry, transport, transformation and decay), thus complementing the coastal monitoring undertaken by the original seven MED POL pilot projects.

Long-term goals are to provide the data needed for development of models of the biogeocycling of pollutants in the Mediterranean.

During the course of the project a proposal was generated for the development of a Joint Mediterranean Cruise (annex V, appendix I). However, due to difficulties in securing suitable research vessels, the idea was not pursued to the end. The proposal was the product of the considerable effort of a joint interagency committee chaired by IAEA, and including representatives from UNEP, FAO, IOC, WMO and IAEA.

MED POL IX : Role of Sedimentation in the Pollution of the Mediterranean Sea (UNESCO/UNEP)[11/]

A comparison between dissolved and particulate elemental concentrations of most metals and organic pollutants in the aquatic environment indicates that they are relatively higher in the solid phase than in the dissolved phase. As a result, the total relative amount of pollutants transported by river water in the dissolved phase compared with that on suspended sediments clearly shows the importance of the latter in any waste load assessment, especially where a high sediment load is present.

In addition to natural particulates from various origins, secondary enriched particulates such as pesticides fixed on clay minerals and organic matter eroded and carried by rivers increase the contaminant load. Pollutants from sewage and industrial wastes may be adsorbed on suspended particles or directly discharged in particulate form into receiving waters.

Development of common procedures for representative sampling of river- suspended sediments will be initiated under this project. This includes methods for separation of suspended solids, extraction procedures and analytical methods for selected organics and heavy metals.

11/ See Project Description in annex VI.

A selection of Mediterranean rivers to be sampled and analysed for substances carried by suspended sediments will be made. Results will be used in the overall assessment of pollutants contributed by major rivers carried out in the framework of MED POL X project.

The project should contribute to an overall assessment of the total pollution load of the Mediterranean by providing data on pollutants associated with suspended river sediments through the collection of a first set of river-sediment pollution data.

MED POL X : Pollutants from Land-Based Sources in the Mediterranean (WHO/ECE/UNIDO/FAO/UNESCO/IAEA/UNEP)[12/]

The main land-based sources of pollution of Mediterranean coastal waters are municipal sewage and industrial effluents discharging through rivers or directly to the sea. Pollution is aggravated in the Mediterranean, which is an almost entirely enclosed area, by very small tidal effects, long periods of calm weather and relatively high ambient temperatures.

In order to obtain comprehensive information on most major pollutant inputs into the Mediterranean from land-based sources, the following tasks are undertaken within this project:

- preparation of an inventory of land-based sources of pollutants discharging directly into the Mediterranean;

- assessment of the nature and quantity of pollutants from coastal sources;

- assessment of the nature and quantity of pollutants carried by major rivers;

- review of present waste disposal and pollution management practices.

The project covers those coastal zones of the Mediterranean sea that directly influence the quality of the marine waters by the discharge of liquid, dumping of solid, or emission of gaseous wastes.

This project, closely linked to the other MED POL projects, should provide the Governments of the Mediterranean coastal States with appropriate information on the type and quantity of pollution inputs from major land-based sources and rivers, and on the present status of waste discharge and management practices which affect marine pollution. This information, combined with that collected through the MED POL projects on the biogeocycles, levels and effects of various pollutants on human health and marine ecosystems should be used to assist the Mediterranean Governments in the implementation of the Protocol for the Protection of the Mediterrranean Sea Against Pollution from Land-Based Sources.

MED POL XI : Intercalibration of Analytical Techniques and Common Maintenance Services (IAEA/FAO/IOC/UNEP)[13/]

Intercalibration

In co-ordinated studies, when many laboratories are involved in measuring trace pollutants such as heavy metals, chlorinated and petroleum hydrocarbons by various

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12/ See Project Description in annex VII.
13/ See Project Description in annex VII.

methods, it is essential to ensure the comparability of the data obtained by different laboratories to deduce any sensible conclusion. Thus, a joint effort by the laboratories participating in the same project towards improving the comparability of the data is essential to make the measurements meaningful. Past experience gained through various intercalibration exercises on the measurements of trace pollutants shows that the data of different laboratories on an identical sample can sometimes differ considerably.

Through this project, reference materials are distributed to all participants in MED POL II and MED POL III. By analysing these samples, which have matrices and pollutant concentrations similar to those of the environmental samples being analysed in MED POL II and MED POL III, the participants are able to improve their analytical performances and ensure the inter-comparability of their data.

The primary objective of the intercalibration programme is to provide analytical quality control to Mediterranean laboratories participating in MED POL. Considering the importance of the comparability and reliability of the data produced, the present intercalibration programme is regarded as one of the key elements in the baseline studies and monitoring of the levels of pollutants in the Mediterranean.

Maintenance

Proper maintenance and rapid repair of the sophisticated analytical laboratory instruments or field equipment used in the various MED POL projects are of great importance to the laboratories using them. As many laboratories in many Mediterranean countries do not have the advantage of maintenance services being provided by local representatives of the producers of these instruments and equipment, the only way to ensure a smooth flow of data is by providing maintenance within the framework of MED POL.

A common maintenance service will be provided by an electronics engineer operating from the IAEA International Laboratory of Marine Radioactivity in Monaco. For the most part he will take care of the routine maintenance and repair of atomic absorption spectrophotometers, gas chromatographs, fluorimeters and recording current meters given to the research centres participating in MED POL I, MED POL II, MED POL III and MED POL VI.

The project should ensure prompt and cost-free routine maintenance and repair of laboratory and field equipment provided to the research centres participating in MED POL if these services are not available locally, and provide advice and instruction on maintenance to local staff in the participating laboratories.

MED POL XII : Input of Pollutants into the Mediterranean Sea via the Atmosphere (WMO/IAEA/WHO/UNIDO/ECE/UNEP)[14/]

At present, it appears that practically no data are available on the atmospheric contribution to the pollution of the Mediterranean, although the input of airborne pollutants may turn out to be the major unknown parameter needed to assess the state of pollution in the Mediterranean Basin.

The first phase of the project is intended to develop the scientific criteria and methods for measuring airborne pollutants. The second phase will include field measurements on the transport of pollutants through the atmosphere, exchange of pollutants through the air/sea interface and modelling of these processes.

14/ See Project Proposal in annex IX.

The objective of the project is to provide information on the relevance of airborne pollution to the present state of pollution of the Mediterranean Sea and thus contribute to the understanding of the biogeochemical cycle of pollutants in the Mediterranean Basin. As the airborne transport of pollutants may be one of the major mechanisms contributing to the transboundary pollution, the results of this project could eventually contribute to the negotiation of a legal instrument designed to control airborne pollution of the region.

MED POL XIII : Modelling of Marine Systems (UNESCO/FAO/IOC/UNEP)[15/]

Modelling is an essential component of any overall plan designed to assess the impact of pollutants on natural systems and provide information needed by those in charge of the rational management of these systems. Modelling is, in particular, one of the most effective scientific tools to explore the functioning of marine ecosystems and their response to environmental stresses.

The project includes the development of two- and three-dimensional hydrodynamic circulation models, models of biogeochemical cycles of pollutants and models of ecosystem responses to pollutants.

The objective of the project is to provide information needed for the design, co-ordination and balance of sampling programmes carried out under the MED POL monitoring projects, and for a better understanding of the complex relationship between the sources of pollution and their effects on marine ecosystems, human health and socio-economic development. Such models provide the means by which the results of the individual projects of the Mediterranean Action Plan, and of MED POL in particular, can be synthesized and better understood.

These models, having predictive capabilities, could be used by the Governments of the Mediterranean coastal States as management tools in the prevention and control of marine pollution affecting the Mediterranean Basin.

C Institutional arrangements and other supporting activities

Co-ordination

The MED POL - PHASE I activities were organized by UNEP's Regional Seas Programme Activity Centre (RS/PAC) in close collaboration with the specialized United Nations bodies (ECE, UNIDO, FAO(GFCM), UNESCO, IOC of UNESCO, WHO, WMO, IMCO and IAEA) which had a major role in their implementation. UNEP was responsible for the overall co-ordination, while FAO (GFCM), IOC and WHO were responsible for the day-to-day co-ordination of pilot projects MED POL II to V, MED POL I and VI, and MED POL VII and X, respectively. IAEA was responsible for the execution of MED POL VIII and XI, UNESCO for the execution of MED POL IX and XIII, and WMO for MED POL XII.

In consultation with the Mediterranean Governments and the specialized United Nations bodies concerned, in August 1976, one participating research centre in each of the seven networks of institutions co-operating in the original seven MED POL projects was selected by UNEP as a Regional Activity Centre (RAC). The role of the RACs was to assist UNEP and the relevant specialized United Nations bodies in the organization and execution of the pilot projects.

15/ See Project Proposal in annex X.

Close collaboration was established between the Regional Activity Centre for the pilot project on baseline studies and monitoring of oil and petroleum hydrocarbons in marine waters (MED POL I) and the Regional Oil Combating Centre in Malta (ROCC), making use of their complementary roles in assessing the extent of the present pollution by petroleum hydrocarbons, in preparing contingency plans for dealing with oil spills and in organizing proper training relevant to their activities.

Participants in the programme

The MED POL projects were carried out by existing national institutions. Participation in the projects was open to all institutions in the region, subject to nomination by their national authorities. Eighty-four research centres from 16 Mediterranean countries[16/] and the European Economic Community (EEC) were identified as active participants in one or more of the MED POL projects. The participation in the pilot projects was not restricted to well developed research centres able to deal with the task in a complex way but, in order to further development, was also open to institutions capable only of a more limited contribution.

The monitoring and research activities to be undertaken by the research centres nominated was specified in a signed agreement between them and the relevant specialized United Nations organization co-operating with UNEP in the implementation of the programme.

Assistance to participants

Substantive support was provided by UNEP, through the co-operating specialized United Nations organizations, to the participants in the programme in order to facilitate or make possible their full participation in the pollution monitoring and research activities. This support included provision of equipment, organization of the permanent intercalibration of analytical techniques which was mandatory for all participants, and provision of a common maintenance service for the more sophisticated instruments used in analytical work (MED POL XI).

Extensive training activities were carried out as part of MED POL. Scientists from a number of participating institutions received on-job training at other Mediterranean institutions with more developed scientific capabilities. Participation of Mediterranan scientists in scientific meetings was also fostered by UNEP as part of MED POL.

Data handling

Data obtained through each project were reported periodically to the specialized United Nations body bearing the responsibility for the technical implementation of each project and through it to UNEP acting as the secretariat of the Barcelona Convention and overall co-ordinator. A rough estimate of the total number of primary data collected through MED POL is 1.5 million data items per year. These data are considered as unclassified, unless stated otherwise by those submitting them.

Data formats to be completed by principal investigators of the various MED POL pilot projects were prepared, using standard international procedures in order to achieve data comparability when reporting their results.

16/ Algeria, Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Malta, Monaco, Morocco, Spain, Syria, Tunisia, Turkey and Yugoslavia.

The facilities of the Geneva-based United Nations International Computing Centre (ICC) were selected to be used on a trial basis as the central data repository and processing facility for the Mediterranean Action Plan and for the pilot phase of MED POL while FAO made the first statistical analysis of the data obtained through MED POL II and III. Data were collected, handled and disseminated according to existing, standard practices.

Documentation

Detailed "operational documents" were prepared for the various MED POL activities (see annexes I to X to this document) as guidelines for the participants in these activities. Each of the operational documents contains a minimal work programme, mandatory for all participants, and an extended programme recommended as desirable for the more advanced research centres. Furthermore, the documents specify the matrices and pollutants to be monitored, the sampling and analytical methods to be followed, the procedures for the intercalibration of the analytical techniques, the type of field observations and laboratory experiments, the format and frequency of data reporting, the needs for training and additional equipment and other issues relevant to the execution of the pilot projects.

Several manuals ranging from technical descriptions of procedures to be followed in obtaining environmental samples to principles involved in epidemiological studies and development of ambient quality criteria, were prepared as an aid to participants in the programme and as a contribution to the legal and management components of the Mediterranean Action Plan.

Bibliographic references relevant to the pollution of the Mediterranean Sea have been prepared by FAO(GFCM) and IOC as assistance to participants in MED POL projects. These bibliographies, in spite of some overlapping, covered only part of the available scientific literature relevant to the protection of the Mediterranean. Therefore, a consolidated and comprehensive bibliography covering all aspects of the pollution of the Mediterranean Sea has been prepared by UNEP in collaboration with FAO(GFCM), WHO, IOC, WMO and IAEA and the relevant Regional Activity Centres.

Periodic progress reports were issued by the International Laboratory of Marine Radioactivity (IAEA) in Monaco on the intercalibration of analytical methods in marine environmental samples, although results and identities of individual participants remained confidential.

To facilitate contacts between the Mediterranean scientists, a Directory of Mediterranean Marine Research Centres was issued in 1976 giving full details (programmes, staff, publications, facilities, etc.) on 50 marine research institutions. An up-dated version of the directory covering over 140 institutions, was issued in 1977 and a new issue, with a wide coverage, will be published in 1982.

A directory on specially protected Mediterranean aquatic and terrestrial (island and coastal) areas is under preparation in collaboration with IUCN.

Informative leaflets relevant to various MED POL activities were prepared occasionally and distributed in large numbers. One of particular interest was a periodically updated list of available documents (publications, reports, background material, etc.), issued in Arabic, English, French and Spanish.

Information of interest to participants in certain MED POL projects was disseminated through news-letters issued by FAO(GFCM), IOC and the Regional Activity Centres for MED POL II and VII with the assistance of, respectively, FAO(GFCM) and WHO.

Since June 1978, an informal quarterly publication (The Siren) has been issued by UNEP, in English and French, to present news from UNEP's Regional Seas Programme. Because of its world-wide circulation, it assists in spreading general, non-technical information on MED POL.

The scientific results of the programme have been published in the form of collated periodic reports submitted directly by the participants in the various projects or in synthesis reports prepared by UNEP and the specialized organizations of the United Nations system supporting the programme. Results have also been made available through regular scientific literature and, in particular, through the Joint ICSEM/UNEP Workshops on Pollution of the Mediterranean Sea.

III LIST OF MED POL-RELATED DOCUMENTS AND REPORTS

The State of Marine Pollution in the Mediterranean and Legislative Controls. GFCM.Stud.Rev.51.FAO, 1972. (English and French)

Report of the IOC/FAO(GFCM)/ICSEM International Workshop on Marine Pollution in the Mediterranean (Monaco, 9 - 14 September 1974), IOC Workshop Report No. 3. UNESCO, 1975. (English, French and Spanish)

Report of the FAO(GFCM)/UNEP Expert Consultation on the Joint Co-ordinated Projects in the Mediterranean (Rome, 23 June - 4 July 1975). FAO, 1975. (English and French)

Report of the IOC/WMO/UNEP Expert Consultation on the Joint Co-ordinated Projects on Pollution in the Mediterranean (Msida, 8 - 13 September 1975). IOC/MPP/3, UNESCO, 1975. (English, French, Spanish and Arabic)

Report of the WHO/UNEP Expert Consultation on Coastal Water Quality Control Programme in the Mediterranean (Geneva, 15 - 19 December 1975), EHE/76.1. WHO, 1976. (English and French)

Manual of Methods in Aquatic Environment Research. Part 2: Guidelines for the Use of Biological Accumulators in Marine Pollution Monitoring. FAO Fisheries Technical Paper No. 150. FAO 1976.

P.C. WOOD: Guide to Shellfish Hygiene. WHO Offset Publication No. 31. WHO, 1976.

Manual of Methods in Aquatic Environment Research. Part 3: Sampling and Analysis of Biological Material. FAO Fisheries Technical Paper No. 158. FAO 1976. (English and French)

Directory of Mediterranean Marine Research Centres. Second Edition. UNEP 1977.

Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL). Report of the Mid-term Expert Consultation on the Joint FAO(GFCM)/UNEP Co-ordinated Projects on Pollution in the Mediterranean (MED II, III, IV and V) (Dubrovnik, 2 - 13 May 1977). FAO 1977. (English and French)

Mid-term Review of the Joint WHO/UNEP Co-ordinated Pilot Project on Coastal Water Quality Control in the Mediterranean. Report of the meeting of principal investigators of collaborating laboratories (Rome, 30 May - 1 June 1977). WHO 1977. (English and French)

Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL). Summary Report of the Mid-term Review Meeting on IOC/WMO/UNEP and IOC/UNEP Pilot Projects with three supplements. (Barcelona, 23 - 27 May 1977). IOC/WMO/UNEP/MED-MRM/3. UNESCO 1977. (English, French and Spanish)

Report on the Mid-term Review Meeting on the Progress of the Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL) and related projects of the Mediterranean Action Plan (Monaco, 18 - 22 July 1977). UNEP/WG.11/5. UNEP 1977. (English and French)

Pollutants from Land-Based Sources in the Mediterranean. (Report prepared in collaboration with ECE, UNIDO, FAO, UNESCO, WHO, IAEA). UNEP/WG.18/INF.4. UNEP 1977. (English and French)

Guidelines for the Implementation of Pilot Projects MED I and MED VI. UNESCO, 1977. (English, French and Spanish)

Manual for Monitoring Oil and Petroleum Hydrocarbons in Marine Waters and on Beaches. UNESCO, 1977. (English, French and Spanish)

Manual of Methods in Aquatic Environment Research. Part 4: Bases for Selecting Biological Tests to Evaluate Marine Pollution. FAO Fisheries Technical Paper No. 164. FAO 1977. (English, French and Spanish)

Selected Bibliography on Studies and Research Relevant to Pollution in the Mediterranean. FAO Fisheries Technical Paper No. 165. FAO 1977.

Guidelines for Health Related Monitoring of Coastal Water Quality. Report of a meeting of WHO/UNEP Joint Group of Experts (Rovinj, Yugoslavia, 23 - 25 February 1977). WHO 1977. (English and French)

Health Criteria and Epidemiological Studies Related to Coastal Water Pollution. Report of a meeting of WHO/UNEP Joint Group of Experts (Athens, 1 - 4 March 1977). WHO 1977. (English and French)

Coastal Water Pollution Control. Report of a joint WHO/UNEP Workshop (Athens, 27 June - 1 July 1977). WHO 1977. (English and French)

The Mediterranean. A special issue, Ambio, Vol.VI, No.6. 1977. (English and French)

First Report on Monitoring of Recreational Coastal Water Quality and Shellfish Culture Areas. Report of a joint WHO/UNEP Seminar (Rome, 4 - 7 April 1978). WHO 1978. (English and French)

Data profiles on Chemicals for Evaluation of their Environmental Hazards. Volumes I and II. UNEP 1978.

Second Report on Coastal Quality Monitoring of Recreational and Shellfish Areas (MED VII). Report of a joint WHO/UNEP Workshop (Rome, 17 - 19 January 1979). WHO 1979. (English and French)

Proceedings of ICSEM/UNEP Joint Workshop on Pollution of the Mediterranean (Antalya, 24 - 27 November 1978). ICSEM/UNEP 1979.

Third Report on Coastal Quality Monitoring of Recreational and Shellfish Areas (MED VII). Report of a joint WHO/UNEP Workshop (Rome, 20-23 November 1979). WHO 1979. (English and French)

Manual of Methods in Aquatic Environment Research. Part 5: Statistical Tests. FAO Fisheries Technical Paper No. 182. FAO 1979.

Principles and Guidelines for the Discharge of Waters into the Marine Environment. Published under the joint sponsorship of UNEP and WHO. WHO 1979. (English and French)

Proceedings of ICSEM/UNEP Joint Workshop on Pollution of the Mediterranean. (Cagliari, 9-13 October 1980). ICSEM/UNEP 1981.

Manual of Methods in Aquatic Environment Research. Part 7: Selected Bioassays for the Mediterranean. FAO Fisheries Technical Paper No.208. FAO 1981. (English and French)

Manual of Methods in Aquatic Environment Research. Part 8: Ecological Assessment of Pollution Effects. FAO Fisheries Technical Paper No.209. FAO 1981. (English and French)

Selected Bibliography on the Pollution of the Mediterranean Sea prepared by UNEP in collaboration with FAO, UNESCO, WHO, WMO, IOC and IAEA). UNEP 1981.

Intercalibration of Analytical Methods on Marine Environment Samples. IAEA, progress reports up to March 1981.

Coastal Water Quality Control in the Mediterranean. Final Report on the Joint WHO/UNEP Co-ordinated Project (MED VII) (1976-1980). WHO 1981. (English and French)

Joint FAO(GFCM) UNEP Co-ordinated Projects on Pollution in the Mediterranean. Final Report. Circ. Gen. Fish. Coun. Mediterr. 8. FAO 1981. (English and French)

Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL - PHASE I). Final Report. UNEP, 1982.

Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL - PHASE I). Scientific Reports of the Participants. UNEP 1982.

Manual of Methods in Aquatic Environment Research. Part 6: Toxicity Tests. FAO Fisheries Technical Paper No.185. FAO 1982 (in preparation).

Directory of Mediterranean Marine Research Centres. Third Edition. UNEP 1982 (in preparation).

Reference Methods for Marine Pollution Studies in the Mediterranean (prepared in collaboration with FAO, WHO, IOC, IAEA and UNEP). (in preparation).

Report on the State of Pollution of the Mediterranean Sea. UNEP. (in preparation).

The Siren. Quarterly news bulletin from UNEP's Regional Seas Programme. UNEP. (English and French)

ANNEX I

OPERATIONAL DOCUMENT

FOR THE JOINT IOC/WMO/UNEP PILOT PROJECT ON

BASELINE STUDIES AND MONITORING OF OIL AND

PETROLEUM HYDROCARBONS IN MARINE WATERS

(MED POL I)

This operational document was produced by a joint IOC/WMO/UNEP Expert Consultation which took place in Msida, at the University of Malta, from 8 to 13 September 1975. The Consultation was attended by 36 participants from 12 Mediterranean Countries. The operational document was revised by the IOC/WMO/UNEP Mid-term Review Meeting held in Barcelona from 23,27 May 1977.

CONTENTS

1. INTRODUCTION

Under the joint auspices of the Intergovernmental Oceanographic Commission (IOC), the General Fisheries Council for the Mediterranean FAO(GFCM) and the International Commission for the Scientific Exploration of the Mediterranean (ICSEM), the United Nations Environment Programme (UNEP) supported an International Workshop on Marine Pollution in the Mediterranean at Monaco, on 9-17 September 1975. The Workshop identified the pollution of coastal waters, including the presence of pathogenic micro-organisms, as the main problem in the Mediterranean and attributed it to the general lack of adequate systems for the treatment and disposal of domestic and industrial waste and to the input of petroleum hydrocarbons and organochlorines. The Workshop reviewed the available information on current regional programmes as well as on the research and monitoring facilities in the Mediterranean, and outlined several pilot projects on pollution monitoring and research for the Mediterranean.

At the UNEP Intergovernmental Meeting on the Protection of the Mediterranean, which was held in Barcelona from 28 January to 4 February 1975, seven of the pilot projects outlined by the Monaco workshop were endorsed as parts of a Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL), the implementation of which was recommended as an element of the adopted Mediterranean Action Plan.

A joint IOC/WMO/UNEP Expert Consultation was held in Malta (8-13 September 1975) to develop an operational document for two of these pilot projects:

IOC/WMO/UNEP Pilot Project on Baseline Studies and Monitoring of Oil and Petroleum Hydrocarbons in Marine Waters (MED POL - I);

IOC/UNEP Pilot Project on Problems of Coastal Transport of Pollutants (MED POL - VI).

Experts of the countries bordering the Mediterranean proper, and several experts from outside the region, prepared the operational documents which served as a basis for the implementation of the pilot projects.

The operational plan for pilot project MED-I was developed on the basis of document IOC-WMO/MPMSW-I/TT-II, which is the plan of operation adopted in 1974 for the IGOSS Pilot Project on Marine Pollution (Petroleum) Monitoring (MAPMOPP). This plan has been revised and further operational guidelines have been included; it is now in use in about 40 countries around the world (doc. IOC Manuals and Guides No.7).

2. OUTLINE OF THE PILOT PROJECT

Baseline data on particulate, dispersed and dissolved petroleum hydrocarbons, on oil slicks and floating tar balls, and on tar on beaches are urgently needed for the Mediterranean because of the present level of pollution by petroleum hydrocarbons and because of the imminent increase in the quantity of petroleum to be transported through the area after the re-opening of the Suez Canal.

The proposed pilot project deals primarily with the contamination of coastal waters by these substances. The levels and trends of pollution in open waters are also studied.

The immediate objective of the pilot project is to monitor marine pollution by oil and petroleum hydrocarbons in order to obtain a picture of their distribution and dynamics in the Mediterranean, with the ultimate goal of providing the coastal states of the Mediterranean basin with information on which measures might be based. Participation is restricted to research centres which are officially designated by the Governments of the Mediterranean coastal States.

3. PROGRAMME OF THE WORK

3.1 Areas of monitoring

The area of concern to the Pilot Project is the Mediterranean Sea proper, extending to the west to the Strait of Gibraltar to a line from Casablanca to the Spanish/Portuguese border and including to the east the Sea of Marmara. The investigation will be primarily restricted to coastal waters.

The participating research centres are asked to designate the coastal areas that most critically need study within this pilot project, taking into account the routes of oil transportation, areas of loading and discharging, regions of offshore oil production, and the major current systems.

Monitoring and baseline studies beyond the limits of territorial waters will be carried out either on the initiative of individual coastal countries or as joint operations involving several coastal countries.

Monitoring in the following non-coastal areas is particularly recommended (see figure):

Western Mediterranean (41° 30'N/38° 00'N - 3° 00'E/7° 00'E)

Tyrrhenian and Ligurian Sea (41° 00'N/38° 00'N - 11° 00'E/14° 00'E)

Adriatic Sea (North of 44° 00'N)

Ionian Sea (36° 00'N/34° 00'N - 17° 00'E/21° 00'E)

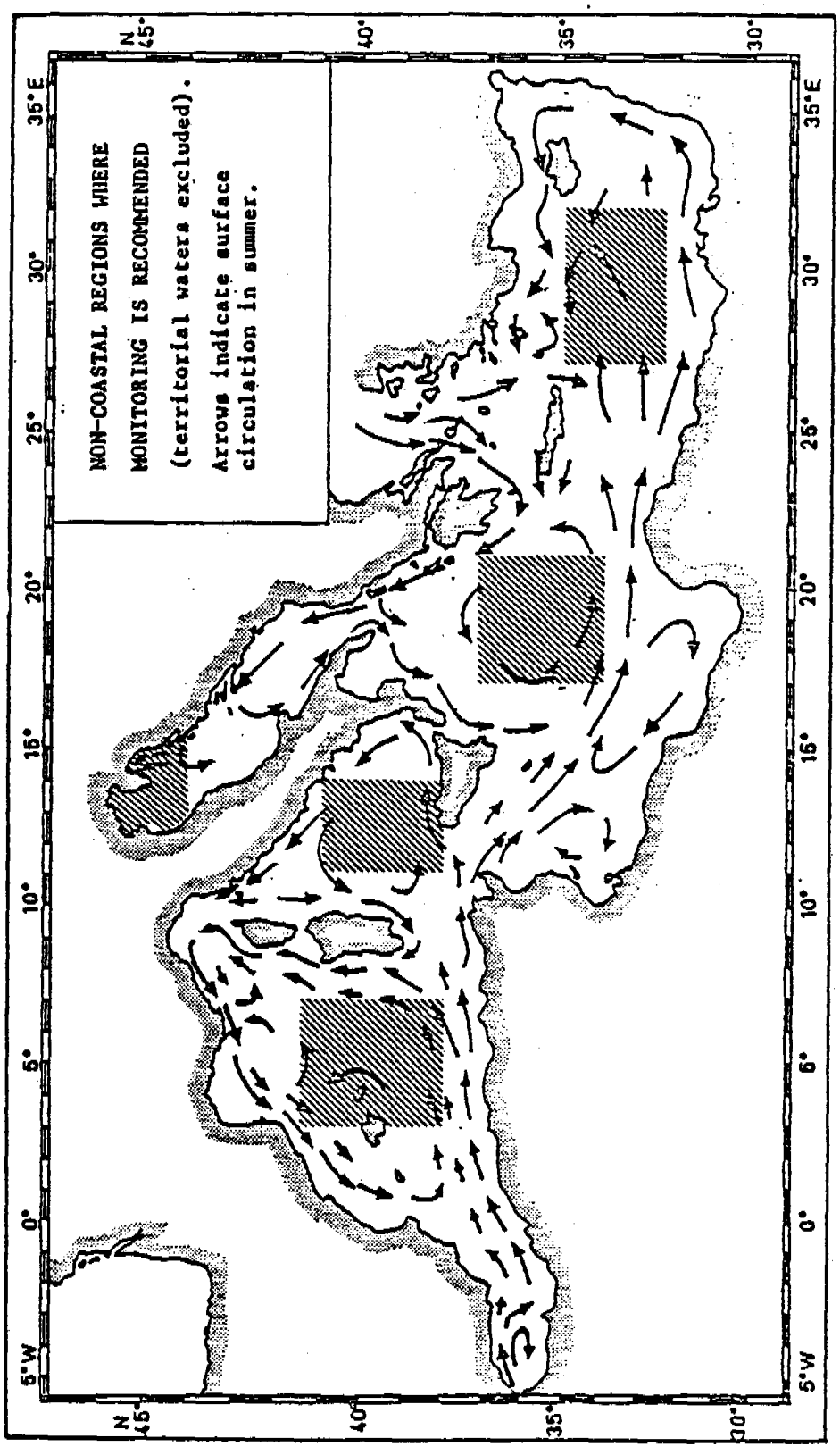
Eastern Mediterranean (35° 00'N/32° 30'N - 27° 00'E/32° 00'E).

3.2 Parameters to be monitored

3.2.1 Basic parameters

In the context of this pilot project observations will be made of the following:

- oil slicks and other floating pollutants;
- floating particulate petroleum residues ("tar balls");



From : Proceedings of the Inter-Parliamentary Conference of Coastal States on the Control of Pollution in the Mediterranean Sea, FAO, Rome, 29/3-3/4 1974. Rome, 1974.

- dissolved/dispersed petroleum hydrocarbons in the surface waters;

- tar on beaches

3.2.2 Complementary parameters

To achieve a better evaluation of the obtained data, the following additional parameters should be recorded whenever possible at the time of sampling or observations:

- sea temperature

- air temperature

- wind speed and direction

- wave period and height

3.3 Sampling methodology

To ensure the consistency of data to be reported, recording of observations and sampling should be carried out following the Manual for Monitoring of Oil and Petroleum Hydrocarbons in Marine Waters and on Beaches (doc. IOC-WMO-UNEP/MED-MRM/3, Suppl. 2) as closely as possible.

3.4 Analytical procedures

The method of choice for the analysis of dissolved/dispersed petroleum hydrocarbons is fluorescence spectrophotometry. However, chromatographic techniques and IR-spectroscopy can be used to obtain complementary information.

To ensure the intercomparability of data, the treatment and analysis of samples should also follow the instructions given in the Manual for Monitoring of Oil and Petroleum Hydrocarbons in Marine Waters and on Beaches.

To facilitate intercalibration procedures, a central distribution of standards for the analytical methods used will be organized by IOC in close collaboration with the Regional Activity Centre for MED POL I (RAC) and co-ordinated with intercomparison exercise under MAPMOPP.

3.5 Frequency of observations and measurements

Visual observation of oil slicks and other floating pollutants should be made whenever at sea.

Sampling of "tar balls", of dissolved/dispersed petroleum hydrocarbons and of tar on beaches should be done regularly and as frequently as possible, at least on a monthly or seasonal basis.

3.6 Data handling

The collection and reporting of data will follow the format set out in the Manual for Monitoring of Oil and Petroleum Hydrocarbons in Marine Waters and on Beaches.

The first evaluation of data obtained will be made by the research centres which have collected them.

The co-ordinating agencies for this pilot project, IOC, WMO and UNEP, will make the final evaluation within the framework of IGOSS and GIPME and will be responsible for informing the research centres participating in the network about the results. Moreover, to ensure that the pilot project fulfills its purpose, provision must be made for recording the data and storing them in national, regional and world data centres, so that they are readily accessible to national and international authorities, as well as to scientific investigators.

All the data should be forwarded to the IOC for further evaluation.

4. PARTICIPANTS IN THE PILOT PROJECT

A number of Mediterranean research centres expressed the wish to participate in the pilot project. These were identified during a feasibility study of the Co-ordinated Mediterranean Pollution Monitoring and Research Programme carried out by two IOC consultants on behalf of UNEP.

Participating Mediterranean research centres will be organized into a network. Membership of the network will not be limited to research centres able to deal with all aspects of the proposed programme but may also include those research centres which are capable of only limited initial contributions whilst under development.

Research centres may join the network at any time they wish. However, their participation in the pilot project, as well as the programmes they are proposing as their contribution, must be cleared by their appropriate national authorities.

5. TRAINING NEEDS

The lack of adequately trained scientists and technicians to perform the necessary observations and analytical work seriously hinders the full participation of some of the national research centres which have expressed the wish to become part of the network participating in the project. Fellowships for in-service training of up to six months each will therefore be awarded, with priority to those national research centres whose full participation in the pilot projects depends on their acquiring adequately trained staff. The fellowships will be available from the start of the programme. All training will be carried out in Mediterranean research centres having adequate facilities and experience in such activities.

Trainees will be selected from national research centres which provide an assurance that the trainee will continue to work on the project upon return to his home centre. The training centres will be expected to maintain contact with trainees who have returned to their home laboratories.

6. REQUIREMENTS FOR TECHNICAL ASSISTANCE

To improve the technical facilities of participating research centres, analytical instruments as well as chemicals, standards and sampling tools may be provided by IOC where needed.

Common maintenance services for the analytical instruments provided for the pilot project will be organized by the sponsoring agencies. Selection of the recipient centres will be based on their need for the requested assistance, particularly in the national research centres from developing countres, and on assurance from the recipients that they will provide adequate facilities and personnel for the installation, maintenance, and operation of the equipment for the purpose of the pilot projects.

7. TIMING

The total duration of the operational phase of the pilot project will be 30 months, starting from July 1976.

8. CO-ORDINATING ACTIVITIES

Co-ordination of the work performed by the network of participating Mediterranean research centres on the basis of this operational document will be organized in close collaboration by IOC, WMO and UNEP. The services of the Regional Activity Centre (RAC) will be used as appropriate.

Such co-ordination may include:

- correspondence with research centres and national authorities;
- organization of data reporting, evaluation and dissemination;
- organization of the training programme;
- organization of technical assistance;
- periodic review of the contribution of participating research centres, and efforts to enlarge the network of participants;
- contact with other related projects elsewhere, and particularly with the IMCO/UNEP Regional Oil Combating Centre for the Mediterranean (ROCC);
- organization of meetings of experts from participating research centres;
- co-ordination of the visits of experts;
- any other activity relevant to the execution of the pilot project.

The activities of this pilot project will be co-ordinated with those of the other pilot projects of the Co-ordinated Mediterranean Pollution Monitoring and Research Programme endorsed by the UNEP Intergovernmental Meeting on the Protection of the Mediterranean.

9. REPORTS

Participating research centres will be asked to submit progress reports to IOC in November 1977 and June 1978. Final reports will be required in October 1978.

Appendix I

MANUAL FOR MONITORING OF OIL AND PETROLEUM HYDROCARBONS

IN MARINE WATERS AND ON BEACHES

(Suppl. to Manuals and Guides No.7. UNESCO 1977)

To ensure the consistency of data to be contributed by various research centres, participants should follow these guidelines as closely as possible.

A. OBSERVATION OF OIL SLICKS AND OTHER FLOATING POLLUTANTS

1. Methods of observation

For visual observations, no instruments are needed, although polarizing glasses may be useful in detecting oil slicks. Guidelines for the visual recognition of oil slicks are given in section 3. Remote-sensing techniques, e.g. side-looking airborne radar (SLAR) and infra-red (IR) radiometers, may be used if available.

A reporting form (see figure I) is to be used for recording the observations. Instructions for completing the form are given below.

2. Instructions for completing the form

Whenever floating oil, petroleum residues and other floating pollutants are observed, they should be reported on the log form. In order to get the quantitative information on the status of pollution, it is equally important to know when observation reveals no pollutants. For surface platforms, a report is required at least once every 24 hours. For aerial observations, a description of the flight path is required.

Observational code:

This code is to be used for the information to be entered in the columns marked A, B, C, D, on the log form for "Observation and Reporting of Oil Slicks and other Floating Pollutants"

Status of observation:

0 = Sea surface observed but no pollutants reported

1 = Sea surface not observed (due to high sea, bad visibility or other reasons)

PLATFORM /SHIP		COUNTRY	INSTITUTE	HEIGHT of OBSERVER ABOVE SEA LEVEL METERS
TYPE	NAME			

DATE/TIME GMT						LAT.		LONG		OBSERVATIONAL CODES				DIMENSION (K. N. MILES)		Environmental Information						REMARKS (Description of Pollutants, etc.
																WIND		WAVE		AIR TEMP	WATER TEMP	
DAY	MO.	YEAR	HR.	MIN.		DEG.	MIN.	DEG	MIN.	A	B	C	D	ALONG TRACK	ACCOSS TRACK	DIR.	SPEED	PER	HT.			

PERSON/ORGANIZATION TO CONTACT FOR FURTHER INFORMATION ABOUT THIS REPORT

NAME _____ ADDRESS _____

Figure I : LOG FORM for Observation and Reporting of Oil Slicks and other Floating Pollutants
(Please refer to instructions on how to complete this form)

2 = Pollutants observed and recorded

Types of pollutants:

1 = Thin oil film (may include occasional minor patches or lumps of thick oil)

2 = Thick oil layer (may be surrounded by oil films, which should be included under this same code)

3 = Plastic materials

4 = Other (specify in remarks column)

Configuration:

1 = Continuous cover

2 = Patches

3 = In a line or lines

4 = Patches and lines

Extent:

The proportion of the sea surface covered should be reported in eigths of the seas surface (as in the WMO code for ice coverage):

1 = 1/8 (slightest presence of reported pollutant)

2 = 2/8

3 = 3/8

4 = 4/8 (half of surface is covered)

5 = 5/8

6 = 6/8

7 = 7/8

8 = 8/8 (complete cover)

Wind direction and speed:

(a) True wind direction (Enter the true direction, in tens of degrees, from which the wind is blowing).

(b) Wind speed (or "force" on the Beaufort scale).

Wave period and height:

(a) Period of wind waves (Enter the average period of wind waves to the nearest second).

(b) Height of wind waves (Report height to the nearest half metre according to the following WMO code:

00 = calm

01 = 1/2 metre

02 = 1 metre

03 = 1 1/2 metre

04 = 2 metre

05-99 = Increase at 1/2 metre intervals).

Air temperature:

Enter the air temperature to the nearest tenth of a degree Celsius.

Water temperature:

Enter the sea surface temperature to the nearest tenth of a degree Celsius.

3. Distinguishing between oil slicks and natural films

A large spill of crude oil or a residual fuel is obvious to the eye. If it has not weathered to tar-like residues, there will be central zones which are brown or black in colour and represent thick oil layers. These will be surrounded by thinner films sometimes showing an iridescence or sheen (variously coloured bands due to light interference effects). At the outer edges of the petroleum slick even thinner films may be present with no obvious colours, but which are visible because of their damping effect on the capillary ripples. Subsequent weathering of these heavy petroleum products will lead to tar residues within the oil slick, usually at the downwind end.

Description of different surface films:

It is difficult to distinguish between natural sea slicks and the films formed by some types of petroleum products. Such problems may arise when the spilled oil is a distillate product (diesel oil, lubricating fluid, or fuel oil) which has spread into a thin film with little colour. Since an oil film of this type eliminates capillary ripples as does a natural sea slick, the following guides should assist the observer in distinguishing between petroleum oils and natural films.

(a) When winds are greater than 8 knots (4.1 m/sec.), natural slicks are readily dispersed. Under these conditions visible natural surface slicks will be rare, and visible films should be assumed to be oil pollution. However, a long, narrow, isolated band of slick, sometimes containing seaweed and ship's refuse, should not be considered an oil slick.

(b) Under relatively calm wind conditions a considerable percentage of the sea surface can become covered with a natural surface film, as evidenced by extensive areas of water without ripples. Pollutant slicks may be confused with natural films under such low-wind conditions. The following rules of judgement should be applied in such a case:

(i) if the condition indicated in the first paragraph of section 3 are observed (layers of dark oil and/or tar residues) or if an oily odour is evident, the slick should be considered of petroleum origin;

(ii) when the sea is relatively calm and if the slick is not obviously petroleum, it should be considered to be a natural film and not recorded. When it is not possible to distinguish between a natural slick and an oil slick, the quantity of pollutant oil would be extremely small and the slick should not be recorded as a spill.

(c) Description of a "natural slick":

A natural slick is usually caused by a film of recent biologically-produced organic material, too thin to be seen but indicated by its ability to damp and to resist the formation of wind generated ripples. The ripple-damping property produces a pattern of light reflection which renders the slick visibly different from the surrounding rippled water. The slick is usually lighter in appearance than the rippled water, but may be seen as a darker zone when viewed toward the sun. In the absence of wind (no ripples), the entire sea surface may appear to be slicked. There is usually no evidence of film colour, oily odour, or thick films unless pollutants oils are present.

B. PROCEDURES FOR THE SAMPLING AND REPORTING OF PARTICULATE PETROLEUM RESIDUES (TAR BALLS)

1. Sampling devices

Any neuston sampler is suitable if used correctly, i.e. properly deployed and towed at its optimum speed. Nets fitted to the sampler should be a plain nylon-web type.

Information on methodology and suitable neuston samplers is to be found in:

Sameoto, D.D. and Jaroszynski, L.O. (1969), Journal of the Fisheries Research Board of Canada, Volume 26, pages 2240-2244,

Derenbach, J.B. and Enrhardt, M. (1975), Berichte der Deutschen Wissenschaftlichen Kommission fur Meeresforschung, Volume 24, pages 207 207-208.

David, P.M. (1965), Journal of the Marine Biological Association of the United Kingdom, Volume 45, pages 313-320.

Zooplankton sampling, UNESCO Monographs on oceanographic methodology No.2. second imp. 1974, 174 pages.

2. Sampling procedure

(a) Samples may be taken day or night, but it should be recognized that daytime sampling will probably reduce the number of organisms sampled. It is desirable (but not essential) to collect a water sample for measuring dissolved/dispersed hydrocarbons at the same location where the tar sampling is carried out.

(b) The sampler must be rigged so that it will move away from the side of the ship and pass through water that has not been contaminated by the ship. It should therefore be towed from a point well forward on the ship, and preferably from a boom. The bridle must be attached to the side of the sampler nearest to the ship. It is to be adjusted, depending on the elevation of the towing point on the ship, so that the sampler rides smoothly.

(c) Adjust the towing speed so that the sampler rides smoothly at the surface for at least 1 nautical mile (depending on the sampler used). If wave conditions do not allow a smooth ride, record the average time that the sampler's muzzle is above or below the surface (instead of sampling it) per time unit, and correct the value of the area swept accordingly.

(d) On completion of the tow, retrieve the sampler, wash its contents down to the end of the net and empty them into a fine sieve. If the net contains an undue amount of extraneous material, empty it into a clean bucket containing water. Recover the tar balls from the sieve or from the bucket and place them in a glass jar.

(e) If fresh sticky oil adheres to the net in quantities exceeding approximately 10 per cent of the sample taken, wash the net with a suitable solvent and retain the washings in a jar. In case quantitative recovery of the tar sticking to the net surface is impossible, record its estimated amount as a proportion of the total sample.

3. Preservation of samples

The freezing of samples is recommended; if this is impracticable they should be refrigerated and the analysis should be completed as soon thereafter as possible.

4. Recording of samples

Record the location, time, sea conditions and other pertinent information on the log form (see figure II).

5. Analysis procedures

(a) If the tar balls have been separated manually from the larger particulate matter also sampled, they may be weighed directly. However, this weight may include inorganic materials such as sand or bits of shells and any water contained in the tar balls. A more reliable estimate may be obtained by proceeding as outlined in (b) below.

(b) If it is not possible to separate the tar balls manually from extraneous material,

(i) dissolve the tar balls in carbon tetrachloride,

(ii) filter the carbon tetrachloride extract into a weighed evaporating vessel and evaporate to dryness: the solvent used to clean the net (as in item 2(e) above) should also be evaporated. In both cases the evaporation may be hastened by mild heating, but boiling should be avoided as there will be some loss of volatile components. This operation should be carried out under a fume hood or in an area with good ventilation,

PLATFORM/ SHIP		COUNTRY	INSTITUTE		SAMPLING DEVICE	MESH SIZE
TYPE	NAME					

STATION NUMBER	SAMPLE NUMBER	WIDTH OF NET (CM)	DISTANCE TOWED (N.MILES)	WEIGHT OF TAR (g)	TAR CONC. (mg/m^2)	DATE			TIME		POSITION				ENVIRONMENTAL INFORMATION					
											LAT.		LONG.		WIND		WAVE		TEMP. °C	
						DAY	MO.	YR.	HR	MIN	DEG	MIN	DEG.	MIN	DIR.	SP.	PER	HT.	AIR	WATER

NAME OF PERSON/OFFICE TO CONTACT FOR FURTHER INFORMATION CONCERNING THIS REPORT.
NAME: ADDRESS:

Figure II : LOG FORM for Sampling and Reporting Particulate Petroleum Residues (Tar Balls)
(Please refer to instructions for completing this log)

(iii) weigh the evaporating vessel and residue.

6. Weight of the tar

Enter the weight of the tar in the log column "weight of tar". In the column "tar concentration" enter the calculated weight of tar per unit area swept by the sampling net.

C. TAR SAMPLING ON BEACHES

1. Selection of area

The sampling should take place on a sandy beach with:

(a) a uniform shoreline (no breakwater or cuts);

(b) a gentle slope, but not so as to make distance from the high to the low tide mark (where applicable) too large for practical sampling;

(c) a minimum of human activity, such as foot traffic, etc;

(d) no local land-based sources of petroleum pollution (otherwise specify in the remarks column of the log form attached as figure III).

2. Size of sampling zone

Tar should be collected at a few stations along the coast. At each station three randomly chosen narrow strips of 1-2 metres width are to be sampled, running across the beach from the backshore to the low tide mark. (Local conditions should be taken into account in selecting a representative sampling zone).

If uniformity of tar distribution in a given area has been established by statistical analysis of data obtained either by air photography or by direct sampling, the number of strips per station can be reduced to one. If areas with different concentrations of tar can be distinguished, each area should be treated separately.

3. Sampling procedures

Stake out the area as proposed above in section 2. Clean off all debris from the backshore to the waterline prior to sampling. Sample only at or near the time of low tide. Pick up all visible solid and semi- solid pieces of tar on the beach surface only.

In heavily polluted areas where picking up tar would be too time consuming, sample by brushing the upper 2-3 cm of the selected stripe, using a long handled floor brush. The piles created which consists of sand, tar, and other particles are then sampled and washed free of sand with sea-water, using a screen with a 2 mm mesh.

Location	Date	Recorder	Time of low tide (local time)	Time of collection (local time)	Prevailing[1] wind direction	Weight of collected tar in grammes per square metre				REMARKS
						non sandy[2]	sandy[3]	coquina[4]	total	

(1) Prevailing wind direction since the previous sampling as: onshore
offshore
alongshore

(2) nearly free of sand

(3) coated with sand and may contain entrained sand

(4) very hard and brittle and may contain shell fragments

Figure III : LOG FORM for Sampling and Reporting of Tar on Beaches

4. Sample analysis

The analysis is done by weighing the tar. This is easily achieved when dealing with clean tar lumps. When the tar particles are heavily covered with sand, cleaning is not advisable. In this case it is suggested that the volume rather than the weight be measured. Put the tar particles into a graduated cylinder. Add water so that all the particles are covered. Read the volumes. Decant the water into a second graduated cylinder. Substract the smaller from the larger volume. The weight of the tar can then be calculated from the volume of water displaced, assumung a density of 0.85 gm/cc (multiply differences by 0.85).

In heavily polluted areas with hundreds of grams of tar per square metre of beach, it is preferably to separate different sizes of tar particles, using a sieve with a 1 cm mesh. The tar contained in each fraction is measured as described above.

5. Sample recording

A draft form with coding instructions and explanatory notes is attached as figure III. If the samples are treated accordingly to the instructions in item 4 above, the weight should be entered under "Weight of collected tar", subcolumn "non-sandy".

6. Prevailing wind direction

The prevailing wind direction since the previous sampling should be entered under the appropriate column as explained in footnote (1) on the log form (see figure III).

D. PROCEDURES FOR SAMPLING, ANALYSIS AND REPORTING PETROLEUM HYDROCARBONS DISSOLVED AND DISPERSED IN SEA WATER

1. Sampling bottle

The device described in figure IV is recommended for collecting the water samples: it consists of a weighted bottle holder with a clean amber glass bottle (2800 ml or 1 gallon standard reagent bottles); the bottle holder is attached to a float by a line of 1 m length; a second retrieving line of suitable length is attached to the float and is used to recover the assembly after the sample has been taken.

How to clean the sample bottle: Use dichromate-sulphuric acid. Preparation of the sample bottle: Remove the dichromate-sulphuric acid, rinse thoroughly with tap water (wear goggles). A continuous liquid film on the wet bottle should be an indication of absence of grease. Replace the original cap liner by a clean teflon or aluminium foil liner. Do not touch with fingers. Leave the bottle to dry. Rinse the dry bottle with CCl_4 and discard the washing. Add a fresh portion of 50 ml of CCl_4 and secure the screw cap.

CCl_4 is recommended because it is readily available in a highly purified form, has an affinity for non-polar organic molecules, is non-flammable and only slightly soluble in water. Since its specific gravity is appreciably greater than that of sea-water, the CCl_4 usually separates readily from the aqueous phase without emulsification. Aromatic-free CCl_4 may be prepared from reagent-grade CCl_4 by

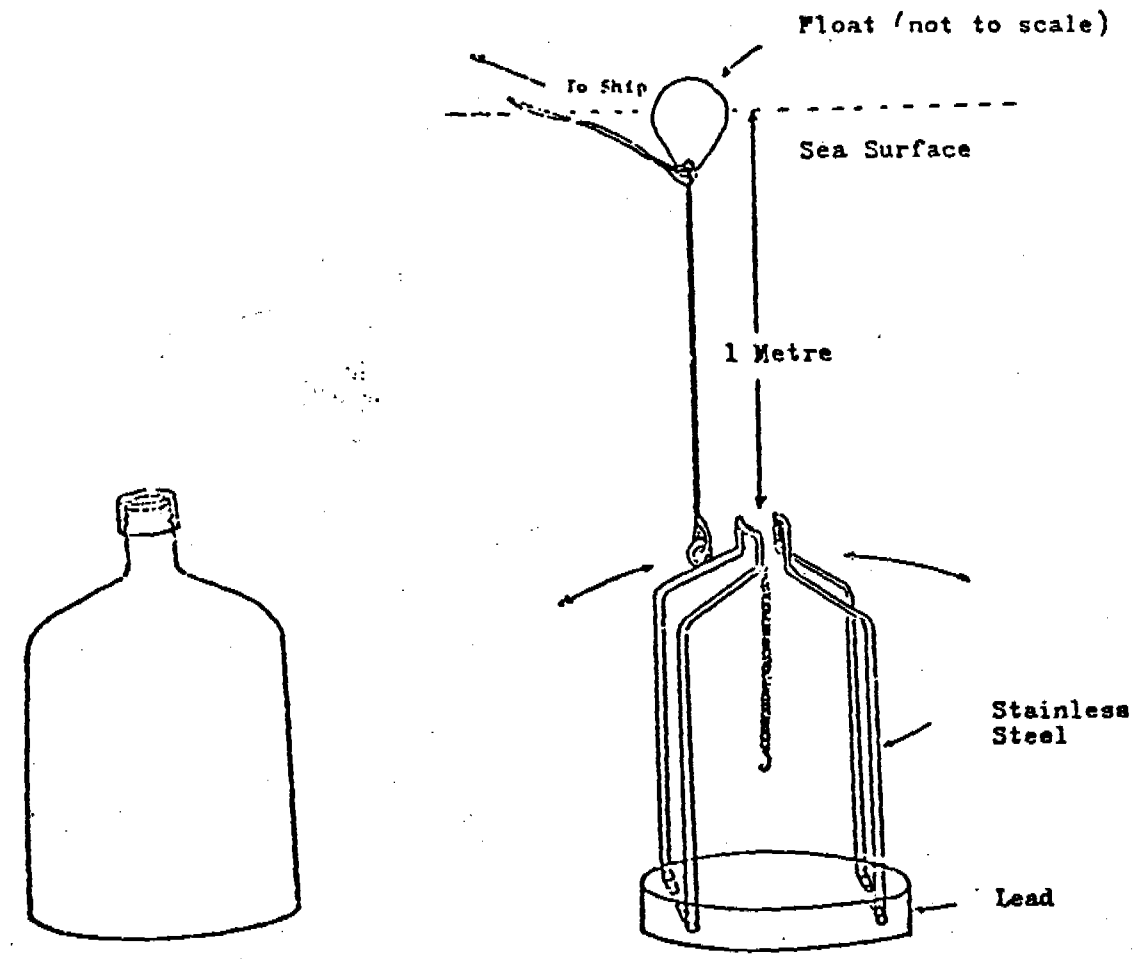


Figure IV : Recommended device for collection of water samples for the analysis of dissolved/dispersed petroleum hydrocarbons

refluxing with activated charcoal and distillation or by column chromatography over activated alumina. Do not use recovered CCl_4.

2. Sampling

Samples should be taken in triplicate. While the ship is still moving slowly forward, the assembly is thrown overboard from the bow and as far as possible away from the ship to avoid water that has been distributed or contaminated by the ship. Make sure the lead weight hits the water surface first. If the assembly hits sideways, the bottle may be forced through the frame and thus be lost. The bottle will immediately sink to 1 m and fill the water. Upon retrieval, some water is spilled (sufficient to allow for possible thermal expansion, approx. 50 ml) out of the bottle. The cap is securely fastened. The bottle containing the water and CCl_4 is shaken vigorously to disperse the CCl_4 throughout the water. The CCl_4 is then allowed to settle and the bottle stored away.

CAUTION: Since the concentration levels of dissolved/dispersed petroleum residues in the open sea are generally in the range of a few microgrammes per litre, or less, throughout the procedure great care must be taken to avoid contamination.

3. Sample preservation

Samples should be kept in the dark. When carbon tetrachloride is used, freezing is not necessary since this solvent is an effective bacteriostat. Samples should be analyzed as soon as possible.

4. Recording of samples

To identify the samples, a log must be maintained, noting the position, date and time. Specified environmental data should also be given when possible. The log forms are attached as figures V and VI.

If samples are collected from the depths greater than 1 metre, enter depth of sampling in the "Remarks" space of the log form.

5. Processing and analysis of samples

(a) Extraction

Draw the CCl_4 phase into a clean pipette and transfer into a clean 100 ml pear-shaped flask. A second extraction is carried out by adding 50 ml of CCl_4 to the sea-water samples and repeating the foregoing procedure. The two portions of CCl_4 are combined.

(b) Extract concentration

Although CCl_4 is an ideal solvent for the extraction process, it is not a suitable medium for the fluorescence analysis. Therefore, the CCl_4 must be replaced by a solvent, such as n-hexane, which does not absorb light in the 300-400 nm range.

The CCl_4 is removed from the extract by evaporating it to dryness in a rotary evaporator or by mildly heating the flask in a water bath (do not allow the extract to boil). If 80 per cent of the CCl_4 has been evaporated, and an aqueous phase is

PLATFORM/SHIP			COUNTRY	INSTITUTE	CRUISE NUMBER
TYPE	NAME				

STATION NUMBER	SAMPLE NUMBER	CONCENTRATION µg/l	DATE			TIME		POSITION				ENVIRONMENTAL INFORMATION						REMARKS
			DAY	MO	YR.	HR.	MIN	LAT.		LONG.		WIND		WAVE		TEMP °C		
								DEG.	MIN	DEG.	MIN	DIR.	SP	PER	HT	AIR	WATER	

NAME OF PERSON/OFFICE TO CONTACT FOR FURTHER INFORMATION CONCERNING THIS REPORT.
NAME: _____ ADDRESS: _____

Figure V : LOG FORM for Sampling, Analysis and Reporting Dissolved/Dispersed Hydorcarbons
(Please refer to instructions for completing this log)

PLATFORM/SHIP		COUNTRY	INSTITUTE	CRUISE NUMBER
TYPE	NAME			

STATION NUMBER		SAMPLE NUMBER		COLLECTION TECHNIQUE AND SAMPLING EQUIPMENT (1)	IDENTIFICATION OF STANDARDS (2)	ANALYTICAL METHODS AND IDENTIFICATION OF INSTRUMENTATION (3)
FROM	TO	FROM	TO			

ADDITIONAL (OPTIONAL) DOCUMENTATION

FILTERED/UNFILTERED (CIRCLE ONE) _____ DATE (S) OF SAMPLE ANALYSIS _____
FILTER SPECIFICATIONS _____ SAMPLE APLIT _____
TYPE OF SAMPLE BOTTLE _____ EXTRACTION PROCEDURE _____
FIXING AGENTS _____ SAMPLE PURIFICATION _____
SAMPLE OF FROZEN/REFRIGERATED/AMBIENT (CIRCLE ONE) ___ ESTIMATED ACCURACY OF METHOD ___
DURATION OF SAMPLE STORAGE _____ OTHER (USE REVERSE) _____

NOTE:
(1) eg. PLASTIC BUCKET, GLASS JAR, SHIP'S INTAKE
(2) THE OIL USED TO CALIBRATE THE INSTRUMENTATION OR METHOD
(3) NARRATIVE DESCRIPTION, WITH EMPHASIS ON DIFFERENCES (IF ANY) FROM THE TECHNIQUES RECOMMENDED BY THE PILOT PROJECT OPERATIONAL PLAN, 1974

Figure VI : DATA DOCUMENTATION FORM (For use with Log Form for Sampling, Analysis and Reporting Dissolved/Dispersed Hydrocarbons) (To be prepared by analyzing laboratory)

still present, pipette the CCl_4 phase into another clean flask and evaporate to dryness.

(c) Clean-up

A general clean-up procedure is outlined in section 7 below. In some areas with a high biological productivity or in some estuarine areas, it is necessary to clean up the extract before proceeding with the analysis. The clean-up should remove non-petroleum material that fluoresces under given conditions. Furthermore, materials that may cause quenching will be removed simultaneously.

(d) Fluorescence measurement

The residue is dissovled in aromatic-free n-hexane (check by fluorescence analysis) and transferred quantitatively into a 5 ml volumetric flask. N-Hexane is added to make the level up to the 5 ml mark. From the volumetric flask a sample of the extract dissolved in n-hexane is placed into a capped 1-cm silica cell.

Place this cell in the spectrofluorometer and measure the intensity of fluorescence in the neighbourhood of 360 nm (excitation at 310 nm). Adjust the excitation and emission wave lengths for maximum response. If possible, both the excitation and fluoroscence spectra for each sample should be scanned. The mixture of fluorescing substances (primarily substituted benzenes and polynuclear aromatic compounds) present in crude and residual fuel oils are excited most strongly at 310 nm and fluoresce most intensively in the neighbourhood of 360 nm.

(e) Calibration

The fluorescence intensity of the sample analyzed is compared with the fluorescence of a reference solution of almost the same concentration as the known extract or to a series of reference solutions. When the measurement of fluorescence of the samples takes more than one day, the fluoresence of the reference solution must be measured at least once a day under identical instrumental conditions.

At present, each laboratory may use its own standards, e.g. dilutions of a crude oil of medium aromatic content. However, to enable equipment and concentrating procedures to be intercalibrated, chrysene is the chosen intercomparison chemical.

When some material other than chrysene, e.g. a diluted crude oil, is used as a standard, a Comparison Ratio "R" of this material as compared with chrysene, should be determined. Using concentrations of about 0.5 ug/ml, the fluorescence of the standard oil and chrysene are measured. The comparison ratio "R" required is calculated as:

$$R = \frac{\text{fluorescence intensity of the chrysene sample} \times \text{weight of standard oil in the sample}}{\text{fluorescence intensity of the standard oil sample} \times \text{weight of crysene in the sample}}$$

(f) Blanks

Throughout the procedure great care must be taken to ensure that samples are not being contaminated; for example, avoid unnecessarily exposing the sea-water sample, the CCl_4 or the final extract, to the atmosphere or other potential sources of

contamination. Solvents and equipment are to be checked frequently for contamination by analyzing blanks, treating a pre-extracted water sample as a blank sample and/or analyzing 100 ml of CCl_4 as a blank extract. One should eliminate sources of contamination rather than adjusting or correcting the data actually obtained to correct for the blank value.

(g) Quantification of results

Calculate the unknown concentration of the sample using the calibration curve. Finally, using the volume of seawater processed, calculate the concentration of fluorescing material as ug of oil or chrysene equivalents per litre of seawater.

Care should be exercised to ascertain the absence of self-quenching effects. In doubtful cases dilute the sample to approximately half the original concentration and check for proportionality of instrument response.

6. Handling of data

Data obtained from samples and intercomparison measurements should both be recorded on the log form (fig. V and VI). If data are stated as chrysene equivalents prefix "C" to the concentration found. If the concentration was measured as oil equivalents, enter in the "Remarks" column the Comparison Ratio "R" of that standard oil and used as compared to chrysene (section 5 (e) above).

7. Procedures for a clean-up of the extract

As stated in section 5 (c), a clean-up of the extract might be necessary to remove non-petroleum material. These compounds could interfere with the fluorometric measurement, especially when analyzing samples taken from areas of very high biological productivity or from estuaries. The clean-up is achieved by a simple column chromatographic purification. Again, great care must be taken not to introduce contamination during any steps of the analysis.

(a) Preparation of the material to be used

Silica gel with particles of an average diameter between 0.4 and 0.8 mm (approx. 20-40 mesh) is refluxed in a Soxhlet extractor for about six hours, using n-hexane, carbon tetrachloride or any other suitable clean solvent, renewing the solvent at least once during the procedure. The silica gel is dried out and activated at 120°C for approximately eight hours. During the subsequent cooling of the silica gel, but while it is still warm, it is poured into a glass-stopped bottle and immediately deactivated with 2 per cent by weight of distilled water. After being shaken the silica gel is left to equilibrate for several hours. If not used immediately, it may be kept for up to four weeks depending on the handling and the air humidity.

In case there are doubts about its purity, the distilled water for deactivation should be prepared as follows: Distil the water (as clean as you can obtain it) in an all-glass still in the presence of $K_2S_2O_8$ at a pH of 2-3 (adjusted with H_3PO_4).

(b) Preparation of the column, and chromatographic clean-up

Fill the lower part of a glass tube (inner diameter 0.9 cm; the lower and reduced in diameter and stoppered with some clean glass wool) for a length of 14 cm with deactivation silica gel. Apply the sample extract (prepared as indicated in section 5 (b) above and dissolved in a few ml of n-hexane) to the column and eluate with

n-hexane. The first 6 ml are discarded as they come off the column. The next 30 ml are collected, concentrated by evaporation, transferred quantitatively into a 5 ml volumetric flask, made up to the 5 ml calibration mark with non-fluorescing hexane, and analyzed as described in section 5 (d) above.

This clean-up procedure may have to be modified as to the deactivation of silica gel, the length of the column, etc. to meet local conditions. When a clean-up procedure is adopted, blanks and standards should be treated in the same way as the actual water extracts.

8. Calibration and intercomparison

(a) Chrysene as the standard

Chrysene has been chosen as the standard material for calibrating the fluorometer and intercomparing analytical procedures. It is available for these purposes in two formats, Chrysene I and Chrysene II.

Chrysene I is packed under nitrogen in sealed, dark vials containing 0.5, 1.0, 3.0, 5.0, 10.0 ug of chrysene without solvent. Chrysene I samples are used to calibrate the fluorometer (omitting concentration procedures).

Chrysene II is packed under nitrogen in sealed dark vials containing 0.5, 1.0, 3.0, 5.0, 10.0 ug chrysene in about 100 ml of CCl_4. Chrysene II is to be used for the intercomparison of concentration procedures. In the event that participants encounter difficulties with postal authorities regarding the solvent, Chrysene I should be ordered and the solution prepared with CCl_4 in the participants' own laboratories.

When working on either Chrysene I or II samples, the participating laboratory will quantitatively remove the material from the vial to prepare intercomparison solutions. When calibrating the fluorometer with Chrysene I samples, the exact volume of n-hexane (5 ml. see section 5 (b)) must be recorded as it is necessary for calculating the concentration of chrysene per ml.

Chrysene III. In many countries pure chrysene can be purchased without difficulty. Therefore, laboratories should be able to prepare their own intercomparison solutions in n-hexane (Chrysene III), which should be used as reference solutions when measuring actual water extracts.

However, these Chrysene III solutions are to be compared with the circulated intercomparison material (Chrysene I or II). All subsequently purchased batches of chrysene are also to be compared, to ensure equal fluorescence properties. If possible, both the excitation and fluorescence spectra for each solution should be scanned to locate the wave lengths of maximum response.

(b) Intercomparison procedures

(i) For the calibration of the fluorometer, use Chrysene I samples after dilution with n-hexane to make up 5.0 ml. Measure the fluorometric response for various concentrations up to the maximum response to be expected from the actual water extracts. The Chrysene III reference solutions must also be measured. Response values are then plotted against chrysene concentrations in ug/ml to obtain a calibration curve.

Note: if the intercomparison solutions are kept free from contamination, there should be only a very small non-zero intercept.

(ii) For intercomparing the concentration procedures, Chrysene II samples are treated as water extracts (described from section 5 (b) onwards). The actual fluorometer reading, when compared with the response to be expected from the known concentration of chrysene in the sample according to the calibration curve, will then indicate any possible loss of material, or contamination.

(iii) For intercomparison of measurements of water extracts, reference solution of Chrysene in n-hexane (Chrysene III samples) are prepared and measured following the same procedure as that used for the unknown extract (see description under section 5 (e).

Appendix II

RECOMMENDATIONS OF THE EXPERT CONSULTATION

RELEVANT TO THE JOINT IOC/WMO/UNEP PILOT PROJECT MED POL I

(Msida, Malta, 8-13 September 1975)

It was suggested that apart from ocean data stations, which would be necessary for measurement of most parameters, ships of opportunity could be used in the whole of the Mediterranean, especially in major shipping lanes, for observation and sampling of oil slicks. It was recognized that monitoring of the open waters was necessary, as additional information on the situation in these areas was required. In areas where monitoring of petroleum hydrocarbons is being performed, data on the physical and chemical properties of sea water should be made available to all participating research centres.

The importance of intercalibration and standardization of equipment and methodology was emphasized, and IOC was requested to assist in this regard.

The Consultation gave careful consideration to the various available methods for analysis of petroleum hydrocarbons in sea water. It was recommended that fluorescence spectrophotometry be used as the reference method in view of its adequate sensitivity for estimating aromatic hydrocarbons, its simplicity in use, and its being less subject to error both in operation and interpretation of data.

Chromatographic techniques and infra-red (IR) spectrometry could be used to obtain additional information. It was recognized that the cost of chemicals used in any of the mentioned analytical techniques could be considered as a limiting factor.

In discussing the methodology for sampling and analysis of tar balls on beaches, the importance of this study for the Mediterranean region and the urgent need for further review of the methodology proposed in appendix I of annex I were pointed out.

Therefore, it was agreed:

(i) to encourage participating research centres to develop statistically significant procedures;

(ii) until a standard procedure is developed, participating research centres should follow as closely as possible the methodology for monitoring tar balls on beaches proposed (appendix I of annex I);

(iii) to request IOC, WMO and UNEP to collect the information on methods used and to convene a small team under the IGOSS Pilot Project to recommend standard procedures.

The role of remote sensing both from aircraft and satellites was discussed. This method offers great possibilities for monitoring marine pollution, many of the techniques are weather/light independent and are capable of rapid, efficient observation over large areas. This approach would provide a further dimension to the measurement of pollution extent and the circulation of coastal waters.

The potential requirements of participating research centres for instruments, sampling equipment and chemicals were reviewed, and an informal list of recommended instruments was brought to the attention of the co-ordinating bodies for the pilot projects.

It was also pointed out that maintenance, repair and calibration of instruments involved in the pilot projecs should be ensured by providing the research centres of riparian states with adequate infrastructure and maintenance facilities whenever possible.

The Consultation was informed about a Directory of the Mediterranean Research Centres being prepared by UNEP in collaboration with the specialized agencies and considered it as an activity which would contribute to better mutual information and collaboration.

Appendix III

RECOMMENDATIONS OF THE

IOC/WMO/UNEP MID-TERM REVIEW MEETING ON MED POL I

(Barcelona, 23-27 May 1977)

The meeting recommended that:

The document "Operational Guidelines for the Implementation of the Pilot Project MED POL I" (IOC/WMO/UNEP-MED/MRM/16), as amended by the meeting, be used by all participating research centres during the implementation of the remaining part of the project.

All MED POL I research centres should participate in the intercomparison exercise organized by the Marine Laboratory, Duke University, Beaufort, North Carolina, USA. The laboratory will supply the chrysene samples and instructions for intercomparison exercise and calibration of instruments. The Regional Activity Centre for MED POL I (RAC-I) should co-ordinate the distribution of samples and, if required, the collection of data. It was further agreed that raw data on intercomparisons will be made available to Duke University according to instructions issued for the exercise.

Collaboration between the RAC-I and the Regional Oil Combating Centre in Malta, is considered useful for future work both within the MED POL I project and beyond.

In writing progress reports, a uniform format should be followed and the IOC should provide each research centre with an outline of this format.

A interdisciplinary task team should be formed to accelerate modelling in the Mediterranean.

Research Centres should participate in the proposed regional cruise in the Mediterranean during 1978. The cruise is planned to monitor those zones of the Mediterranean which have not yet been well studied and those zones which are used for ballast dumping.

The cruise should be inter-disciplinary and the parameters to be monitored should include:

(i) oil slicks and other floating pollutants;

(ii) floating particulate petroleum residues or 'tar balls';

(iii) dissolved dispersed petroleum hydrocarbons in the surface waters.

ANNEX II

OPERATIONAL DOCUMENT

FOR THE JOINT FAO(GFCM)/UNEP PILOT PROJECTS ON

I BASELINE STUDIES AND MONITORING OF METALS, PARTICULARLY MERCURY AND CADMIUM, IN MARINE ORGANISMS (MED POL II)

II BASELINE STUDIES AND MONITORING OF DDT, PCBs AND OTHER CHLORINATED HYDROCARBONS IN MARINE ORGANISMS (MED POL III)

III RESEARCH ON THE EFFECTS OF POLLUTANTS ON MARINE ORGANISMS AND THEIR POPULATIONS (MED POL IV)

IV RESEARCH ON THE EFFECTS OF POLLUTANTS ON MARINE COMMUNITIES AND ECOSYSTEMS (MED POL V)

This operational document was produced by a joint FAO(GFCM)/UNEP Expert Consultation which took place in Rome, at the FAO Headquarters, from 23 June to 4 July 1975. The Consultation was attended by 50 participants from 13 Mediterranean countries. The text of the operational document is identical with that issued as part of the report of the consultation.

CONTENTS

CONTENTS Continued...

GENERAL INTRODUCTION

Under the joint auspices of the Intergovernmental Oceanographic Commission (IOC), the General Fisheries Council for the Mediterranean (GFCM) and the International Commission for the Scientific Exploration of the Mediterranean Sea (ICSEM), the United Nations Environment Programme (UNEP) supported an International Workshop on Marine Pollution in the Mediterranean (Monaco, 9-14 September 1974). The Workshop defined the pollution of coastal waters as the main problem in the Mediterranean and attributed it to the general lack of adequate systems for the treatment and disposal of domestic and industrial waste, to the input of pesticides and hydrocarbons (oil), and to the presence of pathogenic micro-organisms. The Workshop reviewed the available information on current regional programmes as well as on the research and monitoring facilities in the Mediterranean, and outlined several pollution monitoring and research pilot projects for the Mediterranean.

As a follow-up to the Workshop, the GFCM Working Party on Marine Pollution in Relation to the Protection of Living Resources, which met in Monaco from 16 to 18 September 1974, drew up a plan for the implementation of four of the pilot projects dealing with the protection of living resources and fisheries in the Mediterranean. These four pilot projects were the following:

1. Baseline studies and monitoring of metals, particularly mercury and cadmium, in marine organisms

2. Baseline studies and monitoring of DDT, PCBs and other chlorinated hydrocarbons in marine organisms

3. Research on the effects of pollutants on marine organisms and their populations

4. Research on the effects of pollutants on marine communities and ecosystems

At the UNEP Intergovernmental Meeting on the Protection of the Mediterranean, which was held in Barcelona, from 28 January to 4 February 1975, these four projects were endorsed in the frame of a Co-ordinated Mediterranean Pollution Monitoring and Research Programme as part of the adopted Mediterranean Action Plan and their early implementation recommended.

A Consultation was held in Rome (23 June - 4 July 1975) to which experts of the countries bordering the Mediterranean proper were invited in order to discuss the four pilot projects and prepare this Operational Document which will serve as the frame of the co-operation of the Mediterranean research centres in the four pilot projects. The Consultation was prepared and convened by the GFCM of FAO and financially supported by UNEP as part of the Mediterranean Action Plan.

I BASELINE STUDIES AND MONITORING OF METALS, PARTICULARLY MERCURY AND CADMIUM, IN MARINE ORGANISMS (MED POL II)

1. Outline of the Pilot Project

Metals, particularly mercury and cadmium, seem to be among the most dangerous potential hazards for marine organisms and for their consumers. Therefore, baseline studies on the level of various metals in marine organisms are already being conducted in a number of Mediterranean countries. These studies are mostly confined to edible marine organisms from the coastal waters and to a few pelagic organisms (e.g. tuna) of considerable commercial importance.

To achieve a better co-ordination of these studies, to improve the comparability of the obtained results and to obtain an overall picture of the levels of metals considered to be important, this co-ordinated Mediterranean pilot project on baseline studies and monitoring of metals in marine organisms is initiated.

The pilot project will be primarily based on the existing experience and national facilities in the Mediterranean countries, although the role of the international laboratories will not be neglected.

2. Programme of Work

2.1 Metals to be monitored

The Mediterranean, as a tectonically active region which receives large amounts of material from normal weathering processes, might already show high natural levels and great regional variations of various sea water microconstituents in the sea water and sediments. The additional amount of metals introduced by man's activities into the Mediterranean from various land-based sources may therefore be of considerable importance.

The pilot project will deal only with the concentration of selected metals, particularly mercury and cadmium, in marine organisms. Whenever possible, not only the total concentration of mercury but the concentrations of its organically bound forms will be determined too. In addition to mercury and cadmium, which will be the basic elements to be monitored, the measurement of the levels of copper, lead, manganese, selenium and zinc is recommended, particularly when detection methods providing for multi-elemental analysis are used, such as neutron activation analysis, X-ray fluorescence spectrometry and others.

2.2 Organisms to be monitored

Due to the fact that marine organisms accumulate metals to a high degree, monitoring of metals can best be achieved by analysing their levels on selected species.

The following species[1/]: striped mullet (*Mullus barbatus*), Mediterranean mussel (*Mytilus galloprovincialis* and/or *M. edulis*) and bluefin tuna (*Thunnus thynnus thynnus*), were selected for the monitoring programme so that representatives of

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1/ The names of species described in the publication "FAO Species Identification Sheets for Fishery Purposes - Fishing Area 37 - Mediterranean and Black Sea", FAO, Rome, 1973, are those used in this document.

different ecotypes are included. In addition, these species are of great economic importance and are almost ubiquitous for the whole Mediterranean, providing the possibility for comparison of results from various parts of the region. In the parts of the Mediterranean where the bluefin tuna is not regularly available, it should be substituted by the broadbill swordfish (Xiphias gladius).

2.3 Sampling frequency

The sampling frequency for the striped mullet and mussels will be seasonal (i.e. four times a year). No special sampling frequency is established for tuna and swordfish. In special areas where large fluctuations of metal concentrations are expected, more frequent sampling is recommended.

2.4 Sampling area

The monitoring will be carried out primarily in the coastal waters of the Mediterranean proper (Black Sea excluded). The open waters will be monitored only for tuna and swordfish.

The sampling stations will be selected by participating research centres so that the obtained results could be used to characterize the level of pollutants in certain areas. The existing and planned marine parks will be used as reference areas whenever possible.

2.5 Sampling procedures

The sampling of organisms, their storage and treatment prior to chemical analysis will be kept uniform as far as possible in order to ensure the highest possible degree of comparability for the obtained results.

Guidelines for sampling procedures will be developed and made available to participating research centres.

2.6 Analytical procedures

For practical reasons no standard analytical techniques will be used in carrying out the determination of the level of metals in collected biological samples. However, as reference methods, atomic absorption spectrophotometry and gas chromatography will be used for the analysis of the total concentration of metals and of the organically bound components, respectively.

Guidelines for analytical procedures will be developed and made available to participating research centres.

2.7 Analytical services

Not all the participating laboratories will be able to perform the chemical determination of the metals in collected organisms from the very beginning of the programme. Therefore, several Mediterranean research centres will act as subregional analytical service centres.

2.8 Intercalibration of analytical work

To avoid systematic errors and to improve the comparability of the analytical result, an intercalibration exercise will be an integral part of the programme. In this exercise all research centres performing analytical work will participate.

The technical organization of the intercalibration exercise, including the preparation and distribution of adequate reference material, as well as the collection and evaluation of the obtained results, will be done by the International Atomic Energy Agency (IAEA) International Laboratory for Marine Radioactivity, Monaco (see annex VIII).

II BASELINE STUDIES AND MONITORING OF DDT, PCBs AND OTHER CHLORINATED HYDROCARBONS IN MARINE ORGANISMS (MED POL III)

1. Outline of the Pilot Project

Pesticides and other persistent organic compounds have been recognized as a serious threat to marine organisms. The available data on their concentration in various Mediterranean organisms are scarce and, for large parts of the Mediterranean, even non-existent. Therefore, in order to gain a better understanding of the problems stemming from the presence of these substances in the Mediterranean basin and to co-ordinate the present national efforts, a co-ordinated Mediterranean pilot project on baseline studies and monitoring of DDT, PCBs and other chlorinated hydrocarbons in marine organisms is initiated.

The pilot project will be primarily based on the existing experience and national facilities in the Mediterranean countries, although the role of the international laboratories will not be neglected.

2. Programme of Work

2.1 Compounds to be monitored

Man has made increasing use of various chemicals provided by chemical sciences. It has become evident that, in the course of this use, the chemicals have become widely dispersed in the environment. This is especially true for certain persistent organochlorine compounds used as insecticides, as important ingredients of various products or as by-products of certain industrial processes. Trace amounts of these substances have been detected even in areas well removed from any application. The Mediterranean is no exception.

The pattern of accumulation and transfer of organochlorine compounds in marine organisms is quite complex depending on the physical and chemical environmental conditions, as well as on the physiology of various organisms.

The pilot project will deal with the levels of selected organochlorine compounds which are considered as specially relevant to representative members of the Mediterranean ecosystems, DDT, PCBs, dieldrin and their metabolites are singled out as falling into this category but whenever possible other persistent organic compounds will also be identified in analysing samples.

2.2 Organisms to be monitored

Marine organisms, responding to a complex aquatic environment, tend to integrate the various influences coming from their surrounding. Thus the levels of organochlorine substances found in marine organisms can be taken, with certain precautions, as a measure of their overall and variation in the environment. Monitoring of

organochlorine concentrations in organisms can therefore reduce the dynamic complexities of a physico-chemical system to obvious facts applicable in practical work.

Starting from this idea, the following organisms are selected for the monitoring programme so that representatives of different ecotypes are included: striped mullet (Mullus barbatus), Mediterranean mussel (Mytilus galloprovincialis and/or M. edulis) and deep-water pink shrimp (Parapenaeus longirostris). In addition, the selected organisms are of great economic importance and are almost ubiquitous for the whole Mediterranean, providing the possibility for comparison of results from various parts of the region. In parts of the Mediterranean where the deep-water pink shrimp is not regularly available, it should be substituted by the Mediterranean shore crab (Carcinus mediterraneus).

2.3 Sampling frequency

The sampling frequency for all recommended species will be seasonal (i.e. four times a year). In special areas where large fluctuations of environmental concentrations of organochlorine compounds are expected, more frequent sampling is recommended.

2.4 Sampling areas

The monitoring will be carried out primarily in the coastal waters of the Mediterranean proper (Black Sea excluded).

The sampling stations will be selected by participating research centres so that the obtained results could be used to characterize the level of pollutants in certain areas. The existing and planned marine parks will be used as reference areas whenever possible.

2.5 Sampling procedures

The sampling of organisms, their storage and treatment prior to chemical analyses will be kept uniform as much as possible to ensure the highest possible degree of comparability for the obtained results. Guidelines for sampling procedures will be developed and made available to participating research centres.

2.6 Analytical procedures

For practical reasons no standard analytical technique will be used in carrying out the determination of the level of organochlorine substances in collected biological samples. However, gas chromatography will be used as reference method in the analysed samples.

2.7 Analytical services

Not all the participating research centres will be able to perform the chemical determination of the organchlorine compounds in collected organisms from the very beginning of the programme. Therefore, several Mediterranean research centres will act as subregional analytical service centres.

Provisions will be made for the use of existing or creation of new gas chromatography-mass spectroscopy units to provide confirmatory tests for certain doubtful results.

2.8 Intercalibration of analytical work

To avoid systematic errors and to improve the comparability of the analytical results, an intercalibration exercise will be an integral part of the programme. In this exercise all laboratories performing analytical work will participate.

The technical organization of the intercalibration exercise, including the preparation and distribution of adequate reference material, as well as the collection and evaluation of the obtained results, will be done by the IAEA International Laboratory for Marine Radioactivity, Monaco (see annex VIII).

III RESEARCH ON THE EFFECTS OF POLLUTANTS ON MARINE ORGANISMS AND THEIR POPULATIONS

(MED POL IV)

1. Outline of the Pilot Project

The marine environment is characterized by relatively constant physical and chemical conditions. Most marine organisms are therefore adapted to sudden changes in their environmental conditions, to certain substances not normally present in sea water, or to unusually high concentrations of substances which normally appear only as sea water micro-constitutents. Taking into account the present state of knowledge on the effects of these substances on Mediterranean organisms, a co-ordinated research project on the effects of pollutants on marine organisms and their populations is initiated.

The project will not deal with acute toxicity experiments unless the organisms cannot be kept long enough under culture conditions to allow long-term toxicity tests. Instead, long-term experiments are envisaged with the aim of investigating the sublethal effects of potential pollutants, and functional as well as morphological changes.

The experiments will not be limited to individual organisms but should rather cover populations where subtle changes in the behavioural pattern could serve as early warning signs and lead to the possibility of predicting the moment at which the organisms will be harmed at the population level. The influence transmitted through the trophic chains, particularly in experiments on populations, will not be neglected.

Due attention will be paid to establish the most sensitive states in the life cycle of the tested organisms. Physiological and biochemical studies will be conducted in order to provide information on the mechanisms involved in the effects and transport of pollutants.

The damage to the genetic material of individuals and their populations will be studied.

2. Programme of Work

2.1 Substances to be studied

As substances whose effects on marine organisms will be studied, the following are recommended (not in order of priority): arsenic, cadmium, copper, lead, manganese,

mercury, selenium, zinc, DDT, PCBs, dieldrin and their derivates as well as fossil hydrocarbons and mineral or organic nutrients, although other pollutants might be included too whenever specific reasons arise.

Pollutants do not occur in the marine environment as individual substances but in various physical or chemical combinations. Therefore, their physical and chemical interactions and their potential synergistic effects will be carefully examined.

2.2 Organisms to be studied

Studies on the effects of pollutants on marine organisms and their populations will be carried out primarily on species recommended to be monitored for metals and chlorinated hydrocarbons. They are Mullus barbatus, Mytilus galloprovincialis and/or M. edulis, Parapenaeus longirostris, Carcinus mediterraneus.

In addition to these organisms the following were recommended: heterotrophic micro-organisms, phytoplankton (Phaeodactylum tricornutum, Leptocylindrus danicus, Sceletonema costatum, Coccolithus huxleyi), zooplankton (Euterpina acutifrons, Acartia clausi, Clausocalanus arcuicornis), sponges, polychaetes (Capitella capitata, Scolelepis sp.), echinoderms (Arbacia, Paracentrotus), arthropods (Palaemon serratus, Paenaeus kerathurus, Idotea baltica) and fish (Mugil cephalus, Sparus auratus, Dicentrarchus labrax, Scyliorhinus canicula).

2.3 Effects to be studied

In all experiments the environmental conditions, particularly the concentration and the physico-chemical forms of the pollutants under investigation in sea water and food, the body burden of pollutants and the dynamics of their accumulation, will be carefully determined and correlated with the observed effects. Whenever possible, field observations and tests will be performed to verify the results of the laboratory investigations.

The recommendations given by special panels (e.g. Durham Report, ACMRR/IABO Working Party on Biological Effects of Pollutants, ACMRR Working Party on Biological Accumulators, Water Quality Criteria, Washington D.C., 1973) will be closely followed in the experimental work performed as part of this project.

Two types of bioassays will be used during the project:

- Acute bioassays. They will be used only to a limited extent in special cases mentioned in the outline of the project although the scope of the concentration/response curve can give some identification of the reaction of the test organism.

- Chronic sublethal bioassay tests. A variety of tests will be providing information on morphological, physiological, biochemical and behavioural changes in the test organisms and their populations. Additionally, tests for the determination of damage caused by pollutants to the genetic material will be attempted.

The ultimate aim of all these tests is to develop the necessary background for biological monitoring and to contribute data required for the development of water quality criteria. Naturally, these criteria cannot be based solely on biological tests but the expected results might provide the basis for a better understanding of the potential hazard for the ecosystem, including man, from the increased level of pollutants in the marine environment.

2.4 Methodology to be used

To achieve a good comparability of biological experiments is a very difficult task due to the big variety of factors which influence the final outcome of the experiment. Up to now no generally agreed upon procedure exists for such type of experiments and the project will not try to develop standard methods. However, the laboratories participating in the co-ordinated network will use certain common principles to achieve a better comparability of the obtained results. These principles were developed in the documents mentioned in section 2.3.

IV RESEARCH ON THE EFFECTS OF POLLUTANTS ON MARINE COMMUNITIES AND ECOSYSTEMS

(MED POL V)

1. Outline of the Pilot Project

Changes in the structure of marine communities and ecosystems under the influence of pollutants are evident in many Mediterranean coastal areas. An ecological survey of a polluted area can often provide more accurate and detailed information on the combined impact of pollutants than the whole range of laboratory tests and measurements. The importance and usefulness of ecological changes as indicators of the overall pollution level of certain Mediterranean areas are recognized and a co-ordinated research pilot project on the effects of pollutants on marine communities and ecosystems is initiated.

The project will be thoroughly interdisciplinary, and both ecological indices and data on pollutants and other relevant environmental parameters will be collected. Whenever possible, an experimental approach will be used with observations in confined areas and under controlled environmental conditions. Advantage will be taken of accidents releasing sizeable amounts of pollutants into the marine environment since they can be treated as large-scale experiments in nature.

The pilot project will be primarily based on the existing experience and national facilities in the Mediterranean countries.

2. Programme of Work

2.1 Communities and ecosystems to be studied

Theoretically several types of marine communities and ecosystems could be studied in the frame of the proposed pilot project. For practical purposes, the project will deal with natural marine communities and ecosystems under stress in coastal waters, including lagoons and brackish coastal lakes, in areas where ecosystem changes may be anticipated as a consequence of man's activities and with ecosystems in relatively unpolluted areas, such as marine parks, for reference.

Ecosystems will be particularly investigated in areas which were repeatedly studied in the past in order to detect long-term changes.

To the largest possible extent the ecosystems will be studied as integral units taking into account the dynamic interactions between their various components. Special attention will be paid to the role in the transport of pollutants through

the trophic levels of those organisms which will be used in the monitoring pilot projects.

2.2 Parameters and effects to be studied

The parameters and effects to be studied will vary depending on the studied community and ecosystem. Here, only those parameters and effects are listed which have a wider use.

- Community structure. Structural indices, such as species diversity and measures of abundance, trophic relationships and biological interactions, may not be used as direct evidence for the impact of specific pollutants but could be used for the assessment of the integral changes in the ecosystem.

- Functional indices. Carbon assimilation, plant pigments, ATP, total organic carbon in the organisms and growth determination, may yield significant information on primary and secondary productivity and on the functional state of the communities.

- Body burden of pollutants. The body burden will be measured as an indicator of the accumulated level of the pollutants and for use in the assessment of the possible transfer of pollutants to higher trophic levels.

- Level of pollutants in sea water, suspended matter and sediments, including BOD measurements.

- Physical and chemical properties of the environment (irradiation, light attenuation, temperature, salinity, oxygen, nutrients, redox potential of the sediments, total organic carbon, suspended matter, granulometry of the sediments). The measurement of these parameters is important for a better understanding of the community studied.

2.3 Methodoloy to be used

To achieve a good comparability of ecosystem research from different geographical localities is a very difficult, if not impossible, goal. The very uniqueness of each natural community and ecosystem requires that the approach in research is adapted maximally to the ecosystem itself. No generally agreed upon procedure exists in community and ecosystem analysis and the project does not try to develop standard methods. However, the laboratories participating in the co-ordinated network will use certain common principles which were developed in several documents (GESAMP Working Group on the Scientific Bases for the Determination of Concentrations and Effects of Marine Pollutants, ACMRR/IABO Working Party on Ecological Indices, SCOR/ACMRR/UNESCO/IBP Working Group No. 29).

V ELEMENTS COMMON TO THE FOUR PROJECTS

1. Participants in the Programme

A great number of Mediterranean research centres expressed the wish to participate in the programme in response to enquiries by the secretariat of GFCM, and as ascertained during a feasibility study for the execution of Mediterranean co-ordinated monitoring and research programmes carried out by two IOC consultants on behalf of UNEP. The participating research centres will be organized in four networks, one for each of the pilot projects.

The participation in the networks will not be limited to research centres able to deal with the task in a complex way but will include also research centres capable of only limited contributions initially, such as sampling, in order to further their development. Research centres can join the networks at any time they wish. However, their participation in the pilot projects, as well as the programmes they are proposing as their contribution, will have to be cleared by their relevant national authorities.

The research centres participating in the networks will adhere to a joint agreement which will be based on this Operational Document.

2. Training needs

The lack of adequately trained scientists to perform the sophisticated analytical techniques seriously hinders the full participation of all national research centres which expressed the wish to become part of the network participating in the execution of the programme. Therefore, fellowships for in-service training of up to 6 months each will be awarded with priority to those national research centres of the developing countries whose full participation in the pilot projects depends on formation of adequately trained scientists. The fellowships will be available at the very beginning of the programme.

The training will be executed in Mediterranean research centres having adequate facilities and experience for such activity. These centres shall, after return of trainees, maintain regular contacts with the centres from which they came.

Trainees will be selected from national research centres which provide an assurance that the trainee will continue to work on the programme upon return to his home centre.

3. Requirements for Analytical Instruments and Maintenance Services

To improve the analytical facilities of the participating research centres various additional instruments as well as chemicals will be provided through the pilot projects.

Common maintenance and advisory services will be organized through the pilot projects for the more complex analytical instruments provided by the projects. The selection of these instruments for the pilot projects will be based on their performances and the maintenance services which could be organized by their smooth operation.

The selection of the recipient centres will be based on the actual needs for such analytical facilities, particularly in the national research centres of the developing countries, and the assurance of the recipients to provide adequate infrastructure for their installation, maintenance and operation, in accordance with the needs of the programme.

4. Co-ordinating activities

The co-ordination of the work performed on the basis of this Operational Document by the network of participating research centres will be organized in close co-operation between FAO and UNEP with GFCM of FAO as the body responsible for the operation of the pilot projects. The co-ordination may include:

- correspondence with research centres and national authorities if required;
- organization of data reporting, evaluation and dissemination;
- collaboration with the IAEA Monaco International Laboratory for Marine Radioactivity for the intercalibration exercise;
- organization of the training programme;
- organization of the delivery of additional analytical facilities;
- constant review of participating research centres and efforts to enlarge the network of participants;
- supervision of the performances of analytical services;
- contact with similar projects, such as the OECD project on monitoring of metals in the European pilchard of the western Mediterranean basin;
- organization of meetings of experts from participating research centres whenever necessary;
- co-ordination of the visits of experts;
- any other activity relevant to the execution of the programme.

The activities envisaged in the frame of these four pilot projects will be co-ordinated with the activities of other pilot projects in the frame of the Co-ordinated Mediterranean Pollution Monitoring and Research Programme endorsed by the Barcelona Intergovernmental Meeting on the Protection of the Mediterranean.

5. Timing

The total duration of the operational phase of the programme will be two years, starting from September 1975. The timing of the various project activities is given in the following figure.

Appendix I

RECOMMENDATIONS OF THE EXPERT CONSULTATION RELEVANT TO THE JOINT FAO(GFCM)/UNEP PILOT PROJECTS

(Rome, 23 June - 4 July 1975)

1. PILOT PROJECTS ON BASELINE STUDIES AND MONITORING OF METALS AND CHLORINATED HYDROCARBONS IN MARINE ORGANISMS (MED POL II AND III)

1.1 Outline of the Pilot Projects

The Consultation examined the Draft Operational Document, made the final selection of substances and organisms to be monitored, and included them in the Operational Document.

In addition to the metals and organisms recommended for monitoring in the Operational Document, the possible need for monitoring of arsenic and the use of the following species[1/] were discussed: limpet (Patella sp.), European hake (Merluccius merluccius), Atlantic horse mackerel (Trachurus trachurus), European pilchard (Sardina pilchardus), Atlantic bonito (Sarda sarda); phytoplankton, macrophytes and organisms living in sediments.

Areas where further research is recommended are:

- correlation of the body burden of pollutants to the size (age) of the organisms;
- basic statistical requirements for a monitoring plan;
- physiological role of various metals, including their biogeocyle;
- development of reliable analytical techniques, particularly for lead and selenium;
- short- and long-term effects of pollutants on organisms;
- transfer of pollutants through the food chain.

1/ The names of species described in the publication "FAO Species Identification Sheets for Fishery Purposes - Fishing Area 37 - Mediterranean and Black Sea", FAO, Rome, 1973, are those used in this document.

1.2 Sampling and Sample Preparation

The Consultation agreed upon the following recommendations:

(a) A detailed and uniform record on the characteristics of each specimen used for samples as well as relevant data about the collection site will be maintained.

(b) All the necessary precautions should be taken to avoid the contamination of samples during collection, preparation, storage and eventual shipment.

(c) The wet weight and the dry weight (drying at 105°C-110°C) of the samples will always be determined, on separate aliquote portions of the sample if necessary.

(d) For preservation of samples, the following methods, in order of priority, will be used: freeze drying, deep freezing, oven drying. However, samples for mercury analyses will be preserved preferably by deep freezing.

(e) Samples for metal analyses will be kept in sealed polyethylene bottles or bags or in sealed glass bottles. Glass bottles should be used for dried samples. Samples for chlorinated hydrocarbons analyses will be kept in pre-cleaned aluminium foils included in suitable containers (cardboard should be avoided).

(f) Except in cases of samples from tuna and swordfish, samples will be pooled (composite) and composed of at least 6 striped mullets, 10 mussels, 10 shrimps or 10 crabs.

(g) The size of sample will be determined by the requirements of the analytical technique used.

(h) Whenever possible, the size range of specimens selected for monitoring will be: for shrimps 8-10 cm; for striped mullet 10-15 cm; for mussels 4-5 cm; for crabs 2-4 cm.

(i) The skinned and bone-free white muscle of tuna and swordfish, the white flesh of mullet, the edible part of mussel free of byssus and pallial fluid, the abdominal muscle of shrimp free of carapaces and the muscles from chelae of crabs will be used as samples.

1.3 Analytical Procedure

The Consultation agreed on the following recommendations:

(a) In general, for the pretreatment of samples and for the analytical techniques, procedures described in FAO Fisheries Technical Paper No. 137 "Manual of methods in aquatic environmental research. Part 1. Methods for detection, measurement and monitoring of water pollution", Rome, 1975, should be followed.

(b) Double-beam atomic absorption spectrophotometer with flameless attachment and gas chromatograph with electron capture detector, isothermal oven and recorder, should be selected as the basic analytical tools.

(c) The final selection of the instrument should be restricted to a single type of the instruments mentioned under (b).

(d) The selection of the type of instruments provided in the frame of the pilot projects should be based on the instruments' performances and on the maintenance services which could be organized for their smooth operation.

(e) Analytical techniques, such as neutron activation analysis, X-ray fluorescence, etc., are recognized as satisfactory; their use should be encouraged, but they should not be considered as recommended basic techniques.

(f) Common technical assistance services, including maintenance, should be organized through the pilot projects for the instruments provided by the projects. If possible, this service should be extended to the maintenance of the other instruments used in participating research centres for the work in the frame of the pilot projects.

(g) A central distribution of standards, particularly for gas chromatographic analyses, should be organized in the frame of the pilot projects.

(h) The use of existing, or the creation of new, gas chromatography-mass spectroscopy units should be considered in order to provide confirmatory tests for certain doubtful results.

(i) The acquisition of the new instruments in the frame of the pilot projects should be accompanied by appropriate training whenever adequately trained personnel do not exist at the recipient research centre.

1.4 Intercalibration

The procedures for the intercalibration of the analytical techniques as they have been presented by the IAEA Monaco International Laboratory for Marine Radioactivity (see annex VIII) were reviewed and adopted.

Research centres wishing to participate in the intercalibration programme prior to the formal start of the pilot projects are invited to address themselves to the IAEA International Laboratory for Marine Radioactivity.

1.5 Analytical Services

The analytical services availsble in the Mediterranean research centres were reviewed and recognized as sufficient for the needs of the pilot projects.

1.6 Training

The training possibilities offered by the Mediterranean research centres were reviewed and recognized as sufficient for the needs of the pilot projects.

The training activities were emphasized as high priority activities of the pilot projects which should be implemented without delay bearing in mind the needs of the developing countries.

1.7 Future Programmes

The ongoing and planned national monitoring programmes, which could become an integral part of the pilot projects were presented and briefly discussed.

The Consultation recommended that even though the formal arrangements for the start of the pilot projects might be delayed for administrative reasons, the actual work should start without delay according to the timing given in the Operational Document.

1.8 Requirements and Needs of the Participating Research Centres

The needs of the potential participating research centres in the pilot projects were briefly reviewed. It was suggested that their requirements be met as soon as possible and to the extent feasible in the frame of the available budgetary provisions. Priority should be given to those centres which are not yet sufficiently equipped to participate in the pilot projects.

2. PILOT PROJECTS ON THE EFFECTS OF POLLUTANTS ON MARINE ORGANISMS, THEIR POPULATIONS, MARINE COMMUNITIES AND ECOSYSTEMS (MED POL IV AND V)

2.1 Introductory Remarks

The two research pilot projects under discussion should serve as a common scientific basis for the programmes executed as part of the other pilot projects dealing with baseline studies and monitoring activities in the frame of the Action Plan for the Mediterranean.

The need for adequate data handling and modelling was stressed, and the possibility to use the FAO Fishery Data Centre was discussed.

The publication of bibliographies relevant to the pilot project was recommended.

2.2 Outline of the Pilot Projects

The research on functional and structural changes - including the damage to genetic material - in marine organisms, their populations, marine communities and ecosystems under the influence of pollutants was accepted as the general framework of the pilot projects.

The adopted outline of the pilot projects is incorporated in the Operational Document.

2.3 Substances to be Studied

Substances specifically recommended to be studied are included in the Operational Document.

The physico-chemical forms of the studied substances should be taken into account whenever they may influence the obtained results.

The necessity of studying the effects of ionizing radiations and thermal releases was discussed but not recommended in the frame of the pilot projects because these effects are either already co-ordinated through other specific programmes or are only of very local importance.

2.4 Organisms and Ecosystems to be Studied

As criteria for selection of test organisms and systems, the following were adopted:

- organisms or systems with large amount of baseline data available;

- organisms or systems of economic importance;

- organisms or systems specific for the Mediterranean and used by the Mediterranean research centres as study objects.

The feasibility to use representative organisms from various systematic groups was discussed and the list of organisms recommended is reflected in the Operational Document although for special tests other organisms might be used as well.

It was recommended that ecosystems should be studied as integral systems as far as possible taking into account all the different components of which they consist.

The studies of ecosystems should be interdisciplinary to the largest possible extent. They should include not only the determination of structural and functional indices characterizing the ecosystems studied but also data on standard physical and chemical parameters as well as data on the concentration of pollutants in sea water and sediments.

2.5 Effects and Parameters to be Determined

The basic effects and parameters to be studied as well as the basic type of experiments recommended are listed in the Operational Document.

For the various systematic groups, the following research areas and tests were discussed and recommened as suitable:

- heterotrophic micro-organisms: role in the transfer and cycling of pollutants;

- phytoplankton: growth rate, photosynthetic activity, accumulation and loss of pollutants;

- zooplankton: transfer of pollutants through the food chain, growth rate, lethal effects, rate of reproduction, behavioural changes, damage to genetic material, respiratory activity, survival curves, effects on life cycle, malformations;

- echinoderms: fertilization rate, larval development;

- sponges: damage to genetic material;

- polychaetes: toxicity, fecundity, larval transformation, malformations;

- molluscs: changes in sensitivity during larval development, accumulation and loss of pollutants, changes in physiological and biochemical functions and mechanisms, toxicity, metabolic studies;

- arthropods: effects on moulting cycle, damage to genetic material, behavioural studies, changes in physiological and biochemical functions and mechanisms, metabolic studies, behavioural changes, malformations, accumulation and loss of pollutants;

- fish: metabolic studies, changes in physiological and biochemical functions and mechanisms, effects on sensory systems, behavioural changes, reproductive capacity, malformations, accumulation and loss of pollutants.

2.6 Methodology to be Used

In view of the inherent difficulties in interpreting the laboratory experiments in terms of processes taking place in nature, it was recommended that such experiments be conducted under conditions resembling the natural ones as closely as possible.

For the benefit of the participants in the two research pilot projects, it was recommended that, as part of the project activity, guidelines be developed on principles which should be followed in laboratory and field experiments as well as in field observations and measurements.

If necessary, small informal workshops should be organized to solve particular problems and ensure the adoption of methodology which will lead to a better comparability of the results obtained.

Research centres dealing with the determination of the levels of pollutants in environmental samples will participate in the intercalibration exercise.

2.7 Future Programmes

Some of the ongoing and planned national research programmes, which would become an integral part of the pilot projects, were presented.

The Consultation recommended that even though the formal arrangements for the start of the pilot projects might be delayed for administrative reasons, the actual work should start, whenever feasible, without delay according to the timing given in the Operational Document.

2.8 Requirements and Needs of the Participating Research Centres

The needs of some of the potential participating research centres in the pilot projects were briefly reviewed. High priority should be given to an early start of the training activities and to the distribution of additional equipment.

It was suggested that the needs of these centres be met as soon as possible and to the extent feasible in the frame of the available budgetary provisions. High priority should be given to centres from developing countries.

3. MISCELLANEOUS

Besides the official communication of the report of the Consultation to the Governments of countries bordering the Mediterranean, the participants requested that all Mediterranean research centres which expressed their wish to participate in the four pilot projects or which may later express their wish to participate, should also receive the report of the Consultation and be kept informed of the contacts that the sponsoring agencies will have with their national authorities on this subject.

Appendix II

RECOMMENDATIONS OF THE FAO(GFCM)/UNEP MID-TERM EXPERT CONSULTATION ON THE JOINT FAO/UNEP CO-ORDINATED PROJECTS ON POLLUTION OF THE MEDITERRANEAN

(Dubrovnik, 2 - 13 May 1977)

FUTURE ORIENTATION AND RECOMMENDATIONS

1. Pilot Projects MED POL II and III

In view of the late start of the sampling and analytical work and in order to ensure an adequate geographical coverage, the Consultation strongly recommended to extend the duration of pilot projects MED POL II and MED POL III to the end of 1978.

In order to expand the area covered so far, a 1978 joint scientific cruise covering international waters of the Mediterraean is under investigation and should be arranged. A programme should be outlined by the relevant specialized agencies and an organizing committee composed by competent and experienced scientists. Technical aspects will be investigated if and when a sufficient number of participants is interested. It was recommended that the primary goal be training with emphasis on sampling techniques, field data collection, handling of samples, avoidance of contamination, etc. The sampling should include water, sediments and biota. It was suggested that the most suitable ship for the outlined purposes would be a fishery research vessel.

It was recommended to request the biologists attending the Expert Consultation on the review of projects MED POL IV and MED POL V to establish a list of alternative species for monitoring where the species listed in the operational document are not available.

Every participating laboratory is encouraged to determine more components (substances and species) than in the obligatory programme (document FIR:PM/77/4). All participants are reminded that the components in the obligatory programme should not be neglected.

The proposal for the "Mussel Watch" experiment (document FIR:PM/77/11) was adopted and the participants in MED POL II and MED POL III were invited to participate in it on a voluntary basis (see appendix IV).

In relation to the UNESCO paper "The use of Modelling of Marine Systems in the Framework of UNEP Monitoring and Research Programme", by L. Jeftic and T. Legovic, made available at the Consultation, the modelling of biogeochemical cycles of

pollutants, in particular mercury, was accepted as optional activity in the framework of MED POL II and MED POL III.

Other operational programmes suggested were air sampling for chlorinated hydrocarbons and fluxes of metals between ecosystem compartments.

2. Pilot Projects MED POL IV and V

In view of the late start of work and in order to ensure an adequate geographical coverage, the Consultation strongly recommended to extend the duration of pilot projects MED POL IV and MED POL V to the end of 1978.

In order to expand the area covered by MED POL, a joint scientific cruise in the Mediterranean international waters is under investigations and should be planned for 1978. A programme of work should rapidly be outlined by the relevant specialized agencies and an organizing committee consisting of competent and experienced scientists. Arrangements should be accelerated so that the cruise may be completed by the end of 1978. Cruise plans and technical aspects will be investigated if and when a sufficient number of participants is interested.

It is recommended that the primary objective be training in a framework such as the following:

(i) planned research with emphasis on oceanographic-environment measurements and their interpretation; sampling, handling and preservation of samples; standard physico-chemical analyses of environmental parameters and of the biomass of pelagic populations; performances of simple algal-growth bioassays and similar investigations;

(ii) collection of samples of fish, benthic, planktonic and mesopelagic biota, of water, sediments and floating pollutants for further analyses of hydrocarbons, chlorinated hydrocarbons and heavy metals;

(iii) execution of a research programme on potential nutritive, eutrophicative or inhabiting properties of surface and deep waters of the Mediterranean along the course of the cruise, using simple algal growth bioassays;

(iv) continuous observation of the level of visible oil and debris along the course of the cruise.

The most suitable ship for the outlined purposes would be a large research vessel with onboard laboratories for basic oceanographic and environmental analyses, with a bioassay laboratory with growth-chambers or free-space for their installation and with adequate oceanographic and sampling gear which can facilitate the above mentioned training and research (basic meteo-oceanographic measurement equipment, standard and large-size water samplers, sediment corers, grabs and dredges, planktonic gear, biologic midwater and demersal trawls, longline and possibly other exploratory fishing gear).

Concerning the UNESCO paper "The Use of Modelling of Marine Systems in the Framework of UNEP Monitoring and Research Programme", the concept of a model to describe the biogeochemical cycles of important pollutants such as mercury is acceptable as optional activity within the framework of MED POL II-V. Special emphasis should be placed on obtaining more information needed for the model (i.e. bioaccumulation rates and retention times of pollutants in order to determine the transfer coefficients between biotic and abiotic compartments; data on the atmospheric and

terrestial input rates of pollutants as well as on mechanisms and transport rates of substances from the water column to the sediments). These data will be especially useful to researchers studying the effects of pollutants under MED POL IV and MED POL V. The proposed UNEP cruises in international waters would be useful in procuring some of these data not readily obtainable from the on-going pilot projects.

In connection with the "black" and "grey" lists used in the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources, it was suggested that using the experience available through MED POL IV and V, as well as through the other pilot projects a critical review be prepared on the properties of substances listed in the "black" and "grey" lists. The review would serve as useful information to the Mediterranean Governments and help them develop administrative rationale for its application.

Specifically it was recommended that:

(i) relevant components of MED POL in particular MED POL II, III IV and V when operational, be utilized to provide on a regular basis information essential to the establishment of waste discharge control criteria;

(ii) MED POL research centres, within the confines of present capabilities and support, provide the Mediterranean Governments with characteristics of potentially harmful waste constituents and assess the potential impairment of sea water uses as well as effects on fisheries and marine ecosystems;

(iii) MED POL II and MED POL III research centres (in collaboration with investigators of other pilot projects when appropriate) define (a) accumulation of these substances in biological materials and sediments, (b) persistence (physical, chemical, biological) in the marine environment - pollution dynamics, (c) susceptibility to physical, chemical and biochemical changes and interaction with other seawater constituents, and (d) environmental transformation of these substances into more harmful chemical forms.

This last point, as well as the identification of new contaminants, would be facilitated by the development of a gas chromatography/mass spectrophotometry capability for use of MED POL investigators. MED POL research centres should attempt to accomodate the Intergovernmental Consultation by investigating substances of immediate concern (i.e. organosilicon compounds).

It was recommended that principal investigators with chemical background draw their attention to the problems of the chemistry of the contaminants in sea water. Need for investigation of solubility, chemical equilibria, problems of chelation as well as development of suitable analytical techniques has been identified.

It is recommended that for the use in MED POL IV a Manual of bioassay and bioevaluation techniques be compiled. The techniques included should be from published source and their use substantiated by the scientific literature. The techniques included should be critically assessed with their advantages and shortcomings specified. FAO(GFCM)/UNEP should appoint a consultant who will involve MED POL principal investigators, as well as other experts, in this task. The Manual should be widely distributed, especially to recently established centres in developing countries.

It was recommended that principal investigators in MED POL IV, when possible, restrict their investigations to a limited number of species meeting the following criteria:

(i) readily available and utilized in MED POL II and MED POL III;

(ii) maintenance requirements are understood; and

(iii) baseline information on parameters of interest exists.

Adherence to these criteria should result in an increase of in-depth information on effects of pollutants on representative and ecologically critical or commercially most important species.

The proposal for the "Mussel Watch" experiment (document FIR:PM/77/11), as adopted by the Consultation on MED POL II and MED POL III was discussed (see appendix IV). It was felt that in executing such a programme many problems of biological nature would be faced. It was therefore strongly recommended to involve experienced biologists if and when implementing the "Mussel Watch" experiment and to link it wherever possible to pilot project MED POL IV.

The Consultation further recommended with regard to MED POL V that:

(i) every effort be made to facilitate work in zones where studies have not yet been undertaken;

(ii) reliable methods for pollution evaluation be developed to this end, the recruitment or development of specialists, particularly of taxonomists, may be necessary;

(iii) however, in certain conditions and for practical purposes, rapid methods be elaborated (i.e. fouling tests, bioassays and biocoenological methods);

(iv) studies on controlled ecosystems be encouraged;

(v) in the study of ecosystems, development of the link constituted by fish should receive increased attention;

(vi) a Manual be prepared on guidelines for community and ecosystem studies, preferably through assistance of the Regional Activity Centre.

Appendix III

DATA COLLECTION FORMS FOR MED POL II - V

SPECIES CODE TABLE - TABLEAU DE CODE DES ESPECES

Species names shown in parentheses are invalid or uncommon. The given synonyms should be used for the forms and reports.

Noms d'espèces entre parenthèses ne sont plus valables ou ne plus communs. Utiliser les synonymes pour les formulaires et reports.

BACTERIA - BACTERIES

(Enterococcus sp.) = Streptococcus sp.	LACTO	Enter	0
Escherichia coli	ENTERO	Esch	1
Streptococcus sp.	LACTO	Enter	0

ALGAE - ALGUES

Cladophora pellucida	CLAD	Clad	1
(Corallina rubens) = Jania rubens	CORAL	Jan	1
Cystoseira abrotanifolia	FUCA	Cyst	1
Cystoseira myriphylloides	FUCA	Cyst	2
Focus virsoides	FUCA	Fuc	1
Dunaliella tertiolecta	POLYBL	Dun	1
Enteromorpha intestinalis	ULVA	Ent	1
Enteromorpha linza	ULVA	Ent	2
Jania rubens	CORAL	Jan	1
Phaeodactylum tricornutum	PENN	Phaeo	1
Scytosiphon lomentaria	ECTO	Scyto	1
Skeletonema costatum	CENT	Skel	1
Ulva lactuca	ULVA	Ulv	1

SEAGRASS - HERBIERS

Posidonia oceanica	POTA	Posid	1
Zostera marina	POTA	Zost	1
Cymodocea nodosa	POTA	Cym	1

PROTOZOANS - PROTOZOAIRES

Flavella ehrenbergi	TINT	Flav	1

SPONGES - EPONGES

Geodia cydonium	GEOD	Geod	1

ECHINODERMS - ECHINODERMES

Arbacia lixula	ARBA	Arb	1
Astropecten irregularis	ASTRO	Astro	1
Brissopsis lyrifera		Briss	1
Holothuria forskali	HOLOT	Holot	1
Labidoplax digitata	SYNAP	Lab	1
(Oestergrenia digitata) = Labidoplax digitata	SYNAP	Lab	1
Ophiura texturata	OPHIOL	Ophiu	1
Stichopus regalis	HOLOT	Stich	1
(Paracentrotus lividus) = Strongylocentrotus lividus	ECHIN	Strong	1
Strongylocentrotus lividus	ECHIN	Strong	1

ANNELIDS - ANNELIDES

Ancistrosyllis parva	HESI	Anci	1
Aphrodite aculeata	APHRO	Aphro	1
Aricidea sp.	ARIC	Aric	0
Audouinia tentaculata	CIRRAT	Audou	1
Capitella capitata	CAPIT	Cap	1
Chaetozone setosa	CIRRAT	Chaeto	1
Cossura coasta	CIRRAT	Coss	1
Diopatra neapolitana	ONUPH	Diop	1
Glycera convoluta	GLYC	Glyc	2
Glycera rouxii	GLYC	Glyc	1
Hyalinoocia bilineata	EUNIC	Hyal	1
(Lumbriconeris impatiens) = Lumbrineris impatiens	LUMB	Lumb	1
Lumbrineris impatiens	LUMB	Lumb	1
Lumbrineris latreilli	LUMB	Lumb	2
(Lumbriconeris latreilli) = Lumbrineris latreilli	LUMB	Lumb	2
Marphysia bellii	EUNIC	Mar	1
Marphysia kimbergi	EUNIC	Mar	2
Nephtys hombergii	NEPHT	Nepht	1
Nephtys hystricis	NEPHT	Nepht	2
Notomastus latericeus	CAPIT	Noto	1
Ophryotrocha puerilis	EUNIC	Ophr	1
Owenia fusiformis	OWEN	Owen	1
Parsonis gracilis gracilis	PARAO	Para	1
Polydora antennata	SPION	Poly	2
Polydora caeca	SPION	Poly	1
Prionospio malmgreni	SPION	Prio	1
Scolelepis fuliginosa	SPION	Seol	1
Spiophanes bombyx	SPION	Spio	1
Sternaspis scutata	STERN	Stern	1
Sudorume tentaculata	CIRRAT	Sudo	1
Tharyx multibranchis	CIRRAT	Thar	1
Thiasira flexuosa		Thias	1

SIPUNCULIDES - SIPUNCULIDES

Aspidosiphon kovalevskii	SIP	Asp	1

CRUSTACEANS - CRUSTACES

Acartia clausi	PONT	Acar	1
Alpheus glaber	ALPH	Alph	1
Aristeus antennatus	PEN	Arist	1
Artemia salina	ARTEM	Artem	1
Calanus helgolandicus	CAL	Cal	1
Callianassa stebbingi	CALLI	Calli	1
Carcinus maenas	PORT	Carc	3
Carcinus mediterraneus	PORT	Carc	1
Centropages typicus	CENT	Cent	1
Centropages kroyeri	CENT	Cent	2
Clausocalanus sp.	CAL	Claus	0
Crangon crangon	CRANG	Crang	1
Ctenocalanus rarius	CAL	Cten	1
Eriphia verrucosa	XANTH	Erip	1
Eupagurus bernhardus	PALGUR	Eup	1
Euterpina acutifrons	TACHI	Eut	1
Gonoplax rhomboides	GONO	Gono	1
Homarus gammarus	NEPH	Hom	1
(Homarus vulgaris) = Homarus gammarus	NEPH	Hom	1
Idothea baltica	IDOT	Idot	1
(Idothea basteri) = Idothea baltica	IDOT	Idot	1
Lysmata seticaudata	HIPP	Lysm	1
Maja verrucosa	MAJI	Maja	1
Nephrops norvegicus	NEPH	Neph	1
Oithona helgolandica	OITHO	Oitho	1
Oithona nana	OITHO	Oitho	2
Oncaea mediterranea	ONCAE	Onc	1
Orchestia mediterranea	TALIT	Orch	1
Pachygrapsus marmoratus	GRAP	Pach	1
(Palaemon elegans) = Palaemon serratus	PALAEM	Palaem	1
Palaemon serratus	PALAEM	Palaem	1
Paracalanus sp.	CAL	Para	0
Parapenaeus longirostris	PEN	Parap	1
Penaeus kerathurus	PEN	Pen	1
Pisa nodipes	MAJI	Pisa	1
Portunus depurator	PORT	Port	1
Portunus pelagicus	PORT	Port	2
Tigriopus brevicornis	TISB	Tigr	1
Xantho hydrophilus	XANTH	Xanth	1

BIVALVES - BIVALVES

Acanthocardia tuberculata	CARD	Acant	1
Aloidis gibba	MYAC	Aloid	1
(Cardium edule) = Cerastoderma edule	CARD	Cerast	2
(Cardium tuberculatum) = Acanthocardia tuberculata	CARD	Acant	1
Cerastoderma edule	CARD	Cerast	2
(Corbula gibba) = Aloidis gibba	MYAC	Aloid	1
Crassostrea angulata	OSTR	Crass	1
Dosinia lupina	VEN	Dos	1
Donax trunculatus	DONAC	Don	1
Ensis ensis	SOLEN	Ens	1
(Gryhaea angulata) = Crassostrea angulata	OSTR	Crass	1
Lithophaga lithophaga	MYTIL	Litho	1

(Mactra corallina) = Mactra stultorum	MACT	Mact	2
Mactra stultorum	MACT	Mact	2
Merethrix chionae	VEN	Mere	1
Monodonta articulata	TROCH	Mono	2
Monodonta turbinata	TROCH	Mono	1
Murex brandaris	MURIC	Mur	1
Murex trunculus	MURIC	Mur	2
Mya arenaria	MYAC	Mya	1
Mytilus edulis	MYTIL	Mytil	2
Mytilus galloprovincialis	MYTIL	Mytil	1
Mytilus minimus	MYTIL	Mytil	3
(Mytilus perna) = Perna perna	MYTIL	Pern	1
Ostrea edulis	OSTR	Ostr	1
Pandora inequivalvis	PANDO	Pando	1
Perna perna	MYTIL	Pern	1
(Spisula subtruncata) = Mactra subtruncata	MACT	Mact	1
Tapes decussatus	VEN	Tap	1
Venus gallina	VEN	Ven	1
Venus verrucosa	VEN	Ven	2
GASTROPODS - GASTEROPODES			
Glycymeris glycymeris	GLYC	Glyc	1
Littorina neritoides	LITT	Litt	1
(Nassa mutabilis) = Sphaeronassa mutabilis	NASS	Sphae	1
Nassa reticulata	NASS	Nass	1
(Natica hebraea) = Naticarius maculatus	NAT	Nat	1
Naticarius maculatus	NAT	Nat	1
Patella coerula	ACMAE	Pat	1
Patella intermediara	ACMAE	Pat	2
Sphaeronassa mutabilis	NASS	Sphae	1
Turitella communis	TURR	Turr	1
CEPHALOPODS - CEPHALOPODES			
Eledone moschata	OCT	Eled	2
Loligo vulgaris	LOLIG	Lolig	1
Octopus vulgaris	OCT	Oct	1
Sepia officinalis	SEP	Sep	1
TUNICATES - TUNICIERS			
Microcosmos sulcatus	SYTEL	Micro	1
ELASMOBRANCHS - ELASMOBRANCHES			
Raja asterias	RAJ	Raja	1
Scyliorhinus canicula	SCYL	Scyl	1
Squalus acanthias	SQUAL	Squal	1
Squalus blainvillei	SQUAL	Squal	3
TELEOSTEANS - TELEOSTEENS			
Alosa alosa	CLUP	Alosa	2
Alosa fallax nilotica	CLUP	Alosa	1
Aspitrigla cuculus	TRIG	Aspi	2

Atherina hepsetus	ATHER	Ather	1
(Atherina mochon) = Atherina hepsetus	ATHER	Ather	1
Blennius pavo	BLENN	Blenn	1
Boops boops	SPARID	Boop	1
Boops salpa	SPARID	Boop	2
(Chelidonichthys lucernus) = Trigla lucerna	TRIG	Trig	3
(Chrysophris aurata) = Sparus auratus	SPARID	Spar	1
Conger conger	CONGR	Cong	4
Coris julis	LABR	Cor	1
Crenilabrus tinca	LABR	Cren	1
Dicentrarchus labrax	SERRAN	Dicen	1
Dicentarchus punctatus	SERRAN	Dicen	2
Diplodus annularis	SPARID	Diplod	3
Diplodus vulgaris	SPARID	Diplod	2
Engraulis encrasicolus	ENGR	Engr	1
(Gadus capelanus) = Trisopterus minutus capelanus	GADI	Triso	1
Halobatrachus didactylus	BATR	Halob	1
(Labrax lupus) = Dicentrarchus labrax	SERRAN	Dicen	1
Labrus merula	LABR	Labr	1
Labrus turdus (= Labrus merula)	LABR	Labr	1
Lepidopus caudatus	TRICH	Lepid	1
(Liza aurata) = Mugil auratus	MUGIL	Mugil	5
Maena maena	EMMEL	Maen	1
Maena smaris	EMMEL	Maen	2
Merlangius merlangus	GADI	Merla	1
Merluccius merluccius	GADI	Merlu	1
(Morone labrax) = Dicentrarchus labrax	SERRAN	Dicen	1
Mugil auratus	MUGIL	Mugil	5
Mugil capito	MUGIL	Mugil	3
Mugil cephalus	MUGIL	Mugil	1
Mugil chelo	MUGIL	Mugil	2
Mullus barbatus	MULL	Mull	1
Mullus surmuletus	MULL	Mull	2
Naucrates ductor	CARAN	Naucr	1
Oblada melanura	SPARID	Obla	1
Pagellus acarne	SPARID	Page	2
Pagellus bogaraveo	SPARID	Page	3
(Pagellus centrodontus) = Pagelus bogaraveo	SPARID	Page	3
Pagellus erythrinus	SPARID	Page	1
Pegusa lascaris	SOL	Peg	1
Phycis blennoides	GADI	Phyc	1
Platichtys flesus	PLEURO	Plati	1
(Pleuronectes flesus) = Platichtys flesus	PLEURO	Plati	1
Pleuronectes platessa	PLEURO	Pleuro	1
Pomatomus saltator	POMAT	Pomat	1
(Roccus labrax) = Dicentrarchus labrax	SERRAN	Dicen	1
Sarda sarda	SCOMBR	Sarda	1
Sardina pilchardus	CLUP	Sardi	1
Sardinella aurita	CLUP	Sardl	1
Sardinella maderensis	CLUP	Sardl	2
Saurida undosquamis	SYNO	Sauri	1
Scomber scombrus	SCOMBR	Scom	1
Scomberesox saurus	SCOMBS	Scombs	1
(Solea solea) = Solea vulgaris	SOL	Sol	1
Solea vulgaris	SOL	Sol	1
Scorpaena porcus	SCORP	Scorp	1
Scorpaena scrofa	SCORP	Scorp	2

Serranus scriba	SERRAN	Serran	2
Sparus auratus	SPARID	Spar	1
Sphyraena sphyraena	SPHY	Sphy	7
Sprattus sprattus	CLUP	Spratt	1
Thunnus alalunga	SCOMBR	Thun	1
Thunnus thynnus thynnus	SCOMBR	Thun	2
Trachurus mediterraneus	CARAN	Trach	2
Trachurus trachurus	CARAN	Trach	1
(Trigla cuculus) = Aspitrigla cuculus	TRIG	Aspi	1
Trigla lucerna	TRIG	Trig	3
Trisoptrus minutus capelanus	GADI	Triso	1
(Temnodon saltator) = Pomatomus saltator	POMAT	Pomat	1
Upeneus molluccensis	MULL	Upen	1
Uranoscopus scaber	URAN	Uran	1
Xiphias gladius	XIPH	Xiph	1

BIRDS - OISEAUX

Larus argentatus	LARID	Lar	1
Larus ridibundus	LARID	Lar	2
Sterna hirundo	LARID	Ster	1

MAMMALS - MAMMIFERES

Globicephala malaena	DELPH	Glob	1
Grampus griseus	DELPH	Gramp	1
Stenella coeruleoalea	DELPH	Sten	1
Physeter catodon	PHYSET	Phys	1

OTHERS - AUTRES

Phytoplankton (general)	PHYTO
Zooplankton (general)	ZOO

ELEMENT AND COMPOUND CODE TABLE - TABLEAU DE CODE DES ELEMENTS ET COMPOSES

(not limitative) (non limitatif)

ELEMENTS/ELEMENTS

AS	arsenic/arsenic
CD	cadmium/cadmium
CO	cobalt/cobalt
CR	chromium/chrome
CU	copper/cuivre
FE	iron/fer
HG	mercury/mercure
	HGT total mercury/mercure totale
	HGI inorganic mercury/mercure inorganique
	HGM methyl-mercury/méthyle-mercure
MN	manganese/manganèse
NI	nickel/nickel
SE	selenium/sélénium
ZN	zinc/zinc

ORGANIC COMPOUNDS/COMPOSES INORGANIQUES

ALD	aldrin (= octalene)/ aldrine (+ octalène)	$C_{12}H_8CL_6$
BHC	= BHC (hexachlorocyclohexane)	
DDD	p,p'-DDD o,p'-DDD	$C_{14}H_{10}CL_4$
DDT	p,p'-DDT	$C_{14}H_9CL_5$
DDE		$C_{14}H_{11}CL_3$
DIE	dieldrin (= octalox)/dieldrine (= octalox)	$C_{12}H_8CL_6O$
LIN	lindane (gammexane)/lindane (gammexane)	$C_6H_6CL_6$
PCB	polychlorinated biphenyls/biphenyls polychlorés	
TDE	= DDD	$C_{14}H_{10}CL_4$

TISSUE CODE TABLE - TABLEAU DE CODE DES TISSUES

00	Whole body	Corps entier
01	Soft part (whole body without carapace or shell)	Partie molle (corps entier san carapace ou coquille)
	ORGANS	ORGANES
11	Liver	Foie
12	Kidney	Rein
13	Ovary	Ovaire
14	Testes	Testicule
15	Gonads (sex indeterminate)	Gonades (sexe indéterminé)
16	Gall bladder (including bile)	Vésicule biliare (bile incluse)
17	Spleen	Rate
18	Digestive gland	Glande digestive
19	Gills	Branchies
20	Brain	Cervelle
21	Nerves	Nerfs
22	Byssus gland	Gland à byssus
23	Stomach (empty)	Estomac (vide)
	MUSCLES	MUSCLES
31	Fillet (general)	Filet (en général)
32	White	Blanc
33	Brown	Brun
34	Pectoral (birds)	Pectoral (oiseaux)
35	Adductor	Adducteur

36	"Foot" (gastropods)	"Pied" (gasteropodes)
37	Mantle (gastropods)	Manteau (gasteropodes)
38	Pincer (crustaceans)	Pince (crustacés)
39	Abdomen (crustaceans)	Abdomen (crustacés)
40	Tentacles (cephalopods)	Tentacules (céphalopodes)
41	Arms (cephalopods)	Bras (céphalopodes)
	SKELETON AND ECTODERM	SQUELETTE ET ECTODERME
51	Carapace	Carapace
52	Shell	Coquille
53	Skin	Peau
54	Scale(s)	Ecaille(s)
55	Feather(s)	Plume(s)
56	Bone	Os
57	Byssus	Byssus
58	Mould	Mue
	BODY FLUIDS	LIQUIDES DU CORPS
61	Blood	Sang
62	Hemolymph	Hémolymphe
63	Bile	Bile
64	Urine	Urine
70	Subcutaneous fat	Graisse sous-cutanée
99	Others (describe)	Autres (décrire)

INSTRUCTIONS FOR THE UTILIZATION OF THE DATA INVENTORY FORM

Baseline Studies and Monitoring of Metals, Particularly Mercury and Cadmium, in Marine Organisms (MED II)

This data collection and reporting form has been designed to allow easy entry into Supplemental Information Form.

The following specific instructions should be followed:

LOG FORM

Country - Insert name of participating country.

Country Code - Insert the proper two-digit country code from the List of Participating Countries and Research Centres (attached).

Research Centre - Insert name of research centre (see attached list) conducting the baseline studies and monitoring.

Country		Research Centre		Principal Investigator	
Code			Code	Collector	
				Analyst	

Sample Number	Species Code	Sampling							Specimens in sample (No.)	Average Length (mm)	Average Weight (g)	Sex	Age	Tissue analyzed	Element analyzed	Concentration (µg/kg) fresh weight	Estimated Error (%)	Comments
		Date			Location													
		Day	Month	Year	LAT.		LONG.											
					Deg.	Min.	Deg.	Min.										

Figure I : LOG FORM: Baseline Studies and Monitoring of Metals, Particularly Mercury and Cadmium, in Marine Organisms - MED II

Research Centre: .....

Principal Investigator: .....

Information Applicable from Sample, Number ..... to Sample, Number .....

Sampling and Field Handling Methods: .....

.....

.....

Storage Procedures: .....

.....

Methods and Instruments Used in Analysis: .....

.....

.....

.....

Intercalibration Results (Indicate percentage higher or lower than IAEA inter-calibration mean): .....

....

Comments on Sample Handling and Analytical Techniques: .....

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Comments on Results of Analysis: .....

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Figure II : SUPPLEMENTAL INFORMATION FORM to Log Form for MED II

Research Centre Code - Select the proper two-digit Research Centre Code from the List of Participating Countries and Research Centres (attached).

Sample Number - Use numbering sequence according to investigator's option, but fill in all blank spaces with zeros (0), i.e. sample No.1 should be entered as 0001.

Species Code - Select the proper species code number from the attached Species Code Table prepared according to the format of "FAO Species Identification Sheets for Fishery Purposes", Fishery Area 37, Mediterranean and Black Sea, Volumes I and II, published by the Food and Agriculture Organization of the United Nations, 1973. If a species is not included in the table, contact FAO (GFCM) for further instructions.

Sampling Date - Enter the date on which the sample was collected, e.g. 1 July 1977 as 01 07 77 or 12 November 1978 as 12 11 78.

Sampling Location - Enter the position where the sample was collected, using zeros (0) as appropriate (i.e. Long 49° 1' should be entered as 049 01). If latitude and longitude cannot be reported, enter instead the exact names of location of the sampling area under the column "Comments" and indicate the area on a map. (See also item 7.2 of the covering letter).

No. of Specimens in sample, average length, average weight - Use zeros (0) for blank spaces (e.g 12 specimens: 012; 15 mm: 015, 465 g: 0465).

Sex - Enter M-Male, F-Female or I-Indeterminate.

Age - Enter estimated or average age in years (use zeros (0) for blank spaces, e.g. 1 year: 01; 12 years: 12), or ND if not determined.

Tissue Analysed - Enter the appropriate code from the Tissue Code Table (attached)

Element Analysed - Enter the appropriate two-digit element code from the Element and Compound Code Table (attached). For elements not listed in the Table use two letter abbreviation of element periodic system. Use one line of the log form for each metal being tested. Thus if "n" metals are analysed in a sample, use "n" lines of the log form for that sample and as many pages of the log form as necessary.

SUPPLEMENTAL INFORMATION FORM

Attach one completed supplemental information form to each series of log forms. The information on this form will not be entered into the digital data base, but used in the interpretation of the data. It should, therefore, be descriptive and written in a manner understandable to those scientists who may not be specialists in the analysis of metals in marine organsisms.

INSTRUCTIONS FOR THE UTILIZATION OF THE DATA INVENTORY FORM

Baseline Studies and Monitoring of DDT, PCBs and Other Chlorinated Hydrocarbons in Marine Organisms (MED III)

This data collection and reporting form has been designed to allow easy entry into the digital data base. The form consists of two parts, a Log Form and a Supplemental Information Form.

The following specific instructions should be followed:

LOG FORM

Country	-	Insert name of participating country.
Country Code	-	Select the proper two-digit country code from the List of Participating Countries and Research Centres (attached).
Research Centre	-	Insert names of research centre (see attached list) conducting the baseline study and monitoring.
Research Centre Code	-	Select the proper two-digit Research Centre Code from the List of Participating Countries and Research Centres (attached).
Sample Number	-	Use numbering sequence according to investigator's option but fill in all blank spaces with zeros (0), i.e. sample No.1 should be entered as 001.
Species Code	-	Select the proper species code number from the attached Species Code Table prepared according to the format of "FAO Species Identification Sheets for Fishery Purposes", Fishery Area 37, Mediterranean and Black Sea, Volumes I and II, published by the Food and Agriculture Organization of the United Nations, 1973. If a species is not included in the Table, contact FAO (GFCM) for further instructions.
Sampling Date	-	Enter the date on which the sample was collected, e.g. 1 July 1977 as 01 07 77 or 12 November 1978 as 12 11 78.
Sampling Location	-	Enter the position where the sample was collected, using zeros (0) as appropriate (i.e. Long. 49° 1' should be entered as 049 01). If latitude and longitude cannot be reported, enter instead the exact name of location of the sampling area under the column "Comments" and indicate the area on a map. (See also item 7.2 of the covering letter).
No. of Specimens in sample, average length, average weight	-	Use zeros (0) for blank spaces (e.g. 12 specimens: 012; 15 mm: 015; 465 g: 0465).

Country		Research Centre		Principal Investigator	
				Collector	
Code		Code		Analyst	

Sample Number	Species Code	Sampling: Date: Day	Month	Year	Location: LAT. Deg.	Min.	LONG. Deg.	Min.	Specimens in sample (No.)	Average Length (mm)	Average Weight (g)	Sex	Age	Tissue analyzed	E.O.M.	Compound analyzed	Concentration (µg/kg) fresh weight	Estimated Error (%)	Comments

Figure III : LOG FORM: Baseline Studies and Monitoring of DDT, PCBs and Other Chlorinated Hydrocarbons in Marine Organisms - MED III

Research Centre: .....

Principal Investigator: .....

Information Applicable from Sample, Number ..... to Sample, Number .....

Sampling and Field Handling Methods: .....

.....

.....

Storage Procedures: .....

.....

Methods and Instruments Used in Analysis: .....

.....

.....

.....

Intercalibration Results (Indicate percentage higher or lower than IAEA inter-calibration mean): .....

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Comments on Sample Handling and Analytical Techniques: .....

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Comments on Results of Analysis: .....

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Figure IV : SUPPLEMENTAL INFORMATION FORM to Log Form for MED III

Sex - Enter M-Male, F-Female or I-Indeterminate.

Age - Enter estimated or average age in year (use zeros for blank spaces, e.g. 1 year 01; 12 years: 12) or ND if not determined.

Tissue Analysed - Enter the appropriate code from the Tissue Code Table (attached).

E.O.M. (Extractable Organic Matter) - Enter the percentage of fresh weight extracted, and indicate solvent used.

Compound Analysed - Enter the appropriate three-digit compound code from the Element and Compound Code Table (attached). For compounds not listed in the Table use first three letters or usual abbreviation. Use one line of the log form for each compound being tested. Thus if "n" compounds are analysed in a sample, use "n" lines of the log form for that sample and as many pages of the log form as necessary.

SUPPLEMENTAL INFORMATION FORM

Attach one completed supplemental information form to each series of log forms. The information on this form will not be entered into the digital data base, but rather used in the interpretation of the data. It should be, therefore, descriptive and written in the manner understandable to those scientists who may not be specialists in the analysis of pesticides and other chlorinated hydrocarbons in marine organisms.

INSTRUCTIONS FOR THE UTILIZATION OF THE DATA INVENTORY FORM

Research on the Effects of Pollutants on Marine Organisms and Their Populations (MED POL IV)

This Data Inventory Form has been designed to provide, for the digital data base, only an inventory of the experimental parameters.

The following specific instructions should be followed:

LOG FORM

Country - Insert name of participating country.

Country Code - Select the proper two-digit country code from the List of Participating Countries and Research Centres (attached).

Research Centre - Insert name of research centre (see attached list) conducting the research on the effects.

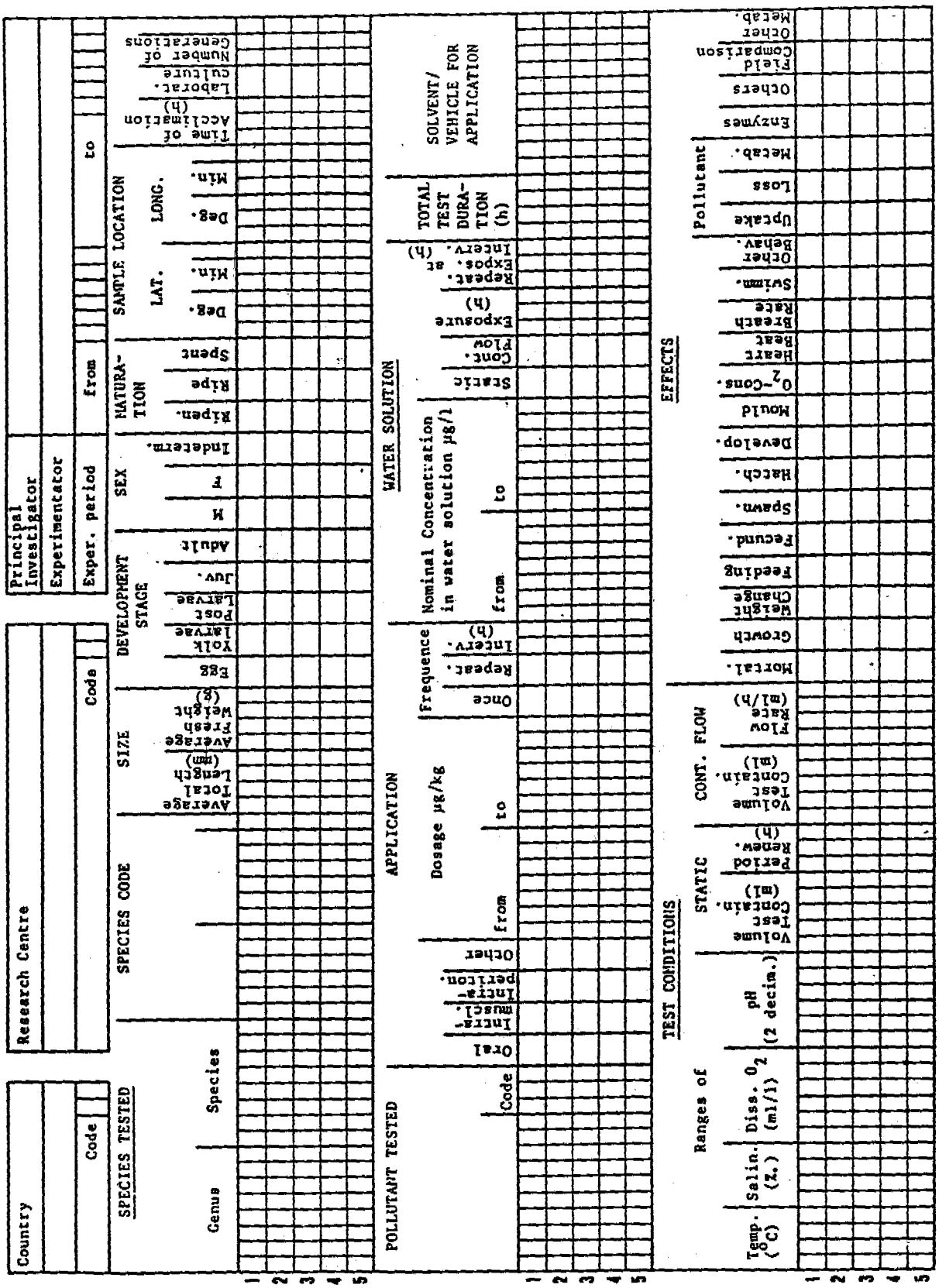


Figure V : DATA INVENTORY FORM: Research on the Effects of Pollutants on Marine Organisms and Their Populations - MED IV

Research Centre Code - Select the proper two-digit research centre code from the List of Participating Countries and Research Centres (attached).

Experimental Period - Indicate the initial and final date of the experimental period, including time for acclimation of test organisms e.g. from 010777 to 160877.

Species Tested

Species - Insert scientific name of the species tested. This may be abbreviated since it is only used as a check against the species code.

Species Code - Select the proper species code from the attached Species Code Table prepared according to the format of "FAO Species Identification Sheets for Fishery Purposes", Fishery Area 37, Mediterranean and Black Sea, Volumes I and II, published by the Food and Agriculture Organization of the U.N., 1973. If a species is not included in the Table, contact the FAO (GFCM) for further instructions.

Size, Development Stage, Sex, Maturation - Give total length in mm, and fresh weight in grams (without decimals). Enter zeros (0) in blank spaces. If several stages of development, sex and maturation have been tested make a mark for all in the same line.

Sampling Location - Enter the position where the organisms were collected (i.e. 49° 1' entered as 4901). In the last column N, and W or E respectively should always be indicated. If latitude and longitude cannot be reported, enter instead the exact name of location of the sampling area and indicate the area on a map.

Pollutant Tested

Element/Compound Tested - Enter the appropriate two or three-digit code from the Element and Compound Table (attached). For element not listed in the Table use two-letter abbreviation of element periodic system. For compounds not listed use the usual three-letter abbreviation (as "PCB" or the first three-letters of the most common name (as "ALD" for Aldrin). Use one line of the data inventory form for each metal or compound being tested. Thus if "n" metals or compounds are tested in an experiment, use "n" lines of the form for that experiment and as many pages of the data inventory form as necessary.

Solvent/Vehicle for Application

Solvent/Vehicle for Application - Usually a pollutant is dissolved in an organic solvent, or it is applicated with the food. Indicate the name of the solvent in the former case or "Food" in the latter.

Test Conditions

Ranges - Give the range of temperature in full degrees and salinity in full $^{o}/_{oo}$. For oxygen, space is provided for one decimal; for pH for two decimals.

Static and Continued Flow Dosage - Give the volume of the container where the test animals are exposed, and the water exchange rate. Enter zeros (0) for blank spaces.

Effects

- Mark the appropriate box where any quantifiable or non-quantifiable observations have been made, which will later be mentioned in the report of results.

Field Comparison - Indicate with a cross if any in situ comparison versus laboratory test were done.

INSTRUCTIONS FOR THE UTILIZATION OF THE DATA INVENTORY FORM

Research on the Effects of Pollutants on Marine Communities and Ecosystems (MED V).

This Data Inventory Form has been designed to provide, for the digital data base, only an inventory of the most important parameters registered during the study of an ecosystem.

The following specific instructions should be followed:

LOG FORM

Country - Insert name of participating country.

Country Code - Select the proper two-digit country code from the List of Participating Countries and Research Centres (attached).

Research Centre - Insert name of research centre (see attached list) conducting the effects studies.

Research Centre Code - Select the proper two-digit Research Centre Code from the List of Participating Countries and Research Centres (attached).

Period of Study - Enter the period of the study (day, month, year) e.g. from 1 July 1977 to 30 June 1978 should read - from 01 07 77 to 30 06 78.

Frequency of Observations - Daily, weekly, monthly, yearly etc.

Country	Code	Research Centre	Code	Principal Investigator	
				Period of Study: from ____ to ____	
				Frequency of Observations	Stations No. / Profiles No.

AREA

Name _____

LAT. ____ LONG. ____

Surface ____ km^2

☐ Intertidal ☐ Coast. Subt.
☐ Nearshore ☐ Open waters

☐ Coastal Lake ☐ Estuary
☐ Bay
☐ Lagoon ☐ Harbour

☐ Pelagic ☐ Benthic
☐ Neuston ☐ Soft Bott.
☐ Holoplankt. ☐ Hard Bott.
☐ Meroplankt. ☐ Secondary
☐ Nekton ☐ Artificial

1/

SPECIES

Categories

☐ Phytoplankt. ☐ Annelids
☐ Zooplankt. ☐ Echinod.
☐ Algae ☐ Elasmobr.
☐ Seagrass ☐ Teleosts
☐ Sponges ☐ Birds
☐ Molluscs ☐ Mammals
☐ Crustaceans ☐ Others

Analyses

☐ Total organic matter
☐ Biomass ☐ Abundance
☐ Diversity ☐ Others 1/

☐ Historical Collection

1/

STRUCTURES AND DYNAMICS

Water

☐ Physical ☐ Chemical
☐ Turbidity ☐ Nutrients

Substrate

☐ Grain size
☐ Sedim. rate ☐ Chemical Composition

Communities

☐ Census ☐ Population dynamics
☐ Trophic relationsh. ☐ Repopulation
☐ Others 1/

1/

POLLUTANTS

Categories

☐ Dom. sewage ☐ Agr. runoff
☐ Ind.effluents ☐ Thermal
☐ River disch. ☐ Others 1/

Codes

1/

1/ Use this space for additional information not covered by the Form

Figure VI : Research on the Effects of Pollutants on Marine Communities and Ecosystems - MED V

Profile No. and Station No. Codes - Give profiles or stations numbers codes.

Area

Name - Insert geographic name.

Latitude and Longitude - For greater areas give 4 geographical positions indicating latitudes and longitudes and use zeros (0) as appropriate.

Surface - Enter the surface of the area under study in square kilometers.

- Check all other boxes as appropriate.

Species

- Check the appropriate boxes.

Structure and Dynamics

Categories and Analyses - Check the appropriate boxes.

Pollutants

Categories - Check the appropriate box(es).

Codes - Enter the appropriate two digit code for element, and three-digit code for compounds such as chlorinated hydrocarbons, petroleum hydrocarbons etc. from the attached Element and Compound Code Table. For elements not listed therein use two letters abbreviation of element periodic systems and for compound insert first three letters or usual abbreviation.

Appendix IV

PROPOSAL FOR THE MUSSEL WATCH EXPERIMENT IN THE MEDITERRANEAN

The proposal for carrying out a "mussel watch" experiment in the Mediterranean in the framework of MED POL II and III was discussed and agreed at the Mid-term Expert Consultation on the joint FAO(GFCM)/UNEP Co-ordinated projects MED POL II-V (Dubrovnik, 2-13 May 1977). The text herebelow is an extract from document FIR:PM/77/11 presented to the above mentioned consultation.

1. Introduction

Bivalves have been recognized as good indicators of certain types of pollutants. It was suggested that they be used for comparative studies on the level of marine pollution.

As UNEP might consider using the proposed "mussel watch" programme on a global scale, it seems to be appropriate to test its applicability first on a regional level. The Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL) appears to be an ideal framework for testing the "mussel watch" for the following reasons:

- existing institutional infrastructure organized through the FAO(GFCM)/UNEP MED POL II and MED POL III pilot projects;
- well organized intercalibration exercise covering the participants in MED POL II and MED POL III pilot projects.

Therefore it is recommended that, as part of MED POL II and MED POL III, the "mussel watch" be tried out during the second phase of these pilot projects by a selected number of participants.

2. Selection of organism

The Mediterranean mussel (Mytilus galloprovincialis), the organism used in MED POL II and MED POL III, is proposed as the organism in which the level of pollutant(s) should be studied.

3. Selection of pollutants

Mercury (inorganic and organically bound) and DDT (possibly with its derivatives) are proposed as pollutants to be monitored.

4. Origin of the test organisms and their exposure to pollutants

All test organisms should come from a simple, relatively well-defined stock from an area where the concentration level of the pollutants to be studied is not too high. They would be distributed to the institutions participating in the exercise and exposed to the "natural" environment, preferably the sites selected by the participants in MED POL II and MED POL III for sampling of mussels.

5. Sampling frequency

Twice a year samples of these exposed organisms (an adequate number to satisfy statistical considerations) would be collected and dispatched to preferably one laboratory where the analytical work could be done.

6. Sampling and analytical procedures

Sampling and analytical procedures should be identical with those used by the participants in MED POL II and MED POL III.

7. Conclusions

By agreeing to execute the Mediterranean regional "mussel watch" programme as part of their activities relevant to MED POL II and MED POL III, the participating research centres would:

- contribute to the testing of the validity of "mussel watch" for global ocean pollution studies;

- add to their present activities a component which would enable them to compare the levels of selected pollutants in "indigenous" organisms in their region before and after they have been exposed to various local conditions.

ANNEX III

OPERATIONAL DOCUMENT

FOR THE JOINT IOC/UNEP PILOT PROJECT ON

PROBLEMS OF COASTAL TRANSPORT OF POLLUTANTS (MED POL VI)

This operational document was produced by a joint IOC/WMO/UNEP Expert Consultation which took place in Msida, at the University of Malta, from 8 - 13 September 1975. The Consultation was attended by experts from 12 Mediterranean Countries. The text of the operational document is identical to that issued as part of the report of the consultation.

CONTENTS

CONTENTS Continued...

1. GENERAL INTRODUCTION

Under the joint auspices of the Intergovernmental Oceanographic Commission (IOC), the General Fisheries Council for the Mediterranean (GFCM of FAO) and the International Commission for the Scientific Exploration of the Mediterranean (ICSEM), the United Nations Environment Programme (UNEP) supported an International Workshop on Marine Pollution in the Mediterranean (Monaco, 9-17 September 1974). The Workshop defined the pollution of coastal waters as the main problem in the Mediterranean and attributed it to the general lack of adequate systems for the treatment and disposal of domestic and industrial waste, to the input of petroleum hydrocarbons and organochlorines, and to the presence of pathogenic micro-organisms. The Workshop reviewed the available information on current regional programmes as well as on the research and monitoring facilities in the Mediterranean and outlined several pollution monitoring and research pilot projects for the Mediterranean.

At the UNEP Intergovernmental Meeting on the Protection of the Mediterranean, which was held in Barcelona from 28 January to 4 February 1975 seven pilot projects outlined by the Monaco Workshop were endorsed as parts of a Co-ordinated Mediterranean Pollution Monitoring and Research Programme whose early implementation was recommended in the frame of the adopted Mediterranean Action Plan.

A joint IOC/WMO/UNEP consultation was held in Malta (8-13 September 1975) to implement two of the endorsed pilot projects:

- Baseline Studies and Monitoring of Oil and Petroleum Hydrocarbons in Marine Waters (MED POL I) and

- Problems of Coastal Transport of Pollutants (MED POL VI)

Experts of the countries bordering the Mediterranean proper and several experts outside the region were invited in order to discuss the two pilot projects and prepare its operational document which will serve as the frame for the co-operation of the Mediterranean research centres in the two pilot projects. The consultation was convened as part of the Mediterranean Action Plan adopted by the UNEP Intergovernmental Meeting on the Protection of the Mediterranean.

2. OBJECTIVES OF THE PILOT PROJECT

The main objective of this pilot project will be the investigation of water circulation in coastal areas and exchange of water between the coastal and offshore regions, in order to provide the necessary information on the physical processes contributing to the transport of pollutants in the Mediterranean Sea.

3. OUTLINE OF THE PILOT PROJECT

Pollutants, either in a dissolved or in a particulate state, are discharged into the sea by the following routes:

- through river discharge;
- through direct terrestrial run-off (e.g. urban or industrial wastes);
- by dumping or discharge from ships;
- from the atmosphere.

They are distributed in the sea under the influence of hydrodynamic conditions existing near each source and in surrounding areas and in particular by two main physical processes:

- horizontal advection; and
- turbulent mixing.

Therefore, in order to understand their actual distribution and to predict the effect of potential sources of pollutants, a sound knowledge of the water circulation and eddy diffusion is required. Since the gross features of the general current system in the Mediterranean are relatively well-known, the pilot project will be directed to the investigation of water circulation in coastal areas and exchange of water between the coastal and off-shore regions, especially in those areas where present or future pollutant discharge may be of importance, as for example at river mouths or urban concentrations.

Such investigations should be made during all seasons and especially under those meteorological conditions that are characteristic of the area, without neglecting small-scale fluctuations.

4. PROGRAMME OF WORK

4.1 Areas of Investigation

The pilot project should commence with studies in areas selected by the participating institutions. It should be noted, however, that not only areas already polluted should be studied but also those still free from pollution. Selected areas might be located near large cities or important rivers such as:

Areas of Investigation	Cities	Rivers
The Mediterranean coasts of Maghreb, including the Strait of Gibraltar	Oran Algiers Tunis	

Areas of Investigation	Cities	Rivers
The eastern Mediterranean coast	Tripoli Benghazi Alexandria Port-Said Tel-Aviv Haifa Beirut Mersin	Nile
The coasts and islands of Greece	Thessaloniki Athens-Piraeus Volos Kavala	
The western coasts of Turkey	Izmir	(Dardanelles)
The northern Adriatic	Rijeka Trieste Venice	Po
The Tyrrhenian and Ligurian Seas	Palermo Naples Rome Livorno Genoa	Tiber
The south coast of France	Marseille	Rhone
The east coast of Spain	Barcelona Valencia Alicante Malaga	Ebro

4.2 Basic Parameters

Noting the influence that coastal and bottom morphology, as well as regional and local wind fields acting on the sea surface, has on coastal circulation, the basic parameters to be studied are:

- currents;
- salinity and temperature;
- surface wind;
- bathymetry (sea depth).

Also, collection of existing data or direct measurements of main river discharges at regular intervals should be used.

4.3 Complementary Data

- meteorological data;
- transparency and turbidity;
- sea level.

Chemical, biological, and geological studies may also be used to supplement the basic data.

4.4 Observation and Methodology

It is noted that many laboratories, especially those in developing countries, may not, at present, be well equipped to make these measurements. The most convenient method should be used by each laboratory bearing in mind that different methods yield different information and that, in general, a higher level of sophistication yields better data (but also requires more training).

(a) Current measurements

The following techniques may be used:

- drift cards or drifters;
- drogues;
- tracers or dyes;
- current meters, preferably recording.

It is suggested that the methods using drift cards might be adopted by all laboratories so that results may be co-ordinated and compared.

Since results obtained with current meters yield different data from those obtained with drift cards or drogues, both methods should be used as far as possible.

(b) Salinity and temperature

Salinity and temperature should be determined by the classic methods or by in situ measurements using STD probes.

Temperature may also be measured using bathythermographs or thermistor chains.

(c) Surface winds

On board vessels, hand or recording anemometers can be used. Also the help of coastal meteorological stations will often be of value in determining this parameter.

Information on the general meteorological situation can be obtained through the meteorological services.

(d) Complementary data

These should be collected depending on local conditions and capabilities following recognized methods.

4.5 Oceanographic Stations

A network of oceanographic stations should be selected to cover the area of study. The number and position of the stations should be based on either previous experience or a preliminary survey.

4.6 Frequency of Observations

Observations should be carried out during all seasons and under different meteorological conditions. In deciding on the periods for observations, local and regional conditions should be considered.

4.7 Depths of Observations

(a) Current measurements

These should be conducted at least in the surface mixed layer, below the thermocline, if this exists, and near the bottom.

(b) Salinity and temperature

These should be recorded either as a continuous function of depth or at discrete depths. In the latter case these depths should include at least the standard depths for data comparison and handling.

4.8 Data Collections and Processing

Because of the large amount of data to be collected, and also because many laboratories and agencies will be participating, there must be provision for processing, storing, and exchange data on a large scale. This means in practice that data must be stored and handled by computers, and in formats that are really handled by both the data centres and the investigators that are involved.

For these purposes, participating countries are required to apply strictly the rules laid down by the IOC Working Committee on International Oceanographic Data Exchange (IODE).

Compliance with these rules will offer the additional advantage of making it possible in certain instances to use the computers of some centres to ensure optimum processing of raw data. The opportunity could also be taken of using the centres to train personnel concerned with application of these techniques.

Finally, consideration might be given to commissioning one or more such centres to produce condensed reports which would be useful in following the development of the project.

5. PARTICIPANTS IN THE PILOT PROJECT

A number of Mediterranean research centres have expressed the wish to participate in the pilot project. These were identified through inquiries by the Secretariat of IOC and during a feasibility study on the execution of the Co-ordinated

Mediterranean Monitoring and Research Programme carried out by two IOC consultants on behalf of UNEP, and officially designated by their governments to participate.

The participation will not be limited to research centres able to deal with all aspects of the proposed working programme, but may also include those research centres which are capable of only limited contribution initially, whilst under development. Research centres may join the project at any time they wish. However, their participation, as well as the programmes they are proposing as their contribution, will have to be cleared by their appropriate national authorities.

6. REQUIREMENTS FOR INSTRUMENTS AND MAINTENANCE SERVICES

To improve the facilities of the participating research centres various additional instruments will be provided through the pilot project.

Maintenance and advisory services will be organized through the pilot project for the more complex instruments used in the project. The selection of the instruments for the pilot project will be based on their performances and the maintenance service which could be organized for their smooth operation.

The selection of the recipient centres will be based on an assessment of the most acute needs for such facilities, and the assurance of the recipients to provide adequate infrastructure for their installation, routine maintenance, calibration and operation in accordance with the needs of the programme.

7. INTERCALIBRATION OF INSTRUMENTS

Intercalibration of instruments will not in general be necessary but may be desirable in certain cases (e.g. when field work is carried out in neighbouring coastal areas by different institutions).

8. TRAINING NEEDS AND TECHNICAL ASSISTANCE

The lack of adequately trained scientists to perform the sophisticated techniques seriously hinders the full participation of all national research centres which expressed the wish to become part of the project participating in the execution of the programme. Therefore, fellowships for in-service training of up to six months each will be awarded with priority to those research centres from developing countries whose full participation in the pilot projects depends on their acquiring adequately trained scientists. The fellowships will be available at the very beginning of the programme.

The training, including on-board training, will be executed in Mediterranean research centres, having adequate facilities and experience in such activity.

Trainees will be selected from national research centres which provide an assurance that the trainee will continue to work on the programme upon return to his home centre. The training centres will be expected to maintain contact with trainees who have returned to their home laboratories.

ANNEX IV

OPERATIONAL DOCUMENT

FOR THE JOINT WHO/UNEP PILOT PROJECT ON

COASTAL WATER QUALITY CONTROL (MED POL VII)

This operational document was produced by a joint WHO/UNEP Expert Consultation which took place in Geneva, at the WHO Headquarters, from 15 to 19 December 1975. The Consultation was attended by 35 participants from 15 Mediterranean Countries. The text of the operational document is identical to that issued as part of the report of the consultation.

Figure IV Continued....

RECORD NAME Detail 2 Record (STD)

14. FIELD NAME	15. POSITION FROM-1 MEASURED IN Bytes (e.g., bits, bytes)	16. LENGTH NUMBER	16. LENGTH UNITS	17. ATTRIBUTES	18. USE AND MEANING	
File Type	1	3	Bytes	A3	Always '022'	
File Identification	4	6	Bytes	A6		
Record Type	10	1	Bytes	I1	Always '4'	
Cast Number	11	5	Bytes	A5	Analogous to NODC Station Number	
Depth	16	5	Bytes	I5	Meters to tenths	SCAN DATA
Dissolved Oxygen	21	5	Bytes	I5	ml/l to thousandths	
Transmissivity	26	5	Bytes	I5	% to thousandths	
Blank	31	4	Bytes	4X		
Scan Condition Code	35	1	Bytes	A1	Code describing how data arrived at	
Scan Data	36	4(20)	Bytes	4(3I5,4X,A1)	Repetition of above	
Sequence Number	116	5	Bytes	I5	Ascending numeric, used for sorting	
					Blanks are used when significance of field indicated exceeds what is measured	

RECORD FORMAT DESCRIPTION STD

Figure IV Continued....

RECORD NAME MASTER RECORD CONTINUED

14. FIELD NAME	15. POSITION FROM-1 MEASURED IN Bytes (e.g., bits, bytes)	16. LENGTH NUMBER	16. LENGTH UNITS	17. ATTRIBUTES	18. USE AND MEANING
Wet bulb temperature	65	4	Bytes	I4	Degrees C to tenths
Dry bulb temperature	69	4	Bytes	I4	Degrees C to tenths
Wind direction	73	2	Bytes	I2	Tens of degrees WMO Codes 0855 and 0877
Wind speed	75	2	Bytes	I2	Whole knots
Weather Code	77	1	Bytes	I1	WMO 4501
Sea State Code	78	1	Bytes	I1	WMO 3700
Visibility Code	79	1	Bytes	I1	WMO 4300
Cloud Type Code	80	1	Bytes	A1	WMO 0500
Cloud Amount Code	81	1	Bytes	I1	WMO 2700
Instrument Information	82	20	Bytes	20A1	Type and Serial Number
Location Name	102	6	Bytes	A6	OCSEP Internal Location Code
Depth to bottom	108	5	Bytes	I5	To whole meters
Maximum depth of cast	113	4	Bytes	I4	To whole meters
Blank	117	4	Bytes	4X	
	DETAIL RECORD (REQUIRED)				
File Type	1	3	Bytes	A3	Always '022'
File Identification	4	6	Bytes	A6	
Record Type	10	1	Bytes	I1	Always '3'
Cast Number	11	5	Bytes	A5	Analogous to NODC Station Number
Depth	16	5	Bytes	I5	Meters to tenths
Temperature	21	5	Bytes	I5	Degrees C to thousandths
Salinity	26	5	Bytes	I5	P.P.T. to thousandths
Sigma-t	31	4	Bytes	I4	To hundredths
Scan Condition Code	35	1	Bytes	A1	Code describing how data arrived at
SCAN DATA	36	4(20)	Bytes	4(3I5,I4,A1)	Repetition of above
Sequence Number	116	5	Bytes	I5	Ascending numeric, used for sorting

SCAN DATA

Blanks are used when significance of field indicated exceeds what is measured.

RECORD FORMAT DESCRIPTION STD

Figure IV Continued....

RECORD NAME TEXT RECORD (OPTIONAL)

14. FIELD NAME	15. POSITION FROM-1 MEASURED IN Bytes (e.g., bits, bytes)	16. LENGTH NUMBER	16. LENGTH UNITS	17. ATTRIBUTES	18. USE AND MEANING
File Type	1	3	Bytes	A3	Always '022'
File Identification	4	6	Bytes	A6	
Record Type	10	1	Bytes	I1	Always '1'
Cast Number	11	5	Bytes	A5	Analogous to NODC Station Number
Text	16	100	Bytes	100A1	Additional pertinent information
Sequence Number	116	5	Bytes	I5	Ascending numeric, used for sorting
MASTER RECORD (REQUIRED THRU BYTES 59)					
File Type	1	3	Bytes	A3	Always '022'
File Identification	4	6	Bytes	A6	
Record Type	10	1	Bytes	I1	Always '2'
Cast Number	11	5	Bytes	A5	Analogous to NODC Station Number
Latitude					
Degrees	16	2	Bytes	I2	
Minutes	18	2	Bytes	I2	
Hundredths of Minutes	20	2	Bytes	I2	
Hemisphere	22	1	Bytes	A1	'N' or 'S'
Longitude					
Degrees	23	3	Bytes	I3	
Minutes	26	2	Bytes	I2	
Hundredths of Minutes	28	2	Bytes	I2	
Hemisphere	30	1	Bytes	A1	'E' or 'W'
Cruise Identification	31	10	Bytes	10A1	Originator Cruise Identification
Number of Scans	41	5	Bytes	I5	Number of scans in a 'station' (There are five scans per record type '3')
Year	46	2	Bytes	I2	Last two digits of year ┐
Month	48	2	Bytes	I2	1-12 ├ GMT
Day	50	2	Bytes	I2	1-31 ├ GMT
Hour	52	2	Bytes	I2	0-23 ├ GMT
Minutes	54	2	Bytes	I2	0-59 ┘ GMT
Depth Interval Indicator	56	1	Bytes	I1	'0' equals unequally spaced depths '1' equals equal spaced depths
Depth Interval	57	3	Bytes	I3	When above equals '1', the depth interval, to tenths of meters reported.
Barometric pressure	60	5	Bytes	I5	Millibars to tenths

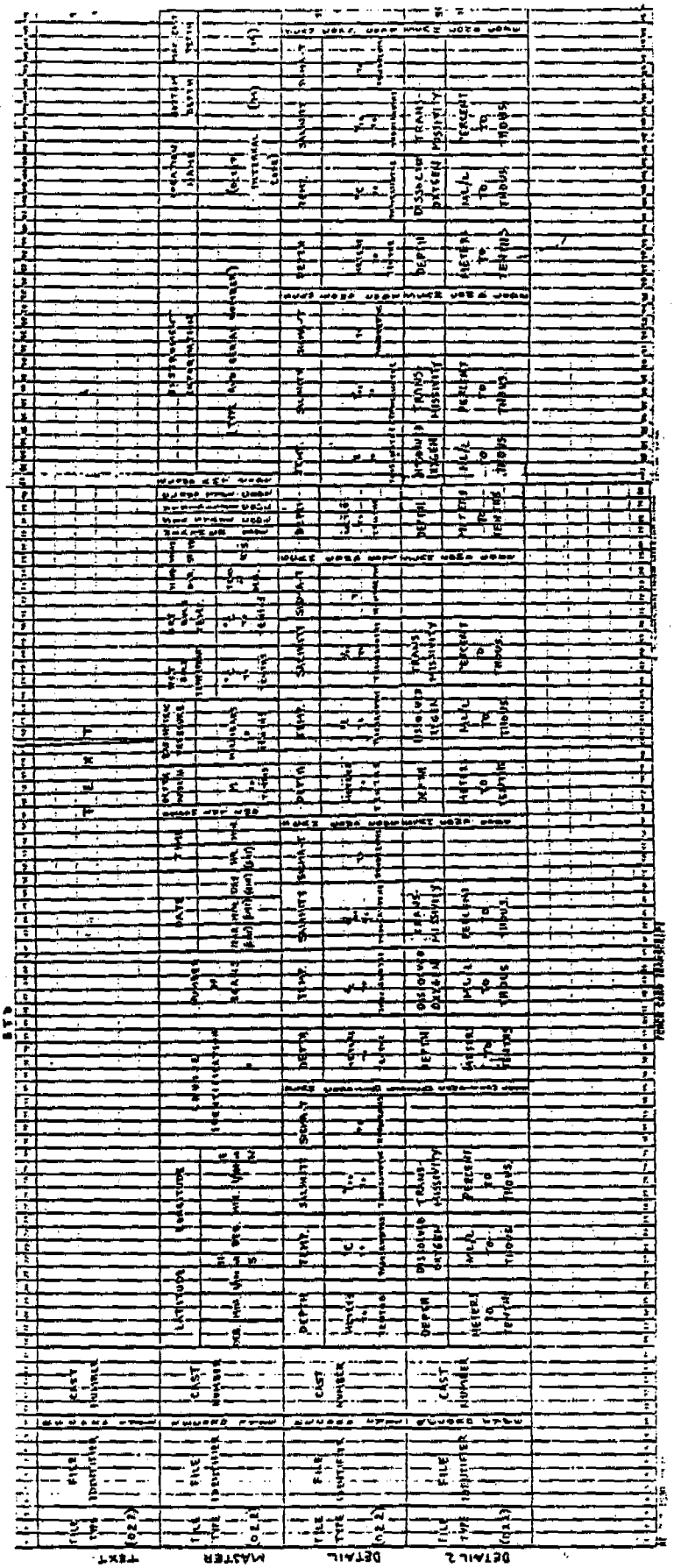


Figure IV continued...

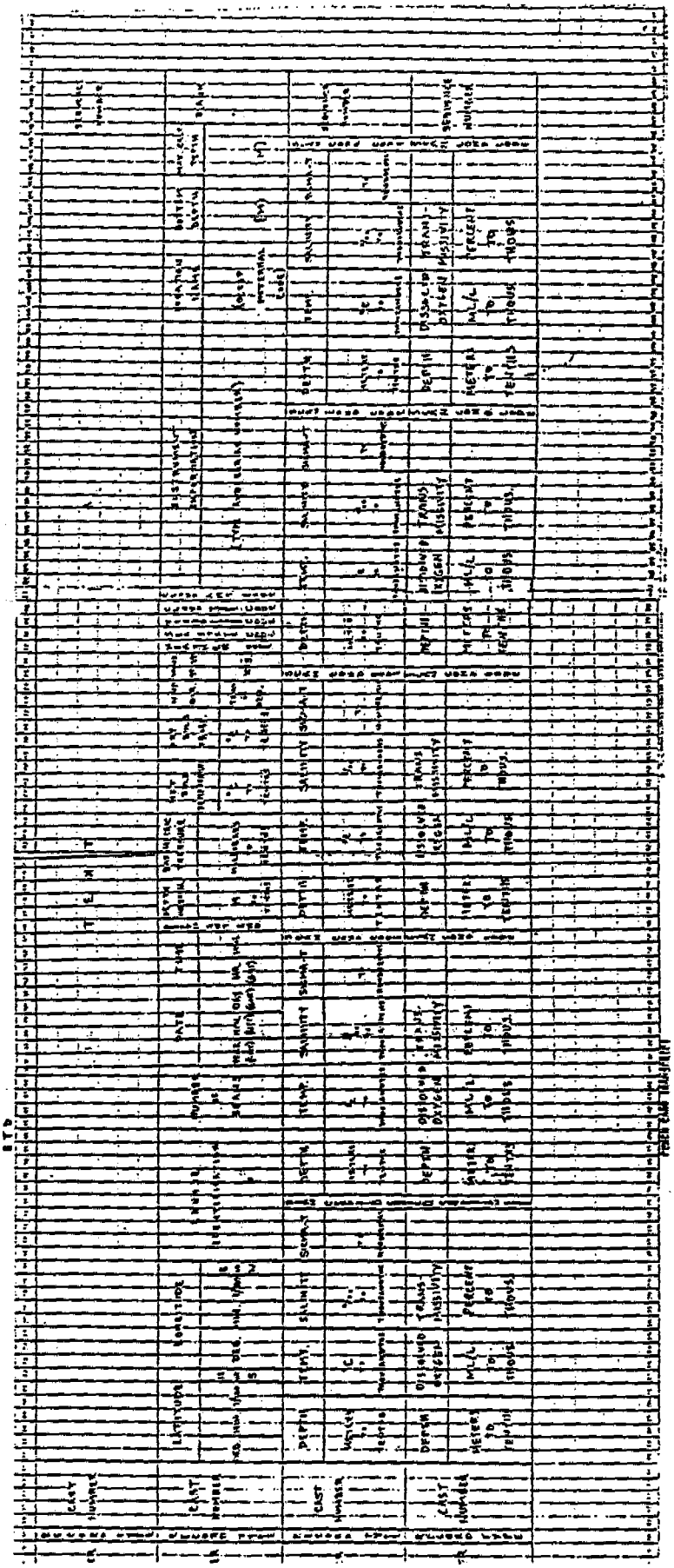


Figure IV : Reporting format for STD data

Figure III Continued...

14. FIELD NAME	15. POSITION FROM-1 MEASURED IN (e.g., bits, bytes)	16. LENGTH NUMBER	UNITS	17. ATTRIBUTES	18. USE AND MEANING
File Header Record					
FILE TYPE	1	3	bytes	A3	"005" (constant value)
FILE DATE	4	6	bytes		Date of File Creation
YEAR	4	2	bytes	I2	Last two digits of year
MONTH	6	2	bytes	I2	Month "01" thru "12"
DAY	8	2	bytes	I2	Day "01" thru "31"
RECORD TYPE	10	1	bytes	A1	"1" for File Header
STATION	11	5	bytes	A5	Buoy Station Identifier
SEQUENCE	16	1	bytes	I1	File Header Number
TEXT	17	44	bytes	44A1	Optional Comments
Station Header Record					
IDENT	1	15	bytes	A3,3I2,A1,A5	Same as "File Header Record" except Record Type is "2"
LATITUDE	16	6	bytes	3I2	Degrees, Minutes, Seconds
LATHEM	22	1	bytes	A1	"N" or "S" Hemisphere
LONGITUDE	23	7	bytes	I3,2I2	Degrees, Minutes, Seconds
LONHEM	30	1	bytes	A1	"W" or "E" Hemisphere
SENSOR	31	4	bytes	I4	Depth in Meters to tenths
WATER	35	4	bytes	I4	Depth in Meters to tenths
blank	39	22	bytes	22X	blank
Data Record					
IDENT	1	15	bytes	A3,3I2,A1,A5	Same as "File Header Record" except Record Type is "3"
DATE	16	6	bytes	3I3	Year, Month, Day; observed
TIME	22	4	bytes	I4	Time in Hours to hundredths
DIRECTION	26	3	bytes	I3	Whole degrees from true north
VELOCITY	29	4	bytes	I4	Current; whole cm/sec
TEMP	33	3	bytes	I3	Degrees Celsius to tenths
PRESSURE	36	4	bytes	I4	kg/cm^2 to hundredths
CONDUCTIVITY	40	4	bytes	I4	Millimhos/cm to hundredths
Inclinometer angle	44	2	bytes	I2	Meter tilt off vertical. In whole degrees
Wind Direction	46	3	bytes	I3	True direction from which wind is blowing. In whole degrees
Wind Speed	49	4	bytes	I4	Cm/sec
Sea Direction	53	3	bytes	I3	True direction from which dominant waves are coming. In whole degrees
Sea Height	56	3	bytes	I3	Height of dominant waves. centimeters
Sea Period	59	2	bytes	I2	Period of dominant waves. Seconds

REPORTING FORM FOR AANDERAA CURRENT METER DATA* : MED VI - Coastal Transport of Pollutants

*issued previously as U.S. National Oceanographic Data Centre Format No. 005 (MESA Bight)

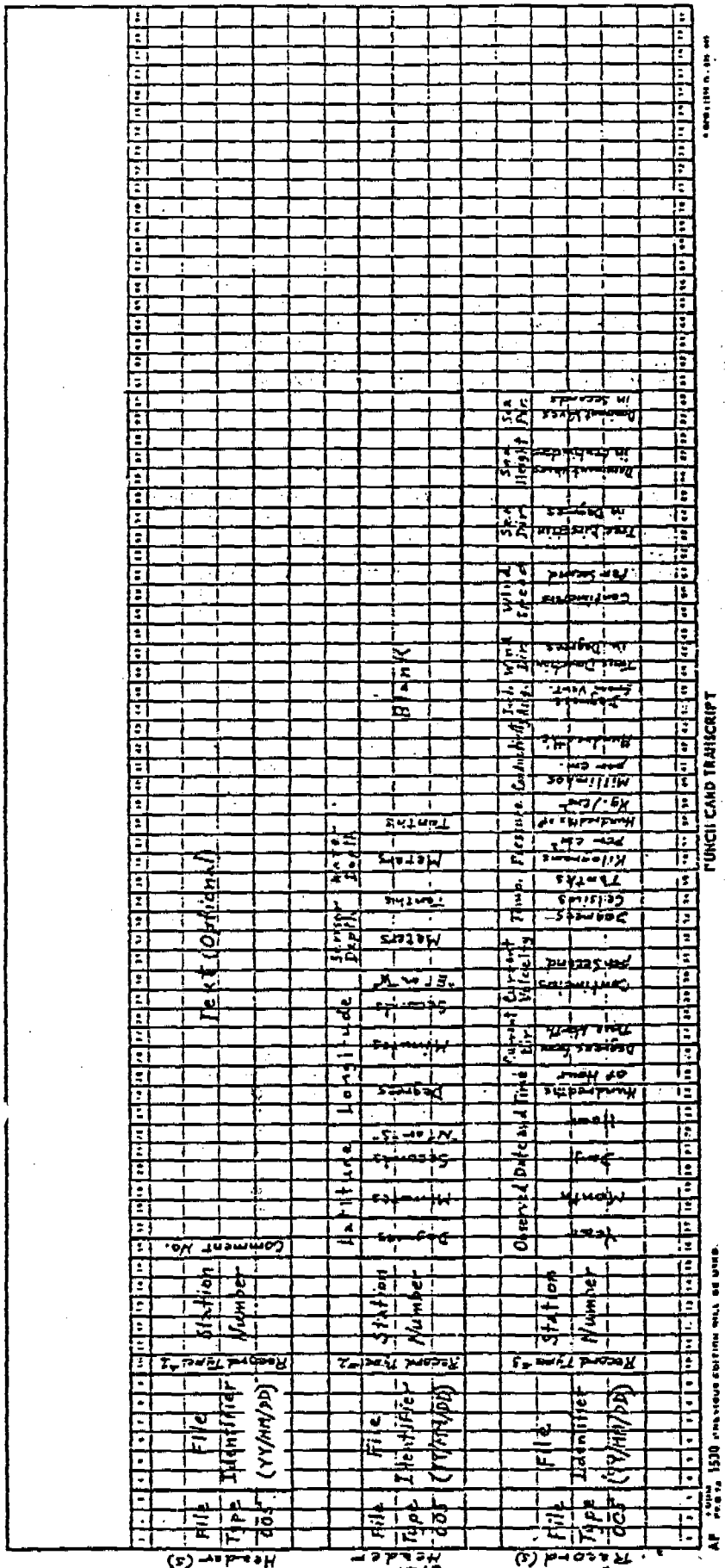


Figure III : ANDERAA CURRENT DATA FORMAT - MED VI

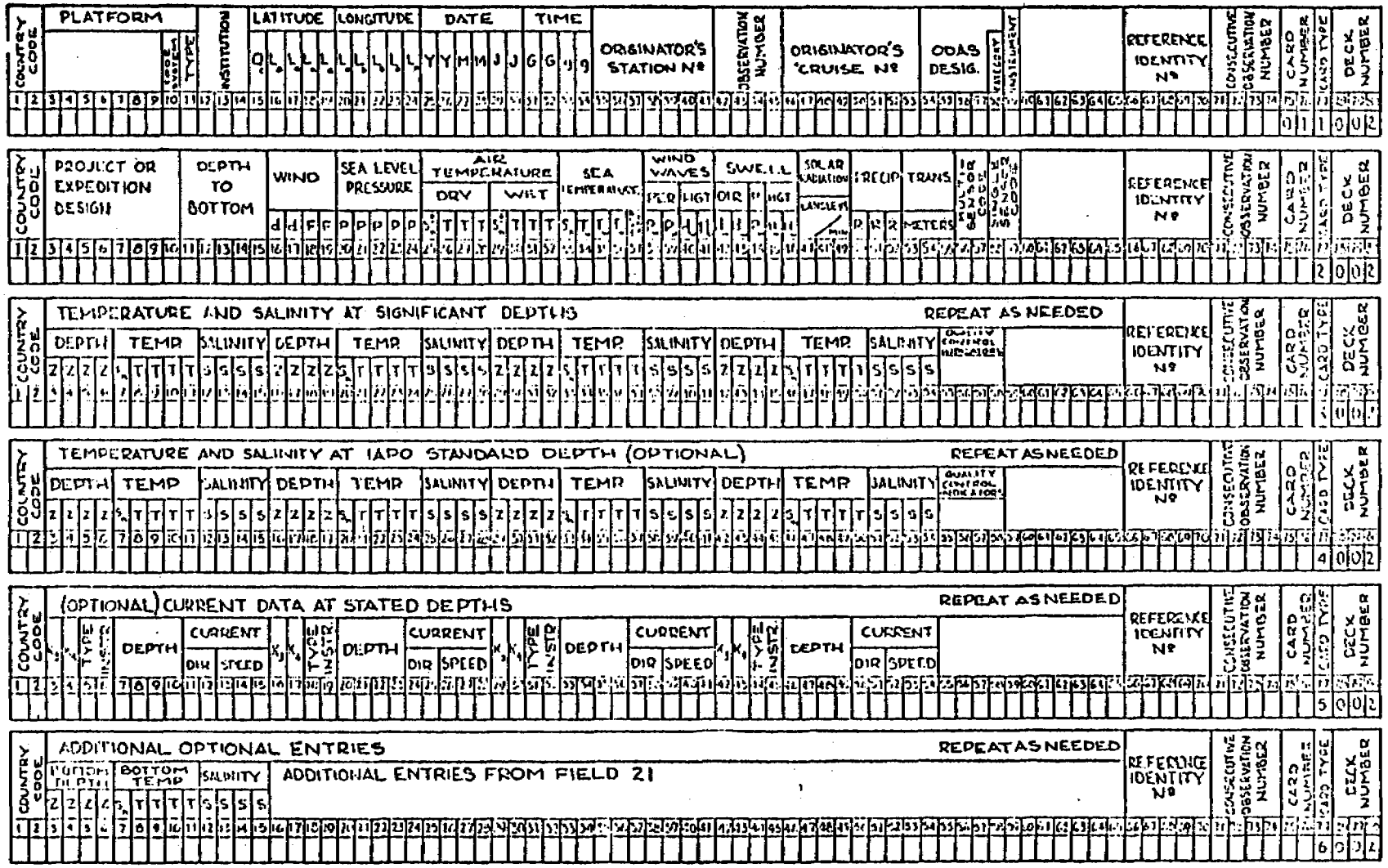


Figure II : DATA REPORTING FORM for Nansen Cast, STD and Current Measurements : MED VI - Coastal Transport of Pollutants

(Form taken from IOC "Manual on IGOSS Data Archiving and Exchange", 1974, UNESCO)

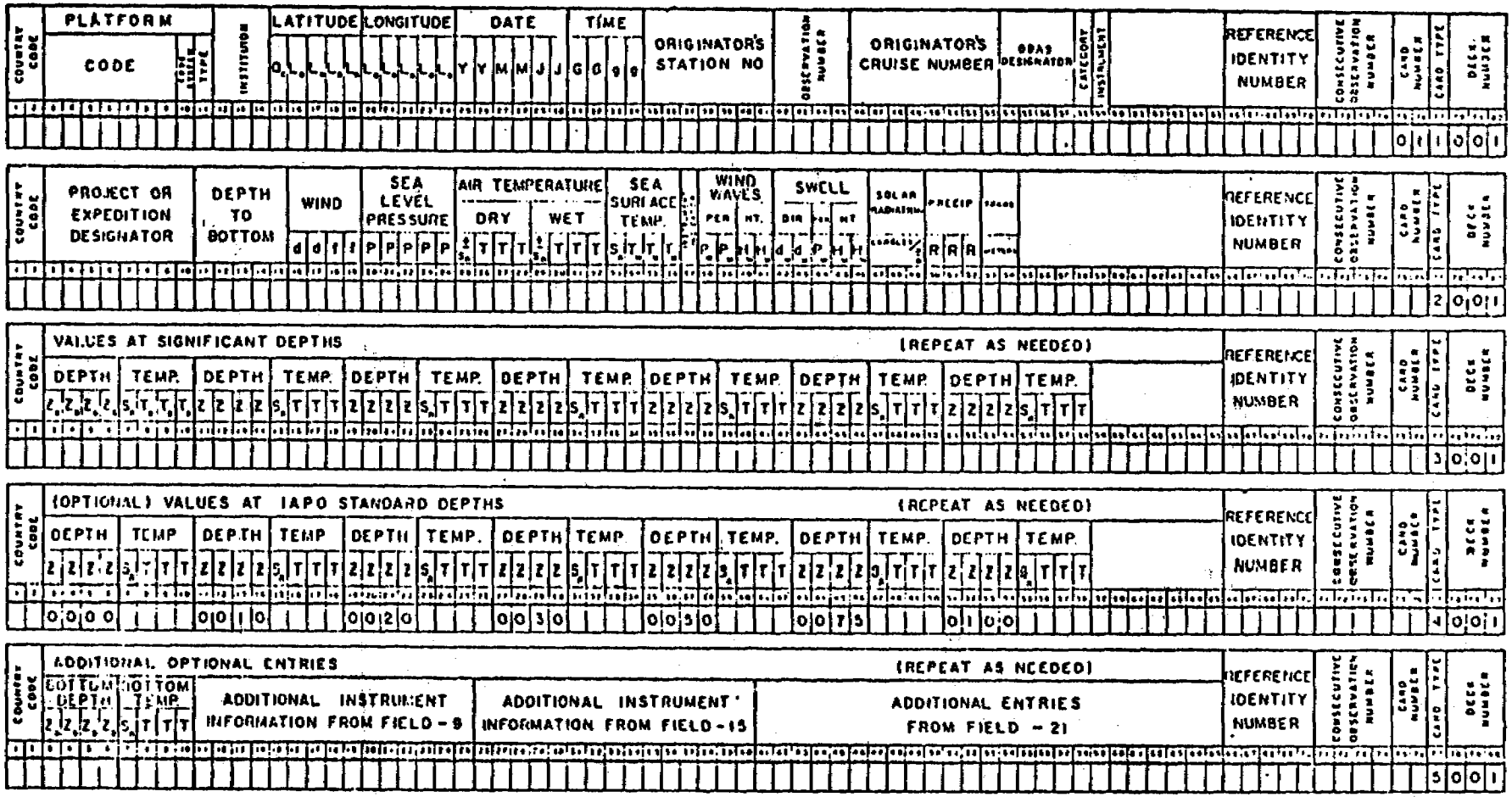


Figure I : DATA REPORTING FORM for Bathythermograph (XBT, MBT) Data : MED VI - Coastal Transport of Pollutants

(Form taken from IOC "Manual on IGOSS Data Archiving and Exchange", 1974, UNESCO)

Appendix III

DATA COLLECTION FORMS FOR MED POL VI

The data collection forms recommended to be used by the laboratories participating in MED POL VI are attached as figures I, II, III, and IV.

- The participating research centres be requested to complete and submit to IOC ROSCOP [1/] forms.

- The participating research centres submit to IOC analyzed data and conclusions; all participating research centres should use the procedures for exchange of data adopted by IODE.

- IOC convene a panel of scientists to recommend assessment procedures and the format in which analyzed data should be submitted to IOC.

1/ Report on Observations/Samples Collected by Oceanographic Programmes.

Appendix II

RECOMMENDATIONS OF THE IOC/UNEP MID-TERM REVIEW MEETING ON MED POL-VI

(Barcelona, 23-27 May 1977)

The meeting recommends that:

- A task team be convened by IOC to consider problems related to the measurement of currents and to prepare a manual of methodology for current measurements.

- For the benefit of participants in the WHO/UNEP pilot project on Coastal Water Quality Control (MED POL VII) one scientist each from MED POL-VI and MED POL-VII redraft the sections related to oceanographic observations in document IOC/WMO/UNEP-MED/MRM/25.

- Specific international agreements to be made to enable scientific cruises to include national waters whenever appropriate.

- The complete set of the CIM (IOC/ICSEM/GFCM) series of charts (bathymetry, gravity and magnetics) of the Mediterranean on scale 1 : 75.000 should be made available by IOC to the research centres participating in MED POL-VI.

- Centres having detailed hydrographic charts of the continental shelf should make them available to interested participants.

- In writing progress reports, a uniform format be followed and that IOC provide each research centre with an outline of this format.

- Research centres participate in the proposed regional cruise in the Mediterranean during 1978 and that the parameters to be monitored include basic hydrographic parameters and meteorological observations.

- The DRIFTEX experiment be expanded provided that the scientific results from the initial experiment in the Ligurian Seas as well as those from Egypt and Yugoslavia be processed and interpreted with financial support of IOC.

- The electronics engineer be supplied with all necessary spare parts including those for the Soviet salinometers.

- IOC keep the research centres informed about research carried out in other centres participating in MED POL-VI.

- An interdisciplinary task team be formed to accelerate modelling in the Mediterranean.

Appendix I

RECOMMENDATIONS OF THE EXPERT CONSULTATION RELEVANT TO THE JOINT IOC/UNEP PILOT PROJECT MED POL-VI

(Msida, Malta, 8 - 13 September 1975)

The Consultation considered the outline for a plan of operation for a co-ordinated study of coastal circulation in the Mediterranean with special reference to marine pollution prepared by the IOC Secretariat (IOC/MPPP/6). In discussing the scope of the project some participants felt that the project should cover both dynamic aspects of coastal water masses and studies on the transport and distribution of the principal pollutants along the coast by the sea, principally near the main sources of pollutant injection.

It was suggested that, since the planned joint activity of UNEP, Economic Commission for Europe (ECE), United Nations Industrial Development Organization (UNIDO) and WHO to prepare an inventory of pollutants entering the Mediterranean from land-based sources was already underway, co-ordination with this pilot project (MED POL X) would be useful at a later stage.

It was agreed that it would be important to prepare guidelines for sampling methodology to permit comparison of results and to facilitate broad participation. The choice of techniques and methodology would be such as to satisfy the minimum requirements in sensitivity and accuracy. In the same regard, consideration would be given to ensuring simplicity in operational procedures and maintenance of instruments.

Figure showing the proposed programme timing for the implementation of MED POL VI (1976 - 1978)

	1976												1977												1978											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1. Preparatory phase	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																			
2. Training										X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X										
3. Delivery of equipment														X	X	X	X	X	X	X	X															
4. Intercalibration trials															X	X	X	X	X	X	X	X			X	X	X	X	X							
5. Taking measurements	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6. Visits of experts										X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7. Data analysis							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8. Meeting (mid-term and final)																X													X							
9. Report																X							X						X							

9. CO-ORDINATING ACTIVITIES

Co-ordination of the work performed by the participating institutions on the basis of this Operational Document will be the responsibility of the IOC and UNEP. This may include:

- correspondence with the national authorities and the participating research centres;
- co-ordination of field work in neighbouring coastal areas or regions;
- co-ordination of large-scale drift card experiments and their evaluation;
- issuance to participants of regular Newsletters giving the progress of field experience, and general results of the participating institutions;
- a contact group meeting in each year of the project;
- organization of data reporting, evaluation and dissemination;
- organization of the training programme;
- organization of the delivery of equipment;
- organization of assistance with maintenance;
- constant review of participating research centres and efforts to enlarge the network of participants;
- contacts with similar projects;
- co-ordination of the visits of experts;
- any other activity relevant to the execution of the programme.

The activities envisaged as contributing to this pilot project will be co-ordinated with the activities of other pilot projects in the frame of the Co-ordinated Mediterranean Pollution Monitoring and Research Programme endorsed by the Barcelona Intergovernmental Meeting on the Protection of the Mediterranean.

10. REPORTS

Participating research centres will be asked to submit progress reports to IOC in November 1977 and June 1978. Final reports will be required in October 1978.

11. PROGRAMME TIMING

Since there is likely to be a variety of national contributions and some countries will be unable to initiate action on the scheduled date, it is not possible to provide a precise general time-table. As a rough guide, a tentative time-table is proposed in the attached figure.

FORM 1 (fig. I): A. REFERENCE POINT(S) MONITORING AND GENERAL DATA [1/]

Page 1

1. General identifications

1.1 Country: Write down the identification code of the country (assigned by WHO/UNEP; list attached).

1.2 Institute: Write down the identification code of the institute (assigned by WHO/UNEP; list attach).

1.3 Area: Write down the average longitude and latitude of the area.

1.4 Date: Time (hour), day, month and year (the last two figures) of the sampling.

1.5 Number of reference sampling point: Use the same order number as given in the relevant map of the monitoring area.

1.6 Total number of monitoring multiple sampling points: Give the total number of sampling points relative to the reference point.

1.7 Total number of reference sampling points for the same area: Give the total number of reference points (usually one or two).

2. Visual appearance

2.1 Beach zone and 2.2 Recreational waters: Up to 12 identification codes for contaminants (Con.) with their quantity (Q.) may be used (according to Table 2, page 10, of "Guidelines for Health Related Monitoring of Coastal Water Quality," EURO/WHO publication, Copenhagen, 1977). The codes should be chosen according to conditions in the field.

3. Dynamic conditions

3.1 State of tide: Mark with 1 the flood tide, with 2 the ebb tide and in metres the actual level (+/-) with respect to the mean level

3.2 State of waves: Mark, using the BEAUFORT scale, with 1 the calm sea, with 2 the near-calm sea and with 3 the rough sea

3.3 Current direction and 3.5 Drift direction: in degrees

3.4 Current speed and 3.6 Drift speed: in cm/s

4. Meteorological conditions

4.1 Wind velocity: in m/s

4.2 Wind direction: in degrees

1/ For each reference point a separate Form 1 (pages 1 and 2) should be completed.

C. SHELLFISH MULTIPLE SAMPLING POINTS MONITORING[1]

1. Identification: 1.1 Date: Time ⌊__⌋ Day ⌊__⌋ Month ⌊__⌋ Year ⌊__⌋ 1.2 Number of the sampling point (located on the map) ⌊__⌋

   1.3 Total number of relevant sampling points ⌊__⌋

2. Hydrographic conditions:

   2.1 Sea temperature in situ °C ⌊__⌋

   2.2 Sample temperature during transport °C ⌊__⌋

   2.3 Salinity ‰ ⌊__⌋

   2.4 Oxygen mg/l ⌊__⌋

	Water in culture area	Shellfish in situ	Sediments	Other .....
3. Elements monitored:	⌊__⌋	⌊__⌋	⌊__⌋	⌊__⌋
4. Bacteriological data:				
Total coliforms	⌊__⌋ No./100 ml	⌊__⌋ No./100 g		⌊__⌋
E. Coli	⌊__⌋ No./100 ml	⌊__⌋ No./100 g	⌊__⌋ No./g	⌊__⌋
Streptococcus faecalis	⌊__⌋ No./100 ml	⌊__⌋ No./100 g		⌊__⌋
Total heterotrophic bacteria		⌊__⌋ No./g		⌊__⌋
5. Pathogenic organisms:				
5.1 Salmonella	⌊__⌋	⌊__⌋	⌊__⌋	⌊__⌋
5.2 Vibrio (cholerae, NAG, para-haemolyticus)	⌊__⌋	⌊__⌋	⌊__⌋	⌊__⌋
5.3 Enterophages	⌊__⌋	⌊__⌋	⌊__⌋	⌊__⌋
5.4 Other	⌊__⌋	⌊__⌋	⌊__⌋	⌊__⌋
.....	⌊__⌋	⌊__⌋	⌊__⌋	⌊__⌋

[1] For the monitoring of the relevant reference point(s), Form 1 should be completed.

Figure III : FORM FOR DATA RECORDING of shellfish multiple sampling points monitoring

Joint WHO/UNEP Co-ordinated Pilot Project on Coastal Water Quality Control in the Mediterranean

Figure II Continued...

			Surface	Subsurface (to be specified)	.....
5.	**Eutrophication conditions:**				
5.1	**Biomass and density of phytoplankton:**				
	Chlorophyllae: a	mg/m^3			
	b	mg/m^3			
	c	mg/m^3			
	Density of phytoplankton	No. units/ml			
5.2	**Nutrients:**				
	Ptot	mg/m^3			
	PO_4 - P	mg/m^3			
	NH_3 - N	mg/m^3			
	NO_2 - N	mg/m^3			
	NO_3 - N	mg/m^3			
5.3	**Indications of anoxic conditions:**				
	Organic N	mg/m^3			
	Relationship of $H_2S/O_2/E_h$				
6.	**Plankton:**				
6.1	**Pathogenic organisms**				

B. RECREATIONAL WATER-MULTIPLE SAMPLING POINTS MONITORING[1]

1. Identification: 1.1 Date: Time[ ] Day[ ] Month[ ] Year[ ] 1.2 Number of the sampling point (see map of the project) [ ]

   1.3 Total number of sampling points within the monitoring area [ ]

2. Hydrographic conditions:		Surface	Inter. Layer	Bottom	Sediments
2.1 Sea temperature in situ	°C	[ ]	[ ]	[ ]	
2.2 Sample temperature during transport	°C	[ ]	[ ]	[ ]	[ ]
2.3 Salinity	‰	[ ]	[ ]	[ ]	
2.4 Oxygen	mg/l	[ ]	[ ]	[ ]	
2.5 Air temperature	°C	[ ]			

3. Bacteriological data:					
Total coliforms	No./100 ml	[ ]	[ ]	[ ]	[ ]
Faecal coliforms (E. coli)	No./100 ml	[ ]	[ ]	[ ]	[ ]
Faecal streptococci (Enterococci)	No./100 ml	[ ]	[ ]	[ ]	[ ]

4. Pathogenic organisms:

Salmonella	[ ]	[ ]	[ ]	[ ]
Shigella	[ ]	[ ]	[ ]	[ ]
V. cholerae	[ ]	[ ]	[ ]	[ ]
other_____	[ ]	[ ]	[ ]	[ ]
_____	[ ]	[ ]	[ ]	[ ]
_____	[ ]	[ ]	[ ]	[ ]

[1] For each sampling point a separate Form 2 (pages 1 and 2) should be completed, as appropriate. Parameters of paragraphs B.1, B.2 and B.3 represent the compulsory monitoring programme for all collaborating laboratories. Parameters of paragraphs B.4, B.5 and B.6 will be completed if and to the extent that the relevant parameters are included in the monitoring programme of the laboratory in question (see also explanatory notes). In the sampling points should be included any remote background sampling point.

Figure II : FORM FOR DATA RECORDING of recreational water multiple sampling points monitoring

Joint WHO/UNEP Co-ordinated Pilot Project on Coastal Water Quality Control in the Mediterranean

Figure I Continued...

6. Effluents:

		1-	2-	3-	4-	5-
Volume of discharge	m^3/h					
BOD_5	mg/l					
Settleable solids in 2 hours	mg/l					
others						
.....						
.....						

		6-	7-	8-	9-	10-
Volume of discharge	m^3/h					
BOD_5	mg/l					
Settleable solids in 2 hours	mg/l					
others						
.....						
.....						

7. Rivers:

		1-	2-	3-	4-	5-
Volume of discharge	m^3/s					
BOD_5	mg/l					
Settleable solids in 2 hours	mg/l					
others						
.....						
.....						

8. Beach materials:

8.1 Bacteriological data:

Total coliforms	No./g	
Faecal coliforms (E. coli)	No./g	
Faecal streptococci (Enterococci)	No./g	

8.2 Pathogenic organisms

Salmonella
Shigella
V. Cholerae
Others .....
.....
.....

A. REFERENCE POINT(S) MONITORING AND GENERAL DATA[1]

1. General identification (reference point):

1.1 Country ⌊__⌋ 1.2 Institute ⌊__⌋ 1.3 Area: Longitude ⌊__⌋⌊__⌋⌊__⌋ Latitude ⌊__⌋⌊__⌋⌊__⌋

1.4 Date: Time ⌊__⌋ Day ⌊__⌋ Month ⌊__⌋ Year ⌊__⌋ 1.5 Number of the reference point ⌊__⌋

1.6 Total number of monitoring multiple sampling points relevant to the reference point ⌊__⌋ 1.7 Total number of reference sampling points for the same area ⌊__⌋

2. Visual appearance:[2] Con. Q. Con.Q. Con.Q. Con.Q. Con.Q. Con.Q. Con.Q. Con.Q. Con.Q. Con. Q. Con.Q. Con.Q.

2.1 Beach zone ⌊__⌋

Con. Q. Con.Q. Con.Q. Con.Q. Con.Q. Con.Q. Con.Q. Con. Q. Con.Q. Con.Q. Con.Q. Con. Q.

2.2 Recreational waters ⌊__⌋

3. Dynamic conditions:

3.1 State of tide ⌊__⌋ [1/-][3] ⌊__⌋ 3.2 State of waves ⌊__⌋ 3.3 Current direction ⌊__⌋⌊__⌋ 3.4 Current speed ⌊__⌋⌊__⌋

3.5 Drift direction ⌊__⌋⌊__⌋ 3.6 Drift speed ⌊__⌋⌊__⌋

4. Meteorological conditions:

4.1 Wind velocity ⌊__⌋⌊__⌋ 4.2 Wind direction ⌊__⌋⌊__⌋

5. Hydrographic conditions:

	5.1 Temperature	5.2 Salinity	5.3 Oxygen-1(mg/l)	5.4 Oxygen-2 (%)	5.5 Transparency
Surface	⌊__⌋⌊__⌋	⌊__⌋⌊__⌋⌊__⌋	⌊__⌋⌊__⌋	⌊__⌋⌊__⌋⌊__⌋	⌊__⌋⌊__⌋
Inter. Layer	⌊__⌋⌊__⌋	⌊__⌋⌊__⌋⌊__⌋	⌊__⌋⌊__⌋	⌊__⌋⌊__⌋⌊__⌋	
Bottom	⌊__⌋⌊__⌋	⌊__⌋⌊__⌋⌊__⌋	⌊__⌋⌊__⌋	⌊__⌋⌊__⌋⌊__⌋	

[1] For each reference point (if there are more than one) a separate Form 1 should be completed.
[2] This item should be completed only when the reference points concern recreational waters and not shellfish monitoring.
[3] Delete the non-pertinent sign.

Figure I : FORM FOR DATA RECORDING of reference point(s) monitoring and general data

Joint WHO/UNEP Co-ordinated Pilot Project on Coastal Water Quality Control in the Mediterranean

Appendix II

The data collection forms recommended to be used in the framework of MED POL VII are attached as figures I, II and III.

JOINT WHO/UNEP CO-ORDINATED PILOT PROJECT ON COASTAL WATER QUALITY CONTROL IN THE MEDITERRANEAN

Explanatory notes for completing Data Recording Form 1 (fig. I), Form 2 (fig. II) and Form 3 (fig. III).

GENERAL REMARKS

1. Monitoring of recreational sea-water

The forms to be completed for the above monitoring in a given area will include:

(a) one form 1 (fig. I) for each reference point:

(b) one form 2 (fig. II) for each multiple sampling point including any remote background sampling point(s).

2. Monitoring of shellfish area

The forms to be completed for the above monitoring will include:

(a) one form 1 (fig. I) for each reference point:

(b) one form 3 (fig. III) for each multiple sampling point including any remote background sampling point(s).

3. Reference points and remote background points

Reference points are the points selected as representative of general conditions of the area (dynamic, meteorological, hydrographic conditions).

Remote background points are the points which are not influenced by pollution as the monitored area may be.

- The strengthening of co-ordination between the different components of the Mediterranean Action Plan contributing to the solution of coastal pollution control problems is regarded as essential. In particular, results of projects on coastal water quality control (MED POL VII), on the impact of pollutants on ecosystems (MED POL V) and on land-based sources of pollution (MED POL X), should be mutually utilized to further the development of the Protocol on Land-Based Sources of Pollution.

- Uniform, computer-compatible data reporting forms and systems should be developed by the Regional Activity Centre (RAC), in collaboration with the participating laboratories and WHO, and used by all participants in MED POL VII in order to enable the full and comprehensive utilization of data collected through this and other MED POL projects. An appropriate training activity should be developed by the RAC to introduce this reporting system.

- Basic and applied research programmes supporting the monitoring programme should be considered part of MED POL VII and ways should be found to promote them. Some research studies regarded as important are given in this report, e.g. on water and sediment interaction, the use of bacteriophages as pollution indicators, and pathogenic bacteria and animal viruses.

- The public health implications of the eutrophication of coastal waters caused by land-based discharge should be studied as part of MED POL VII, while MED POL V should review the magnitude and extent of the problem as well as its impact on the ecological balance.

- Epidemiological studies should be initiated in a number of Mediterranean countries and carried out according to the uniform methodology recommended in the report of the Expert Consultation on Health Criteria and Epidemiology of Health Risks related to Beach and Coastal Pollution (Athens, 1-4 March 1977), and ways should be found to support them.

- In addition to shellfish, fish should also be monitored for microbiological quality.

- The use of standard media for the monitoring programme is strongly recommended and the suggestion of the subgroup is specifically endorsed.

Appendix I

RECOMMENDATIONS OF THE WHO/UNEP MID-TERM REVIEW MEETING

ON FUTURE ORIENTATION OF MED VII

(Rome, 30 May - 1 June 1977)

The participants had a far-ranging discussion on the progress of the project and made the following recommendations:

- In view of the fact that only nine of the 18 countries have so far nominated laboratories, efforts should be made to increase the number of institutions participating in the project, particular attention being paid to countries which have not yet nominated their participants.

- The mandatory part of the monitoring programme, as outlined in the operational document, should be carried out with strict adherence to the methodology described in the Guidelines for Monitoring Public Health Aspects of Coastal Water Quality.

- The development of methods for the assessment and principles for the control of coastal water pollution is considered to be one of the prime tasks of project MED POL VII and the activities under this project component should therefore be intensified considerably.

- Environmental engineering research on technological solutions for land-based waste disposal problems common to Mediterranean countries should be supported and co-ordinated with the efforts initiated under the present project.

- The forthcoming workshop on coastal water pollution control is regarded as an important starting point, leading to continuing activity by interested scientific institutions which would collaborate on the development of relevant control principles and technologies.

- Original data submitted by participants in the project to WHO and to meetings of the institutes collaborating in MED POL VII should be treated as restricted and should be used further only in connexion with appropriate interpretation.

- Savings should be transferred from unspent training funds to the purchase of equipment.

- Guidelines and principles for assessing the quality of recreational beaches should be developed as part of MED POL VII activities.

- In order to ensure full comparability of the data obtained and the most adequate geographic coverage, efficient co-ordination should be exercised at the national level, at the level of MED POL VII, and between MED VII and the other relevant components of the Mediterranean Action Plan.

Table 6 Continued....

	1976												1977												1978										
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
4. Training																																				
Development of on-job training plan among collaborating institutions						x	x	x																												
Operation of on-job training and exchange programme									x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x							
Training course in French												x																								
Training course in English															x																					
5. Pollution management																																				
Workshop on principles of coastal water pollution control																	x																			
6. Publication programme																																				
Guide to shellfish hygiene		x																																		
Guidelines on coastal water quality monitoring					x																															
Manual on pollution control in coastal waters										x																										
Health criteria for the quality of coastal bathing waters															x																					
Proceedings of workshop on principles of coastal water pollution control																										x										
7. Co-ordination																																				
Consultations with collaborating institutions		x			x			x			x			x			x			x			x			x			x							
Progress reports												x						x						x												

Table 6 : Workplan and timetable*

	1976												1977												1978											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1. Monitoring programme																																				
Preparation of technical guidelines for uniform monitoring and data reporting			x	x	x																														
Establishment of network of collaborating institutions		x	x	x																															
Selection and designation of monitoring areas				x	x	x																													
Establishment of local measurement programmes for each area						x	x	x																											
Routine monitoring and data collection and evaluation								x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
2. Epidemiological studies																																				
Review of the present situation									x	x	x																									
Consultation on health criteria for coastal bathing waters												x																								
3. Equipment acquisition																																				
Evaluation of needs of collaborating institutions						x	x	x																												
Procurement of expendable material							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x							
Procurement of non-expendable equipment									x	x	x	x																								
Procurement of basic laboratory equipment									x	x	x	x																								

*The workplan and timetable were adjusted and extended according to relevant revision and extension of the project

8. IMPLEMENTATION AND CO-ORDINATION

The execution of the present project follows the general procedures applicable to all pilot projects with the Co-ordinated Mediterranean Pollution Monitoring and Research Programme. The aspects described in the following sections 8.1 and 8.2 are considered of particular importance.

8.1 Workplan and timetable

Major activities are indicated in the project workplan and timetable which is given in table 6. The net time for the actual monitoring is two years which leads to a total project period of two and a half years, ending in 1978. The sequence of procedures for starting the project includes the establishment of a network of research centres participating in the monitoring activities, the designation of monitoring areas in the participating countries and subsequently, the design and initiation of sampling and analysis, as outlined in section 4 of this document. Equipment purchase and on-job training accompanies monitoring, to support the laboratories requesting assistance. At the same time, the designated host institutions start preparing their meetings and training courses to be held later in the project.

8.2 Co-ordination

The co-ordination of the work performed on the basis of this operational document by the network of participating research centres will be organized with close co-operation between WHO and UNEP, with WHO as responsible for operating the pilot project.

The activities undertaken within the framework of this pilot project will be co-ordinated with those of the six other pilot projects of the Co-ordinated Mediterranean Pollution Monitoring and Research Programme and with the different activities planned or executed by UNEP as approved by the Intergovernmental Meeting on the Protection of the Mediterranean (Barcelona, January/February 1975).

In addition to the on-job training activities, the training programme should cover the following activities:

(a) national courses for scientists and technicians;

(b) international courses for senior professionals, project leaders and managers;

(c) fellowships for young graduates to attend basic courses in environmental sciences and engineering.

Training activities in national courses should be tailored to national needs for specialized manpower in countries participating in the project.

Training courses will be given at one of the research centres of the network. The host institute sponsoring such courses will provide the basic didactic facilities (classrooms, adequately equipped laboratories, library, audio-visual aids) and secure the administrative and secretarial support needed. It will also arrange for other institutes in the host country to provide training in special subjects and facilities for field studies.

The faculty of the host institute will give the majority of lectures and exercises (e.g. two thirds of course lecturers will be from the host institute) while the remainder will be invited from other specialized research centres and countries participating in the network. The preparation of training course documentation (lecture notices, etc.) will be the responsibility of the host institute.

7. PROGRAMME OF TECHNICAL DOCUMENTATION

Considerable work has been undertaken in recent years on various aspects of marine pollution management, such as criteria, standards, monitoring, control, etc. All material prepared will be made available to the research centres participating in the network and other interested institutions in the Mediterranean area. A series of technical guidelines will be published; it will contain generally valid technical and scientific information as well as information pertinent to the situation in the Mediterranean coastal waters. The following documentation is planned:

(a) health criteria for the quality of coastal bathing waters;

(b) guidelines on coastal water quality monitoring;

(c) guide to shellfish hygiene;

(d) manual of coastal pollution control;

(e) proceedings of workshops on principles of coastal water pollution control.

Reviews and comments on these documents by experts concerned with the Mediterranean will be taken into account prior to publication. Small editorial panels will be formed, if required, to finalize the documents.

6. TRAINING PROGRAMME

In certain Mediterranean countries, only a limited number of scientific staff and technicians are at present working on problems concerning the hygiene of the marine environment and pollution control, although faculties of medicine and pharmacy, hygiene institutes, public health schools, technical colleges, science faculties, veterinary schools and the Pasteur Institutes, among other institutions, continuously train professional staff and technicians at all levels. As a first step, therefore, trained personnel, who are at present scattered in hospitals, institutes, public service or the private sector, should be recruited and offered permanent posts in line with their particular qualifications. Special attention should be paid to training the senior staff and technicians responsible for monitoring, epidemiological surveys and research and the professionals and managers dealing with pollution control activities. Refresher and retraining courses should be organized and directed specifically to problems involved in the implementation of the programme. Since the technicians and experts recruited will already be qualified and experienced, such courses should obviously be above elementary level. Personnel should be chosen from consideration of their personal history, qualifications, scientific background, experience and present involvement in pertinent problems.

6.1 Specialized on-job training

Highest priority should be given to the training of individuals (scientists, laboratory technicians, etc.) in microbiological and other analytical techniques relevant to the measurement programme of the project: fellows will be selected (on request) from participating research centres and sent to research establishments which have adequate facilities for such activities and the necessary experience. Research centres willing to receive trainees will be identified early in the project and models for individual training programmes will be designed in line with project requirements. Close correlation with the monitoring programme (sampling, analysis, data reporting) is essential, since the on-job training of individuals at other research centres of the network is regarded as one of the major means of achieving harmonization of measurements and compatibility of analytical results. Individual programmes for trainees should be of similar lay-out so that small groups of fellows could be accommodated simultaneously at the host centre; more people could thus be reached in a shorter time. After the return of the trainee, regular and close contact should be maintained between the training centre and the laboratory for which the trainee came. Reciprocal consultantships could be arranged when necessary.

After the network has been established, the staff situation in each participating research centre will be examined and the training needs identified to permit the development of a comprehensive on-job training plan for the entire project period. This programme might be backed up by additional fellowships provided through the WHO regular budget for activities in the Mediterranean region.

6.2 Training courses

The development and operation of comprehensive water pollution control programmes involves a variety of professionals in each country: scientists, such as biologists, oceanographers, chemists, epidemiologists and hygienists, as well as sanitary engineers, environmental managers and policy-makers.

This workshop is planned to be held at one of the institutions collaborating in the project, with participants being invited from all Mediterranean countries. In addition, international experts will be invited to prepare the necessary working documents.

5. EQUIPMENT ACQUISITION PROGRAMME

In order to further the objectives of the pilot project, it is envisaged that three categories of equipment and supplies will be purchased and provided for co-operating national research centres, in particular for those in the developing countries.

Supplies of equipment will be provided to participating national research centres upon their specific request and in accordance with the monitoring and research activities which they carry out under the pilot project.

Supplies needed to implement the basic monitoring programme of the pilot project will be purchased on the detailed instructions of a group of experts who will select the most appropriate measurement procedures. These supplies will be provided to participating national research centres in accordance with the requirements of sampling programmes carried out under the pilot project.

5.1 Expendable laboratory material

Expendable laboratory material, such as membrane filters and related filtration accessories, bacteriological growth media and related chemicals and indicators and simple, standardized, bacteriological water samplers, is needed for basic monitoring operations.

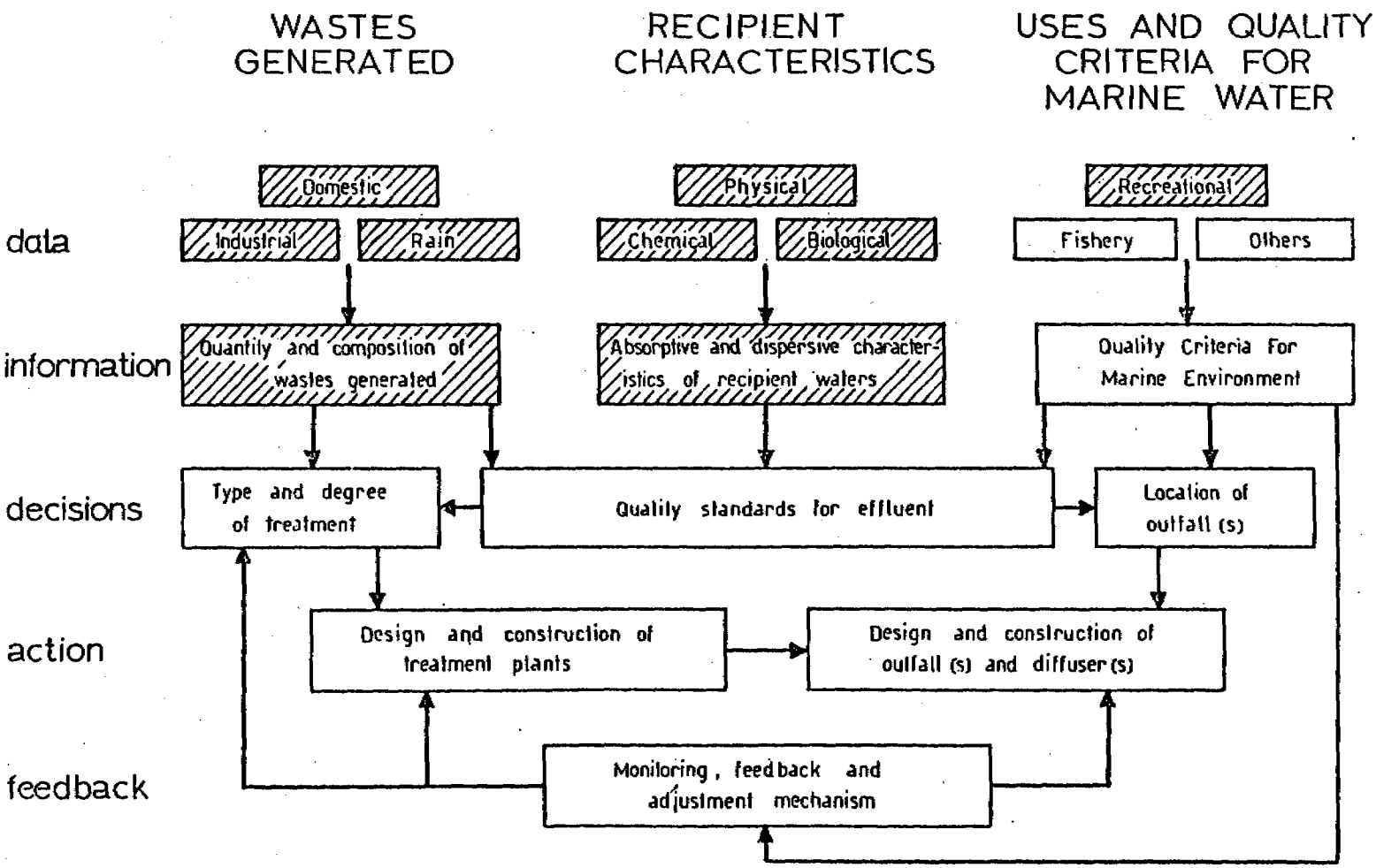
5.2 Specific research equipment

Specific research equipment is required to carry out research studies dealing with particular aspects of detection, identification, behaviour, metabolism and disappearance of human pathogenic bacteria and viruses in marine environment and edible marine biota, as detailed in the pilot project programme. Examples of such specific research equipment are: ultracentrifuges and ultrafiltration units, lyophilization equipment, various items for serologic techniques, bioturbidimeters, ATP scintillation monitors, etc.

5.3 Basic equipment for bacteriological laboratories

Although it is assumed that participating national research centres are already equipped with standard items such as sterilization facilities, incubators, blenders, homogenizers, desk centrifuges, plate colony counters, standard optics, glassware and a minimum of equipment needed for basic environmental measurements (temperature, salinity, oxygen, pH, turbidity, etc.), it is envisaged that, in particular cases, a certain amount of standard equipment will be provided in order to facilitate the implementation of the project programme.

Table 5 : Design process of liquid wastes disposal system



- recommendation of both long-term and short-term research programmes aimed at providing reliable data for management decisions.

4.3 Development of principles for coastal water pollution control

4.3.1 Need for pollution control programme

Marine water pollution is a complex phenomenon, with multiple causes and effects. Its prevention and control requires a broad range of scientific, technical, economic and legal tools.

Effective marine pollution control will ultimately depend on modification, reduction and dispersion of wastes discharged and dumped into the sea. It will be necessary to institute and execute a series of local and regional pollution abatement programmes covering the major population and industrial centres around the Mediterranean. Such programmes should aim at the development of long-range plans covering large geographical areas.

To develop the necessary long-term comprehensive programmes without sacrificing their short-term impact, a multilevel approach is necessary. This will lead to the establishment of a hierarchy of individual projects and programmes of a similar nature which will only vary in scope, depth and detail. It is also necessary to assure effective and prompt action at the local level and at the same time to provide the required framework for co-ordination of activities.

4.3.2 Workshop on coastal water pollution control

In response to the related needs of the Mediterranean countries, the development of principles and guidelines for coastal water quality management has been included in this project as one of its main objectives. A workshop will be convened and technical guidelines on various aspects of coastal water pollution published.

The purpose of the workshop will be to examine the methodology for marine pollution control planning and to outline a plan of action leading to the development of a model code of practice for the disposal of liquid wastes into the Mediterranean (table 5).

The publications produced or being prepared by WHO will be utilized and included as background material for the workshop (see section 7).

The workshop will be devoted to the following aspects of marine coastal pollution control:

(a) development of master plans, preliminary engineering and feasibility studies;

(b) information systems;

(c) manpower training and development;

(d) technology transfer, adaptation and development;

(e) public health criteria, monitoring and surveillance;

(f) legislation and enforcement.

Table 4 : General principles for epidemiological studies

PARAMETERS	POPULATIONS STUDIED	METHODS
I. DISEASES	Population at risk	1. Survey by questionnaire
1. Cutaneous and mucosal conditions		
1.1 Dermatoses Bacterial Mycotic Parasitic Viral Chemical (if applicable)	Permanent Temporary Weekends Holidays	2. Analytical data Microbiological Immunological Biochemical Clinical exploration
1.2 Otitis		
1.3 Sinusitis		
1.4 Eye conditions	Organized stays (e.g. holiday camps and children's holiday homes)	
1.5 Genital conditions		
2. Diseases of the respiratory and pulmonary tracts		
2.1 Rhinopharyngeal diseases	Control groups outside seaside resorts (mountains, country)	
2.2 Pulmonary diseases Aerobic Anaerobic		
3. Gastrointestinal diseases		
3.1 Bacterial Salmonella Shigella Vibrio (especially V. cholerae, V. parahaemolyticus and NAG vibrios) E. coli serotypes of gastroenteritis		
3.2 Viral Enteroviruses (in particular)		
3.3 Parasitic		
4. Allergic conditions		
5. Intoxications of chemical origin		
II. ENVIRONMENT		
Human (healthy carriers and subclinical patients)		
Tourist infrastructure and consumer products (see text)		
Current situation regarding endemic and epidemic diseases		

4.2 Epidemiological studies

The scientific studies on the epidemiological evidence of health effects caused by inadequate sanitary conditions in coastal areas will be primarily promoted by:

(a) review of present findings from Mediterranean and related research studies;

(b) development of proposals for future studies.

4.2.1 Principles of epidemiological studies

The dangers of bathing in, and the consumption of seafood from, polluted water have been known for a long time. Special risks occur from random collection of "wild" shellfish by individual members of the public and from the sale of seafood by unauthorized merchants. The epidemiological surveillance necessary is the product of a very exacting medical science. Past programmes have not given satisfactory results and it is therefore necessary to develop a new basis utilizing medical and paramedical personnel, including physicians specializing in infectious diseases, paediatricians, dermatologists, gynaecologists, microbiologists, biologists, hygienists, immunologists, epidemiologists, statisticians, sanitary engineers and other technical personnel. It is recommended that national and other meetings should be organized.

As it is difficult at this time to propose a complete programme, only general principles have been set out. Each participating country will organize activities within the scope of technical and administrative possibilities.

The minimum list of diseases to be covered by the investigations is given in table 4.

It is possible to indicate a number of parameters concerning the sanitary condition of the neighbourhood where the outbreak of disease occurs.

The cause of the disease must be investigated in the local infrastructure, with studies of the extent and duration of sea-bathing, use of beaches and consumption of seafood. Investigation must cover both resident population and visitors. It must be continued throughout the period of incubation of the disease and the investigating institution must be notified by local medical practitioners of each case which occurs.

4.2.2 Health criteria for recreational waters

An expert consultation will be called with the purpose of examining the health criteria on which the various coastal water quality standards are based and of developing rational and economically justified health standards for recreational waters and beaches around the Mediterranean. In particular, the group of experts will undertake:

- comparison of the various standards for the quality of recreational waters;
- examination of the epidemiological and other evidence on which these standards are based;
- review of recommended health criteria for the quality of coastal bathing waters including some public health and associated guidelines for implementation;

- Total coliforms

- E. coli

- Streptococcus faecalis

- Total heterotrophic bacteria.

In relation to the epidemiological conditions, the following additional parameters are suggested:

- Salmonella

- Vibrio (cholerae, NAG, para-haemolyticus).

In addition, it is suggested that the level of pollution is evaluated by assay of enterophages.

Specialized and well-equipped institutes will carry out more comprehensive investigations using inoculation, cellular cultures or electron microscopy for viruses.

Apart from the four parameters which are regarded as being a minimum programme, these investigations will not usually be carried out routinely. All participating institutions must have access to resources for carrying out virological examinations. The list of edible marine organisms to be studied should not be restricted to oysters and mussels but extended to other seafood consumed either raw or partially cooked in Mediterranean areas. The choice of organisms will be left to local public health authorities.

(b) Monitoring procedures

All participating laboratories should adopt the same technique; uniformity will be assured by the use of guidelines[3/], either published or in the course of revision.

Location and sampling points: Sampling points will be in the culture area, its surroundings and close to sources of pollution.

Frequency: The sampling frequency will depend on the time of year, the legal season for consumption and the period of maximum demand. Frequency will be determined by the local public health authority.

Sampling methods: Samples of shellfish will be taken not only in situ but also at points along the distribution and marketing chain. Systematic surveillance will be organized in the stabilization areas, at the despatch points, on arrival at the wholesalers, at the market and in restaurants. Cases are known, for example, of paratyphoid being transmitted by human carriers. Shellfish are excellent food but very susceptible to contamination. Extreme precautions are, therefore, essential.

Standard methods of analysis: The methods are summarized in the Guide to Shellfish Hygiene, which will be published in the course of this project.

3/ Fish and Shellfish Hygiene, Technical Report Series No. 550 (Geneva, WHO, 1974).

Table 3 : Parameters to be measured in molluscan shellfish beds selected as surveillance areas

Parameters	Surveillance and sampling areas	Sampling frequency	Sampling and analysis procedures	Interpretation and utilization of results
1. Biological 1.1 Microbiological compulsory: Coliform organisms; Faecal E.coli; Faecal streptococci; Heterotrophic micro organisms Salmonella Cholerigenic vibrios Haemolytic vibrios 1.2 Eukaryotic parasites Yeasts and parasite cysts and eggs 1.3 optimal: Viruses Bacteriophages Enterophages Enteroviruses 1.4 Biotoxins	The shellfish sampled for analysis purposes will be taken from the centre of the beds and from surrounding areas exposed to polluting wastes. Surveillance should be carried out for: (a) Waters and sediments from shellfish beds; (b) Marine areas used for breeding purposes; (c) Shellfish purification plants; (d) Dispatch units; (e) Distribution and marketing networks and sales points.	Three-monthly surveillance carried out in all cases Monthly surveillance in large-scale shellfish breeding areas Weekly surveillance in all areas at periods of maximum consumption Daily surveillance in the purification plants and in the distribution network by sporadic sampling	Samples to be taken in representative batches of 5 - 10 shellfish (depending on size) Analysis to be carried out on an ad hoc basis by mixing the flesh and intervalvular fluid and applying conventional techniques for the measurement of coliform organisms (cf.WHO bibliography)	Results of measurements to be compared with WHO standards. Contamination rates: E. coli < 1/ml for raw shellfish < 2/ml for cooked shellfish Streptococci < 1/ml Salmonella and other pathogens Absent
2. Physical and chemical Salts of heavy metals and pesticides Beta radioactivity Detergents and hydrocarbons Physicochemical and other parameters	In relation to other pilot projects. Beta radioactivity will be tested for in areas liable to be directly or indirectly affected by any wastes from neighbouring nuclear plants.			

taken at these points. A number of undeveloped coastal areas will be chosen to provide background information. These will be sampled at a lower intensity than more highly polluted areas. Mapping and registering of all sampling points will be established for each monitoring area, following a standard format.

Frequency of sampling and analysis: The sampling frequency is determined by a variety of factors, the following being of prime importance.

The seasonal aspect is the most important one. Highest sampling frequency is needed during the main tourist season which stretches from May to September for the Mediterranean. Sampling at a lower frequency during the other seasons is, however, essential to obtain baseline data on the effect of pollution inputs. All points will, therefore, be sampled at least once per month during the tourist season and three times, equally spaced, during the remainder of the year. If more than 10% of the samples taken 10 m from the coast show a value of E. coli of over 500 per 100 ml, the intensity of the sampling programme will be doubled and the programme will continue at double intensity for at least one year. In addition to the minimum recommended programme (table 1), intensive or ad hoc campaigns may be conducted as appropriate.

Analytical methods: Although various methods for the determination of E. coli in water are currently used in the Mediterranean countries, only the membrane filtration method, as described in the International Standards for Drinking-Water[2/], will be applied in the present project.

Guidelines will be issued for the measurement of the other physical, chemical and biological parameters, taking into account the need to use methodology and analytical techniques which give results comparable with those of the other pilot projects of the Co-ordinated Mediterranean Pollution Monitoring and Research Programme.

4.1.4 Monitoring of shellfish

Surveillance over the hygiene of seafood is a matter of particular concern and is a long-established practice. Most Mediterranean countries have laboratories for research and surveillance located along the coast. Public health laboratories and those serving hospitals and veterinary establishments also participate in this work. They act immediately when there is an outbreak of disease.

Samples are taken in the culture area of water, sediments, plankton and, of course, of shellfish and the micro-organisms absorbed on standard gauges immersed for short periods, according to circumstances.

The location of all sources of pollution within the study area must be carefully recorded. Regular sampling surveys of the seawater must be carried out according to standard methods.

(a) Parameters to be measured

They are the same for water, sediments, shellfish and for the sources of pollution (see table 3). The following will always be measured:

2/ International Standards for Drinking-Water, 3rd edition (Geneva, WHO, 1971).

Table 2 : Parameters to be measured optionally in addition to the obligatory programme

I Bacteriological analyses of total and faecal coliforms and faecal streptococci in sediments and beach materials.

II Investigations on human pathogenic micro-organisms in water, beach materials, sediments and plankton.

III Parameters applied to eutrophication conditions

1. Biomass and density of phytoplankton

   (a) Chlorophylles in mg/m^3

   (b) Density of phytoplankton in No. cells/l

2. Nutrients

   (a) P_{tot}, PO_4 in mg/m^3

   (b) NH_3, NO_2, NO_3, and organic N in mg/m^3

3. Indications of anoxic conditions

   (a) Relationship of $H_2S/O_2/E_h$

   (b) Other observations

Table 1 : Parameters to be measured for the obligatory part of the monitoring programme in coastal waters

I Parameters describing general conditions in the monitoring area at the time of sampling

1. Meteorological conditions

With particular emphasis on continuous measurements of wind direction and velocities.

2. Hydrographic conditions

(a) Sea temperature and its vertical distribution from the surface to the bottom;

(b) Salinity in $^{o}/oo$ (0 m depth, intermediate layer and bottom);

(c) Oxygen in ml/l and % saturation (0 m depth, intermediate layer and bottom);

(d) Turbidity as Secchi in m.

3. Dynamic conditions

(a) State of tides;

(b) State of waves;

(c) Current measurements: direction and speed in m/sec;

(d) Drifts: direction and speed in m/sec.

4. Visual observations on pollution traces

(a) Colour, discoloration, unusual turbidities;

(b) Odour;

(c) Slicks, foams, floatables, dead organisms, etc.

II Parameters measured on individual samples

1. Accompanying data

(a) Air, sea and sample temperatures during transportation;

(b) Salinity in $^{o}/oo$;

2. Bacteriological data

(a) Total coliforms as no. Col/100 ml;

(b) Faecal coliforms (E. coli) as no. Col/100 ml;

(c) Faecal streptococci (enterococci) as no. Col/100 ml.

among the various study areas around the Mediterranean coast and covers examination of recreational waters, sediments and beaches, using physical, chemical, biological and microbiological parameters.

(a) Parameters to be measured

Beach zone: The stretch of beach along the waterline will be examined with regard to its visual appearance. This will indicate the presence and extent of tarballs, oilslicks, seaweed, dead organisms, stranded debris and any other polluting materials. A uniform visual classification scheme will be adopted for all study areas. These surveys will be co-ordinated with the coastal water sampling programme.

Recreational waters: Examination of the water zone where body-contact water sports take place will be carried out with respect to its visual appearance and physical, chemical, biological and micro-biological characteristics[1/]. The microbiological tests are limited to the most common indicators of faecal pollution. The density differences between faecal coliforms and faecal streptococci might indicate the possible sources of pollution. Pathogenic organisms are, of course, of particular importance and whereas it is not practicable to specify a generally applicable programme, it should be emphasized that assays of Salmonella, Shigella, V. cholerae, etc. should be carried out in a systematic manner wherever possible, using the same sampling network as for the other parameters. Parameters related to eutrophication phenomena will only be included in the programme in places where nuisance from algal blooms becomes apparent. A list of measurement parameters is given in tables 1 and 2.

Sediments: Basic sedimentological characteristics of the monitoring area need to be described, and type, structure and other features of particular sediment samples used for bacteriological examination, recorded.

Effluents and rivers: Major effluents and rivers discharging into the study area need to be examined. It is not suggested that every discharge of domestic sewage will need to be separately sampled. Only biochemical oxygen demand, settleable solids and the volume of the discharge will be determined in the minimum programme, although other parameters should be covered where appropriate. Sampling should be carried out on the same days as for coastal waters.

(b) Monitoring procedures

Sampling and analysis in the monitoring areas of the participating countries need to be conducted according to common principles and procedures and harmonized with those accepted for the other pilot projects.

Location of sampling points: While the sanitary inspection of beaches covers the entire tideline, sampling points have to be defined for the water body. Each point will be identified by three co-ordinates and kept fixed throughout the project period. The area sampled will cover the entire body of water which exerts significant influence on the recreational quality of the coastal waters. In all study areas, samples will be taken at a distance of 10 m from the low tide mark every 250 m along the coastline. In addition, at least one sampling point will be established for each km^2 of the study area. In water over 5 m in depth, samples will be taken from the surface layer, from the middle of the water body and from the interface layer above the benthos. In addition, bottom sediment samples will be

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1/ J. BRISOU: An environmental sanitation plan for the Mediterranean seaboard. Public Health Papers 62, (Geneva, WHO, 1976).

(e) surveillance of shellfish waters and specimens;

(f) data analysis and interpretation.

The results obtained from each monitoring area will be first examined and evaluated by the co-operating institutions. Subsequently, a joint evaluation will be undertaken by the project management in collaboration with the co-operating institutions. To ensure uniformity of data reporting, technical guidelines and a standard format will be developed. The possibility of computerization of data will be investigated.

The following guidelines will be used:

4.1.1 Selection of monitoring areas

Public health implications are most serious for bathing and for shellfish waters. Therefore monitoring areas should first be established where intensive recreational activities take place. Locations which are highly frequented and which are simultaneously exposed to discharge of waste waters and other pollution inputs should preferably be chosen, taking into account meteorological and oceanographic conditions.

Secondly, monitoring areas should be established in shellfish growing waters.

In addition, remote areas, which are neither visited by holiday makers nor subject to any pollution loads, should be included to serve as reference (clean) areas.

4.1.2 Characteristics of monitoring areas

The first step to be taken to implement the pilot project will be to draw up a detailed map of the areas selected for monitoring. This will include the qualitative and quantitative identification of:

(a) sewage outlets and any waste or other discharge points;

(b) solid waste dumping sites on-shore and off-shore;

(c) local currents in the coastal waters relative to point sources and beach location;

(d) climatological, meteorological and hydrographic conditions.

If insufficient quantitative information exists, discharge measurements (flow gauging) or current measurements will have to be made prior to, or in conjunction with, the sampling and analysis programme in the areas, keeping in mind the possibility to use modern techniques such as remote sensing.

The importance of direction and rebound on the coast of coastal currents has to be particularly noted because it plays an important role in the circulation of pollutants, especially those fixed on floating matter which are submitted to the movement of the currents.

4.1.3 Monitoring of beaches and bathing waters

A standard pattern of surveillance is proposed, representing a minimum programme to be extended where considered necessary. It is designed to secure compatibility

3. OBJECTIVES

The overall objective of the pilot project is to produce statistically significant data, scientific information and technical principles which are required for the assessment of the present level of coastal pollution as it concerns human health and are indispensable for the rational design and efficient implementation of national programmes for the control of coastal pollution from land-based sources in the Mediterranean area.

The immediate objectives of the pilot project are:

(a) to design and implement a programme for the sanitary and health surveillance of coastal recreational areas and of shellfish growing waters in selected coastal areas of the Mediterranean;

(b) to initiate a scientific study on the epidemiological evidence of health effects caused by inadequate sanitary conditions in coastal areas and to promote related studies;

(c) to review methods for the assessment of coastal pollution and to recommend principles for the control of pollution from land-based sources;

(d) to make supplementary equipment available to institutes collaborating in the monitoring network;

(e) to provide training facilities for professionals working on coastal water quality monitoring and control;

(f) to make technical and scientific information available through the publication of guidelines and other information material.

4. PROGRAMME OF WORK

The programme of work outlined in this operational document will only be carried out by national laboratories and in areas designated by their governments. The work will be closely co-ordinated and harmonized with the work executed by other pilot projects which constitute the UNEP Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL).

4.1 Monitoring of selected coastal areas

The monitoring part of the project will be implemented through:

(a) establishment of a network of collaborating national institutions nominated by their governments;

(b) selection and designation of monitoring areas by the governments;

(c) choice and harmonization of monitoring procedures and analytical methods;

(d) surveillance of beaches and bathing waters;

1. INTRODUCTION

As part of the activities envisaged within the framework of the Mediterranean Action Plan, a joint WHO/UNEP Expert Consultation was held at the WHO headquarters in Geneva (15 to 19 December 1975) to develop this operational document for the pilot project on Coastal Water Quality Control. The document was prepared by experts invited in their personal capacity from all Mediterranean states and by a few experts nominated by their Governments.

2. OUTLINE OF THE PILOT PROJECT

The serious and rapidly growing pollution of the coastal water of the Mediterranean is having an increasing impact on the social and economic well-being of the countries bordering it. In addition to the millions of inhabitants living along the coastline of the Mediterranean, millions of tourists spend their holidays on the shores of this sea, thus there is a considerable potential for exchange of pathogenic agents. The present situation constitutes a significant health hazard in many places; salmonellosis, dysentery, viral hepatitis and poliomyelitis have all been endemic in the Mediterranean area, and during recent years there have been a number of cholera outbreaks. There is a distinct need for better statistics concerning correlation between diseases and water pollution. There is ample evidence that contaminated shellfish are an important concern to public health. It is also certain that contamination of seafood by chemicals and heavy metals has to be taken into consideration, but this aspect is dealt with by other pilot projects within the framework of the Co-ordinated Mediterranean Pollution Monitoring and Research Programme. The risk of infection from swimming and other recreational activities in coastal waters is enhanced in certain areas because of the absence or inadequacy of beach sanitary facilities. Thus the following actual and potential health effects are of prime importance:

(a) infection from seafood (shellfish in particular);

(b) infection from bathing;

(c) the sanitation and amenity of beaches and coastal waters.

There is a general scarcity of experienced scientists, engineers and administrators for the planning and implementation of pollution control programmes. The proposed pilot project will deal with these problems within the overall framework of the UNEP Co-ordinated Mediterranean Pollution Monitoring and Research Programme and WHO will assume the responsibility for its implementation.

CONTENTS

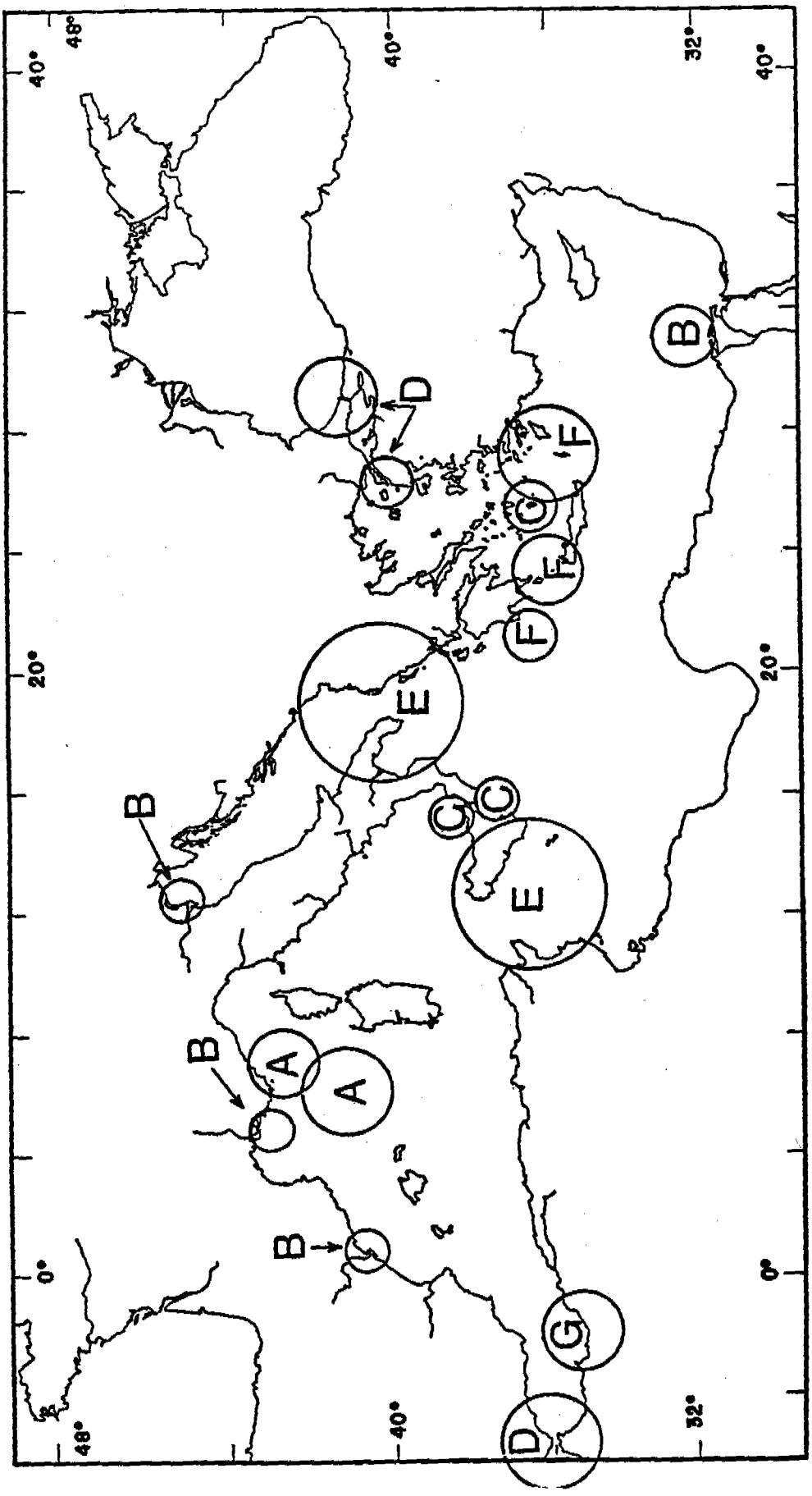

Figure III : MED CRUISE zones of special interest: A) High surface evaporation due to Mistral winds. Origin of western Mediterranean bottom water. B) Po, Rhone, Ebro and Nile river fans. C) Possible high volcanic input: Stromboli, Etna (active) Thira (inactive). D) Sills defining limits of Mediterranean water exchange with other seas. E) Sills separating Mediterranean regional seas. F) Deepest areas of Mediterranean. Origin of bottom waters.

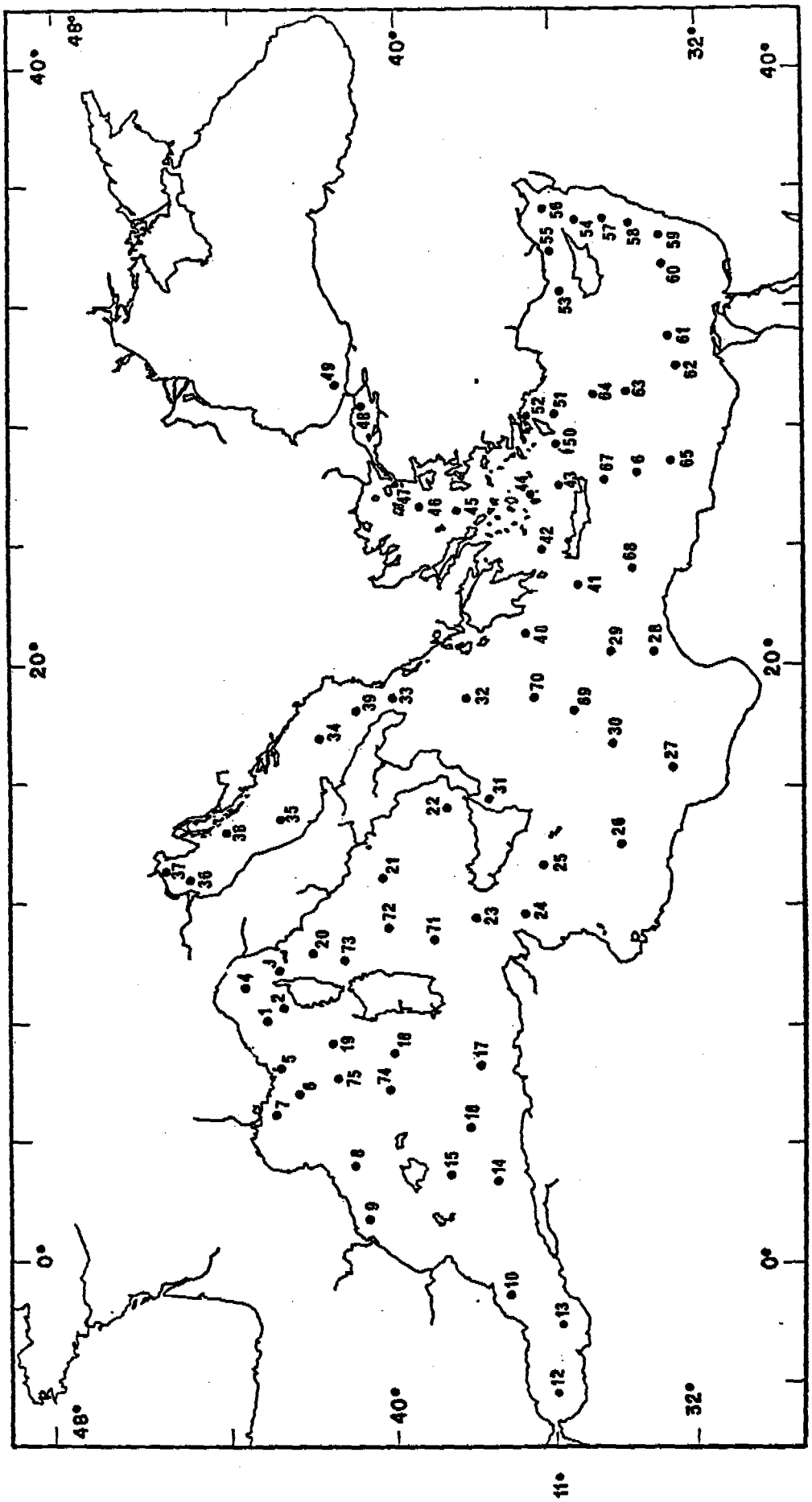

Figure II : MED CRUISE - standard open ocean station numbers

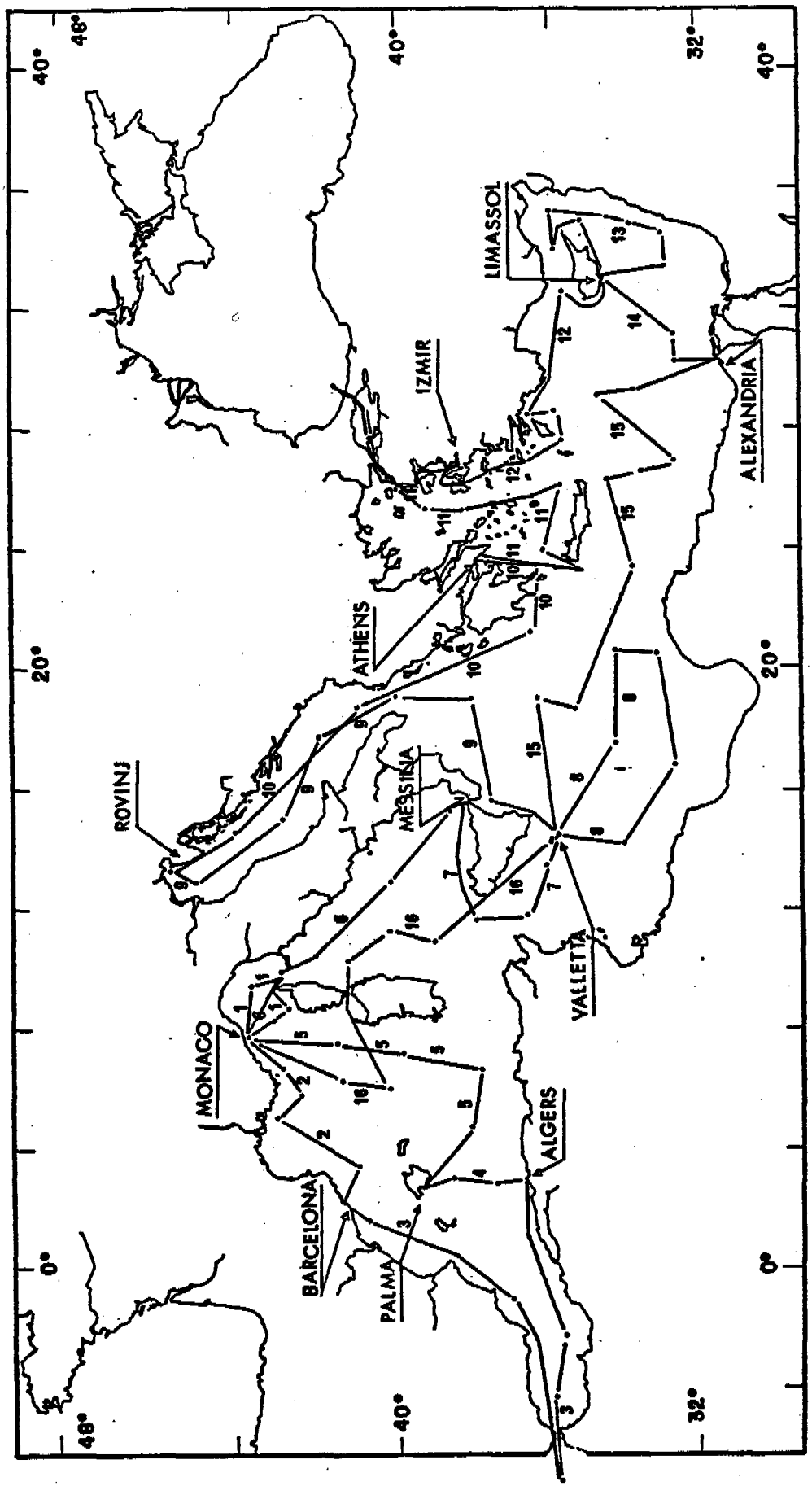

Figure I : 1978 MED CRUISE tracts, Nos. 1 through 13. Points indicate standard open ocean stations (SOOS). Ports of call are also indicated. (No work will take place in territorial waters unless specifically requested by appropriate Government bodies).

(i) Study of air to sea particulate flux by large-volume air filtration techniques;

(j) Otter-trawling and dredging for benthic organisms;

(k) Intercalibration of methods;

(l) large-volume sampling for radionuclide measurements.

4.2 Geographic area to be covered

MED CRUISE will cover only the open waters of the Mediterranean. Specific programmes in the coastal waters might be undertaken only upon request of countries controlling these coastal waters.

The cruise has been divided up into 16 legs - consisting of a total of 75 SOOS (figures I and II) - which are initiated and terminated at eleven different ports of call throughout the Mediterranean. In some cases, stations have been designated in areas where known oceanographic phenomena occur in order to correlate pollutant levels with general or specific oceanographic features (figure III). Three examples are the Mediterranean and Black Sea water exchange across the Gibraltar Sill (stations 11-13), areas of bottom water formation off the islands of Rhodes and Thira (stations 41, 42, 43, 48, 49 and 50), and the Mediterranean and Black Sea water exchange aross the Bosphorus. The detailed MED CRUISE plan is presented in the table.

The proposed cruise tracts and sampling stations outlined in the table will require approximately four months to complete. This is considered the minimum time necessary to survey the open waters of the Mediterranean extensively. Pending the availability of additional ship time (i.e. two months), certain areas or specific stations would be re-occupied as dictated by the results obtained during the first 16 legs.

4.3 Detailed sampling procedures for SOOS

(A) Biota

(i) Microplankton

Surface microplankton (phytoplankton and zooplankton) samples wil be taken by towing standard plankton nets at a depth of approximately 4 metres for 30 to 60 minutes. Towing speed should be between 2 and 3 knots. Samples will be carefully examined and all tar balls, paint chips, metal chips, etc., removed before storage. An aliquot of the sample will be preserved in formalin for identification and the remainder split in two for separate analyses of heavy metals and chlorinated hydrocarbons. The drained microplankton samples will be wrapped in pre-cleaned aluminium foil or plastic, depending upon the desired analysis, and stored frozen at $-20^{o}C$.

(ii) Macrozooplankton and nekton

Standard Isaacs-Kidd midwater trawls will be made in stepped-oblique fashion between 200m and the surface. The trawl should be towed for approximately 60 minutes at speeds of 3-4 knots. The organisms will be sorted on board and the predominant species treated and stored as outlined for the microplankton. The principal

This proposal for a joint Mediterranean cruise (MED CRUISE) was prepared under the direction of Dr. Charles Osterberg by members of his staff on advice from the Steering Committee.

2. CRUISE OBJECTIVES

The long-term objective of the cruise will be to increase the data base for understanding biogeochemical processes which influence the fate of pollutants in the Mediterranean Sea.

The short-term objective of the cruise is data acquisition, intercalibration of sampling methods, familiarization with new techniques and training of personnel from countries which lack adequate facilities for shipboard training.

3. CRUISE SCHEDULE

The cruise is planned for a 4-6 month period during 1978.

4. CRUISE PROGRAMME

4.1 Scope

The core of the MED CRUISE project will consist of a regular interdisciplinary sampling programme carried out at a series of standard open ocean stations (SOOS) situated in a grid designed to maximize information gained from the different cruise legs. At each SOOS, the following samples will be taken:

(a) Large volume water samples for heavy metals and chlorinated hydrocarbons;

(b) Undisturbed sediment core for heavy metals and chlorinated hydrocarbons;

(c) Isaacs-Kidd midwater trawl for measuring heavy metals and chlorinated hydrocarbons in nekton and macrozooplankton;

(d) Surface phytoplankton and zooplankton for heavy metals and chlorinated hydrocarbons;

(e) Neuston tow for tar balls;

(f) Water samples at 1 metre depth for dissolved hydrocarbons;

(g) Standard hydrographic casts for temperature, salinity, dissolved oxygen and nutrients.

In addition, at a few selected SOOS the following activities will be undertaken:

(h) Determination of flux of particulate matter and associated pollutants in water by use of sediment traps;

Appendix I

PROPOSAL FOR A

JOINT MEDITERRANEAN CRUISE (MED CRUISE)

prepared by the IAEA/FAO/IOC/WMO/UNEP Steering Committee
in September 1977

1. INTRODUCTION

As part of the Mediterranean Pollution Monitoring and Research Programme (MED POL), which is the scientific component of the Mediterranean Action Plan adopted by the Intergovernmental Meeting on the Protection of the Mediterranean Sea (Barcelona, January 1975), several joint cruises have been made during the past two years to collect data on the state of pollution in the open waters of the Mediterranean Sea. These were carried out under a joint IAEA/IOC/UNEP project entitled "Biogeochemical Studies of Selected Pollutants in the Open Waters of the Mediterranean" and have furnished some of the first comprehensive information on the levels of heavy metals and chlorinated hydrocarbons in water, biota and sediments from the open Mediterranean and also filled the need for a systematic means to aquire more samples in the coastal zones as part of the MED II and III monitoring programmes. Several expert consultation meetings have pointed out the necessity of obtaining further data from the open Mediterranean and also the need for systematic means to acquire more comprehensive data in the future.

Reviewing the results of these activities, the Mid-term Review Meeting on the Progress of the Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL) and Related Projects of the Mediterranean Action Plan (Monaco, 18-22 July 1977) recommended (paragraph 5.5 (vi) of UNEP/WG.11/5) the following:

"More experience is needed and should be provided by experts in organizing and carrying out joint oceanographic cruises which would increase the number and quality of data on the open waters of the Mediterranean and could be used, on request by the relevant national authorities, to provide additional data for certain coastal waters. A Steering Committee should be established and charged with the task of preparing a detailed programme for such a cruise along the lines suggested in document UNEP/WG.11/INF.7. This programme, which should be submitted for approval to the Intergovernmental Meeting early next year in Monaco, should be prepared in close consultation and co-operation with as many Mediterranean scientists as possible."

In order to pursue the matter according to this recommendation, a Steering Committee was set up on 9 September 1977, composed of FAO, IOC, WMO, IAEA and UNEP, with IAEA chosen as co-ordinator of the work and Dr. Charles Osterberg, Head, International Laboratory of Marine Radioactivity, Monaco, elected as Chairman.

4. WORKPLAN AND TIMETABLE

Activity	Time	Responsibility
Signature of project document	September 1976	IAEA, UNEP
Start of laboratory investigations at IAEA Monaco Laboratory	October 1976	IAEA
Selection of co-operating national research centres	October 1976	IAEA, UNEP
Planning of cruise schedules	Oct/Nov. 1976	IAEA
Research contracts signed with national research centres	November 1976	IAEA
Start of laboratory investigations at co-operating national research centres	November 1976	Research centres
Cruises co-ordinated by IAEA	Jan/Dec. 1977	IAEA, research centres
Mid-term meeting	June 1977	IAEA
Mid-term report	July 1977	IAEA
Final meeting	February 1978	IAEA, UNEP
Final report	March 1978	IAEA, UNEP

attempt to elucidate the importance of sinking particles in transferring these compounds to the sediments.

A study will be made of the concentrations of certain halogenated hydrocarbons in sediments as a function of depth in the sediment and as a function of distance from shore.

The results of these studies, together with the results of water analysis, will help in determining the importance of aeolian transport of pollutants to the Mediterranean Sea and in elucidating the function of sedimentation processes in stripping the water column of organic pollutants.

(e) Chlorinated hydrocarbon dynamics in marine organisms

To evaluate the processes involved in tissue distribution, commercially important marine organisms, such as mussels and shrimps, will be labelled with chlorinated hydrocarbons in order to follow the tissue distribution with time during the accumulation phase. Differences in the route of uptake will be studied by administering selected chlorinated hydrocarbons both through the food-chain and directly from water. Various combinations of the compounds can be given simultaneously to assess synergistic effects on tissue localization. Other groups of labelled organisms will be transferred to an in situ location offshore near Monaco and individuals periodically sacrificed to determine the flux of these pollutants from the various tissues under natural conditions. Results will provide information on principal deposition sites of chlorinated hydrocarbons in tissues as well as mechanisms for translocation of these pollutants within the organisms. Experiments will also be initiated to elucidate degradative pathways within organisms and hopefully identify metabolic derivatives of chlorinated hydrocarbons.

To test the hypothesis that zooplankton and their particulate products could play a role in transporting chlorinated hydrocarbons to depth, a study of the natural levels of these compounds in zooplankton and their particulate products will be undertaken. Large numbers of a single species of macro-zooplankton, the euphausiid Meganyctiphase norvegica, will be analysed along with their freshly released moults and faecal pellets. In addition, microplankton, which serve as food for the euphausiids, will be collected simultaneously and analysed to aid in assessing the total flux of these compounds through euphausiids.

Also, the information on chlorinated hydrocarbon content in zooplankton particulate products will be useful in the studies involving correlation between chlorinated hydrocarbons in sediments with those in particulate matter in the overlying waters. Furthermore, measured concentrations in euphausiid tissues and their known food will give insight into the question of whether food-chain magnification of these compounds takes place at this trophic level.

- baseline studies and monitoring of DDT, PCBs and other chlorinated hydrocarbons in marine organisms (MED POL III);

- research on the effects of pollutants on marine organisms and their populations (MED POL IV); and

- research on the effects of pollutants on marine communities and ecosystems (MED POL V).

The participation of national research centres in the project will be based on research contracts with the IAEA and subject to co-ordination in the framework of the MED POL Programme.

The work proposed in the framework of this project will consist of:

(a) Inorganic and organomercurial measurements

Differential anodic stripping voltametry will be used to determine the level of inorganic mercury and organomercurials in water samples collected from open sea areas which are expected to be influenced by different mercury sources. The stated sensitivity of the analytical method will permit differentiation of the various chemical forms of mercury. To complement this method, conventional flameless atomic absorption spectrophotometry and gas chromatographic techniques will be employed whenever possible for confirmation.

(b) Heavy metal biokinetics in marine organisms

In order to widen the knowledge of the biokinetics of some rarely studied metals, controlled laboratory studies will be initiated on the flux of V, As and Ni through selected marine biota. The results should prove useful in formulating models of the general biological transfer and cycling of these metals. In addition, information from these studies will serve as fundamental baseline data for any future work that may be undertaken with these elements.

Organisms of commercial importance, such as shrimps and mussels as well as ecologically important zooplankton, will be used in bioaccumulation and retention studies. Stable V, As and Ni will also be measured in the organisms, their food and particulate products.

(c) Determination of low molecular weight halogenated hydrocarbons in Mediterranean sea-water

Efforts will be made to measure low molecular weight halogenated hydrocarbons, other than PCBs and DDT, in open ocean samples (sea water, biota, sediments) using the standard gas chromatographic technique and its modification by Tenax sampling.

(d) Transport pathways of halogenated hydrocarbons to and within the Mediterranean Sea

Air samples will be collected along transects perpendicular to the coastlines of the major basins in order to determine the presence of any concentration gradients. This will be done for both PCBs and low molecular weight halogenated hydrocarbons.

Measurements will be made of the concentrations of certain halogenated hydrocarbons on particulate matter as well as in the water from which they were filtered, in an

- to carry out objective assessments of problems affecting the marine environment and its living resources; and

- to develop a programme for the monitoring of marine pollution and its effect on marine ecosystems.

2.2 Immediate objectives

The objective of the project is to obtain data on pollution in open waters of the Mediterranean which are necessary for the assessment of the total present load of pollutants in the Mediterranean and in particular, for the understanding of the dynamics of pollutants, (entry, transport, transformation and decay).

These data, combined with those that will be collected through the seven ongoing research and monitoring pilot projects (MED POL I to VII), would provide a sound basis for a model on the biogeocycle of pollutants in the Mediterranean.

The project is intended to supplement four of the seven MED POL pilot projects, namely MED POL II - V, by providing results of open-ocean measurements of water, sediments and marine air concentrations of low molecular weight halogenated hydrocarbons, PCBs and DDT which will not be measured as part of these pilot projects. Water measurements for inorganic and organomercurial compounds have likewise been excluded from these pilot projects; yet, without such information, any future attempts at calculating mass balances for pollutant inputs to the Mediterranean or the explanation of abnormally high concentrations of these entities in the marine organisms to be monitored, will be practically impossible. Biokinetic data on the behaviour of selected trace metals and chlorinated hydrocarbons will be valuable in predicting effects of these pollutants on organisms.

3. DESCRIPTION OF THE PROJECT

Open-ocean measurements of inorganic and organomercurial compounds, PCBs, DDT and selected low molecular weight chlorinated hydrocarbons in sea-water and in marine organisms will be undertaken by the IAEA Monaco Laboratory in co-operation with selected Mediterranean research centres. Cruises for sample collection will be planned for the widest geographical coverage possible in order to supplement the baseline measurements made in coastal waters by laboratories participating in the Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL).

The project will be named MED POL VIII and will be considered as part of the Co-ordinated Mediterranean Pollution Monitoring and Research Programme; it will be implemented in close collaboration with UNEP.

The proposed studies will be carried out by the IAEA International Laboratory of Marine Radioactivity, Monaco, in co-operation with Mediterranean research centres having qualified scientists and adequate facilities to participate in the work outlined herebelow. The participants in these studies will be primarily selected, in consultation with UNEP, among the national research centres officially nominated by their governments as participants in the FAO(GFCM)/UNEP pilot projects on:

- baseline studies and monitoring of metals, particularly mercury and cadmium, in marine organisms (MED POL II);

investigated and is a reasonably well accepted fact. However, most reports to date are concerned with environmental levels and toxicities of the higher molecular weight chemicals, especially DDT and PCBs. Only a few reports concern the lower molecular weight compounds in spite of the fact that many of them are highly toxic, are more easily lost to the environment and in many cases are produced in quantities far exceeding the more commonly studied compounds.

Considering the population density of countries surrounding the Mediterranean, very little information concerning pollution by halogenated hydrocarbons is available. It has only been during the last few years that information about existing PCB and DDT levels in the Mediterranean has become available, even though these chemicals were found eleswhere in environmental samples as early as 1966. The kinds of data needed concerning chlorinated hydrocarbons in the Mediterranean Sea are : first, baseline information on the types of organic chemicals present and their existing concentrations; second, data on the transport of these compounds to and within the Mediterranean.

(d) Transport pathways of halogenated hydrocarbons to and within the Mediterranean Sea

The techniques for measuring the concentrations of polychlorinated biphenyls in marine biota, sea-water, suspended particulate matter and sediments are established. Some modifications of these techniques will allow measurement of the low molecular weight halogenated hydrocarbons in biota, sediments and air.

(e) Chlorinated hydrocarbon dynamics in marine organisms

For several years data have been accruing on the distribution of chlorinated hydrocarbon pollutants in marine ecosystems. Chlorinated hydrocarbons, once incorporated into biota may be broken down by metabolic processes to form other compounds which may be more or less toxic. Despite the vast amount of data collected to date, questions still arise as to what metabolic derivatives are formed after chlorinated hydrocarbons enter the organism, whether certain pollutants are indeed magnified through the food web, and what is the detailed distribution of these pollutants in different organs and tissues.

There is also evidence that vertically migrating zooplankton play an important role in the downward vertical transport of radionuclides and trace metals in many ocean areas and several studies suggest that released particulate products, in fact, account for the greater part of the downward flux. Although it has been proposed that chlorinated hydrocarbons may be transported downwards by association with particulate matter, direct evidence of this possible vector is still to be determined.

2. OBJECTIVES

2.1 Long-term objectives

The project is related to the following objectives and priorities:

- to support and encourage the development of effective mechanisms for collecting, analysing and disseminating information bearing on the environmental problems available in scientific, technical and legal literature and at the various research institutions, keeping in mind the special needs of developing countries;

1. BACKGROUND

(a) Inorganic and organomercurial measurements

Extensive measurements of mercury in selected marine organisms are planned in the framework of the MED POL pilot projects on baseline studies and monitoring of pollutants in the Mediterranean. While the acquisition of baseline data on mercury in commercially important marine organisms is a pressing administrative need for marine pollution control, scientific knowledge on the chemical fate of mercury in sea-water, introduced into the marine environment from various sources, is essential for understanding the processes involved in the uptake of mercury by marine organisms as well as for predicting the degree of harmful effects of mercury pollution.

Whereas the presence of mercury in sea-water has been attributed to a variety of sources, such as industrial wastes, domestic wastes, air transport, natural land run-offs etc., little is known about the different chemical forms of mercury found in the sea from various sources or how different chemical forms of mercury behave in the marine environment. Since the normal concentration of mercury in sea-water has been estimated to be between 10-20 ng/l, quantitative differentiation of the different chemical forms of mercury in sea water is extremely difficult to obtain using conventional analytical methods. A new direct method for mercury determination has been developed in the IAEA Monaco Laboratory by means of anodic stripping voltametry which makes possible the measurement of concentrations as low as 5 ng Hg/l for inorganic as well as methyl mercury.

(b) Heavy metal biokinetics in marine organisms

In addition to the knowledge of standing metal concentration in biota, information on metal flux through organisms is essential when using dynamic models to assess metal pollutant transfer processes in the marine ecosystem. More recently, studies have been undertaken to investigate the metabolism of some of the more critical heavy metals and metalloids such as Hg, Pb, Cd, Zn, Co and Se. These studies have been greatly facilitated by the use of radiotracers which allow measurement of flux parameters not readily obtainable with stable isotope techniques.

Vanadium, arsenic and nickel are three elements which have recently received particular attention. Based on their relative toxicity and anthropogenic input to the atmosphere, all three are considered as potential marine pollutants. Little information is available on the kinetics of these elements in biota; however, three isotopes, ^{49}V ($T_{1/2}$ = 600d), ^{73}As ($T_{1/2}$ = 80d) and ^{59}Ni ($T_{1/2}$ = 8 x 10^4y) emit weak X-rays at 4.5, 6.9 keV, respectively, and following chemical separation, can be monitored by standard X-ray spectrometric techniques.

(c) Determination of low molecular weight halogenated hydrocarbons in Mediterranean sea-water

Halogenated hydrocarbons are the most extensively produced man-made organic chemicals. The world-wide ubiquity of these chemicals has been extensively

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ANNEX V

DESCRIPTION OF THE JOINT IAEA/IOC/UNEP PROJECT ON BIOGEOCHEMICAL STUDIES OF SELECTED POLLUTANTS IN THE OPEN WATERS OF THE MEDITERRANEAN

(MED POL VIII)

The text of this project description is an extract from the project document prepared by IAEA and UNEP in 1976

Page 2

5. Eutrophication conditions: The data on samples referred to as "surface" are samples collected as near to the water surface as possible. The collection depth in the two other columns should be specified by the investigator depending on local conditions

6. Plankton: Mark with 1 if present, with 2 if absent (blank = no information)

FORM 3 (fig. III): C. SHELLFISH MULTIPLE SAMPLING POINTS MONITORING 3/

1. Identification

1.2 Use the same order number of sampling points as given in the relevant map of the monitoring area

1.3 Give the total number of sampling points which are monitored in the area

3. Elements monitored: Check the elements which are monitored in the area

4. Bacteriological data: Give the number of bacteria per 100 ml, per 100 g or per g as indicated for each relevant microorganism

5. Pathogenic organisms: Mark with 1 if present, with 2 if absent (blank = no information)

3/ In the shellfish monitoring area one or more reference points should also be included. For each of these points a separate Form 1 (pages 1 and 2) should be completed.

5. Hydrographic conditions

5.1 Temperature: in ^{o}C (Centigrade)

5.2 Salinity: in $^{o}/oo$

5.3 Oxygen-1: in mg/l

5.4 Oxygen-2: in % of saturation

5.5 Transparency: as Secchi in m.

Page 2

6. Effluents and 7. Rivers: Use the same order number to identify the same effluents and the same rivers of the area

Volume of discharge: Note that the volume of the effluents is in m^3/h and that of the rivers in m^3/s

8. Beach materials

8.2 Pathogenic organisms: Mark with 1 if present, with 2 if absent (blank = no information)

FORM 2 (fig. II): B. RECREATIONAL WATER MULTIPLE SAMPLING POINTS MONITORING 2/

Page 1

1. General identification

1.2 Use the same order number of sampling point as given in the relevant map of the monitoring area

1.3 Give the total number of sampling points in the monitoring area

2. Hydrographic conditions

2.2 Give the temperature of the sample container during transport

4. Pathogenic organisms: Mark with 1 if present, with 2 if absent (blank = no information)

2/ For each sampling point a separate Form 2 (pages 1 and 2) should be completed as appropriate Parameters of paras. B.1, B.2 and B.3 represent the compulsory monitoring programme for all collaborating laboratories. Pars. B.4, B.5, and B.6 will be completed if and to the extent that the relevant parameters are included in the monitoring programme of the laboratory in question.

4. DESCRIPTION OF PROJECT

The major elements of the project and the necessary arrangements for their implementation are described hereunder.

4.1 Geographical coverage

The project will cover, subject to approval of the responsible national authorities, the coastal regions of the 18 countries bordering the Mediterranean proper. The term 'coastal regions' is used to describe those coastal zones which directly influence the quality of the Mediterranean Sea by the emission, discharge or dumping of their gaseous, liquid or solid, wastes.

4.2 Waste categories

The project covers relevant activities which result in the discharge of chemical and microbiological pollutants or substances which create physical hazards in the marine environment. In order to gain a comprehensive picture of all pollution inputs into the Mediterranean, the following broad categories of pollution sources will be taken into consideration:

- municipal sewage
- municipal solid waste and sludge;
- air pollutants;
- industrial liquid and solid wastes;
- agricultural run-off pollutants;
- river pollution inputs.

4.3 Project activities

During the first phase of the project, common methodology is developed to ensure a uniform approach for the collection of data in the Mediterranean countries. Specific guidelines are also developed for the preparation of a source inventory for:

- municipal wastes, including sewage, sludge and solid waste;
- industrial wastes, including airborne, liquid and solid wastes;
- agricultural run-off pollutants, including fertilizers and pesticides;
- pollution loads from major rivers;
- radioactive substances.

1. BACKGROUND

The project is part of the Mediterranean Action Plan adopted at the Intergovernmental Meeting on the Protection of the Mediterranean (Barcelona, January/February 1975) and endorsed by the third Session of the UNEP Governing Council, Nairobi, April 1975 (UNEP/GC/55, decision III).

It is closely related to the Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL), and also to the other components of the Mediterranean Action Plan, notably the projects on integrated planning of the region's development ("Blue Plan") and the Protocol on Land-Based Sources of Pollution. Likewise the project is connected with numerous past and present activities of various United Nations and intergovernmental organizations in the Mediterranean region.

In particular, the project is expected to provide a substantial input to the preparation of the technical background study and other components of the Protocol on Land-Based Sources of Pollution.

2. LONG-TERM OBJECTIVES

The ultimate objective of the project is to provide the Governments of the Mediterranean Coastal States, as the sole beneficiaries of the project, with appropriate information on the type and quantity of pollution inputs from major land-based sources and rivers, and on the present status of waste discharge and water pollution management practices.

3. IMMEDIATE OBJECTIVES

To achieve a comprehensive picture of all major pollution inputs into the Mediterranean, the following tasks will be undertaken:

(i) to prepare an inventory of land-based sources of pollutants discharging into the Mediterranean;

(ii) to assess the nature and quantity of pollutants entering the Mediterranean from coastal sources;

(iii) to assess the nature and quantity of pollutants entering the Mediterranean through major rivers; and

(iv) to review the present waste disposal and management practices.

CONTENTS

ANNEX VII

DESCRIPTION OF THE JOINT WHO/ECE/UNIDO/FAO/UNESCO/IAEA PROJECT ON POLLUTANTS FROM LAND-BASED SOURCES IN THE MEDITERRANEAN

(MED POL X)

The text of this project description is an extract from the project document prepared by the Co-operating Agencies and UNEP in 1976.

4. WORKPLAN AND TIMETABLE

October 1975 - March 1976

Preparation and distribution of a questionnaire to countries of the Mediterranean region. Preparation and collation by countries of the information called for in the questionnaire.

April - June 1976

Roving mission to countries by a consultant to assemble relevant information and material.

July - August 1976

Preparation of a working document for the first task force to be held in September.

September 1976

Convening of the first task force to evaluate the existing information and correlate the meaningful data.

January 1977

Convening of the second task force to define an action programme on the role of river sedimentation in the pollution of the Mediterranean Sea.

April 1977

Submission of final reports.

5. FOLLOW-UP ACTIONS

The main follow-up actions to this project are envisaged as follows:

- gathering of available material and existing knowledge on sediment inputs into the Mediterranean Sea;
- greater appreciation of the role of the sedimentation processes in the problems of pollution of the Mediterranean Sea;
- provision of guidelines to decision makers on likely effects of different land use and development actions on sediment loads transported into the Mediterranean Sea, and the consequences of such transport on both terrestrial and aquatic (freshwater and marine) ecosystems;
- development of co-operative action programmes between the countries of the region in respect to sediment transport by rivers into the Mediterranean Sea.

CONTENTS

5.2 Neccesary deck, navigational and manoeuvring equipment, etc.

(A) Winches

One hydrographic winch with at least 6,000m of cable is essential. This winch should be equipped with a tensiometer as well as good meter wheels. It should have variable speed capability for both deployment and retrieval with a speed range of 0-100 metres per minute.

A trawl winch is also required and should be capable of pulling a bottom dredge or trawls at depths up to 5,000m. This would allow dredging in the deepest areas of the Mediterranean (stations 40, 51 and 67). However, if this capability is not available, the minimum depth for dredging samples in most areas of the open Mediterranean sea is about 2,500m. This winch should also be equipped with tensiometers and be capable of accurately measuring the amount of cable deployed, e.g. by means of a meter wheel.

(B) Crane

Since gravity coring and large-volume water sampling involve the use and manipulating on deck of fairly heavy equipment, it is desirable that the ship be equipped with a small flexible-boom type crane. This would allow the safe manoeuvring of Bodman bottles and corers from storage areas to the hydrographic platform; it would also be needed for the deployment and retrieval of sediment traps.

(C) Navigation

The ship should be capable of determining its position in the open sea to within, at least, 1 km. It would be preferable if the ship had satellite navigational capabilities; however, any other navigational system which would meet the stated requirements is acceptable. When on station the ship must be capable of maintaining a vertical wire angle in at least moderate seas. Therefore, it should be equipped with a bow thruster or other manoeuvring system in order to meet this requirement. In order to carry out plankton tows with fine mesh nets the ship must have a minimum steady speed capability of 2 knots or less.

(D) Depth recorders

The ship must be equipped with the necessary sonar transmitters (one for shallow and one for deep areas), precision graphic recorders and ancillary equipment in order to determine bottom depths of up to 5,000 metres and to record signals from acoustic pingers.

(E) Laboratories

The ship should contain enough laboratory space to accommodate at least 15 to 20 scientists. It should have running sea-water and fresh water, a 110-220V A.C. 50 cycle electrical supply, at least 2,000 litre capacity freezing space (walk-in type) for storing biological and sediment samples, and a cold room for storing water samples (metals). To operate the analytical instrumentation, a separate stabilized supply of 5 kilowatts (220° $\pm$ 5 per cent) is essential. It should also have a workshop for repairing or fabricating equipment while at sea. The shop should contain all common tools, table saw, band saw, drill press etc. Good communication links between labs, winches, hydrographic platform and bridge are essential.

(F) Optional items

An air compressor supplying clean air for filtration apparatus and for servicing scuba diving tanks is recommended. This latter gear will be used for observation, repairs and the deployment and retrieval of some specialized equipment such as sediment traps.

6. SCIENTIFIC EQUIPMENT REQUIREMENTS

The following equipment should be purchased and provided with the ship:

6.1 General

2 pH meters
Minimum 20 Niskin bottles
25 unprotected and 50 protected certified reversing thermometers
STD probe (preferably with rosette sampler) with adequate cable and winch capabilities to 5,000m
2 induction salinometers
1 4-channel autonalyser
1 fluorescence spectrophotometer and spare parts
2 small rubber dinghies
1 irradiance meter
2 desk top calculators
1 small centrifuge capable of 2,000 g
10 plastic buckets (10 litres)
Large spool of sisal rope
Large spool of nylon cord
15 complete sets of raingear (oilskins)
1 quartz distillation apparatus (capable of 10 litre/day)
Ion exchange column to deionize water
Large volume filtration system (Batelle Northwest type) and pump
5 Millipore filter flasks and scinters
1 case of Millipore filters of various pore sizes

6.2 Biota

8 1-metre plankton net rings
High-speed plankton nets
2 zooplankton separators
4 1-metre diametre zooplankton nets with about 276-300um aperture
4 1-metre diametre phytoplankton nets with about 76um aperture
4 neuston sleds and nets
2 3-metre Isaacs-Kidd mid-water trawl depressors and nets
4 otter or beam trawls
2 bottom dredges with sieves and screen
Dip nets and hand lines
4 dissecting microscopes (30-100 X)
2,000 100-ml glass plankton bottles
Adequate formal, alcohol, range of acids and fixatives
10 plastic sorting trays
5 complete dissection kits
2,000 200-ml plastic bottles for sample storage

6.3 Water

2 sets of automatic pipettes
6 30-litre PVC Niskin bottles (preferably on a rosette sampler with STD probe and electronic activator)
3 60-litre Bodman type bottles
100 35-litre plastic bidons
A 2,000-litre plastic bag sampler
5 automatic burettes and 500 certified bottles for Winkler filtration
Several vacuum pumps
Several bathythermographs (preferably XBT) for both shallow and deep waters

6.4 Sediment

2 21-cm Sphincter cores with spare nose cone
Grab sampler (van Greve type)
Box corer
Bottom dredge
Acoustic pinger
Precision depth recorder
2 turbidity meters
3 Secchi discs
1 set of standard geological sieves

6.5 Air

2 high-volume Bendix air pumps
1 low-volume air pump with continuous filter
Changer

7. PARTICIPANTS

The participation in the MED CRUISE will be limited to marine scientists and technicians from institutions designated as participants in MED POL. For the various cruise-legs, priority will be given to participants from countries traditionally interested in the area covered by the individual legs.

Steps have been taken by the Steering Committee to identify the potential participants in the MED CRUISE.

8. CO-ORDINATION

The Steering Committee for MED CRUISE will handle all matters relevant to the cruise until the latter has been approved by the Governments and the relevant organizations of the United Nations system supporting the Mediterranean Action Plan. Afterwards the Steering Committee will be changed into the MED CRUISE Co-ordinating and Management Committee (CMC) composed of Mediterranean scientists and representatives of the relevant United Nations bodies.

A Mediterranean scientist will be appointed for 12 months as cruise co-ordinator to organize and supervise the implementation and follow up its results under the general guidance of the CMC.

For the individual cruise-legs scientific leaders wil be selected who will be responsible to the cruise co-ordinator for the successful accomplishment of the various legs.

The cruise co-ordinator will be selected by the Steering Committee and will be appointed by IAEA on the Committee's recommendation. The selection and appointment of scientific leaders for various cruise-legs will be made by the CMC on the recommendation of the cruise co-ordinator.

ANNEX VI

DESCRIPTION OF THE JOINT UNESCO/UNEP PROJECT ON THE ROLE OF SEDIMENTATION IN THE POLLUTION OF THE MEDITERRANEAN SEA (MED POL IX)

The text of this project description is an extract from the project document prepared by UNESCO and UNEP in 1975.

more refined correlation between concentrations of various pollutants and depth in the sediment.

(D) Suspended particulate matter

At representative stations, samples of suspended particulate matter will be taken for analyses of chlorinated hydrocarbons, trace metals and occasionally radionuclides. Techniques involved will be adjusted to eliminate possibilities of contamination. For example, glass fibre filters will be used in the sampling procedure for chlorinated hydrocarbons.

At a few stations, it is planned to deploy and retrieve sediment traps. This will be done in collaboration with certain Mediterranean scientists and some from abroad. The exercise will involve the deployment of traps which will either be moored to the bottom or allowed to 'free-float' for periods of up to three months, after which time they will be retrieved using either the same ship or any other suitable vessel working in the Mediterranean during the latter half of 1978. Depending on the timing of MED CRUISE, relative to other available vessels, time will be allotted for either deployment or retrieval of these sediment traps in selected areas. The analysis of material caught in the traps will be a multidisciplinary effort involving sedimentologists, biologists and analytical chemists, etc.

(E) Air

Air samples will be taken for chlorinated hydrocarbon analysis using high-volume air pumps fitted with glass fibre filter traps and silicone-oil coated beads. Samples of airborne particulate matter for metal analysis will also be taken. In order to avoid ship contamination, all samples will be taken while the ship is under way rather than on the indicated stations. Samplers will be placed in the furthest and highest position available on the ship in order to avoid stack gases, etc.

(F) Tarballs

At each station, neuston nets will be towed at the surface for approximately 30 minutes to collect tar balls and "mousse".

(G) Oil slicks

During the cruise, oil slicks, whenever encountered, will be sampled by means of a surface film sampling device (e.g. Garrett type).

(H) Other

In addition to the core programme, the ship can be put to use in ongoing MED POL projects such as releasing drift cards (DRIFTEX) and aiding in the contingency plan for the Malta Oil Combating Centre.

5. SHIP REQUIREMENTS

5.1 General

The MED CRUISE is planned to be undertaken by using a chartered vessel from the USSR. It will be in the 50-70 metre class and be capable of accommodating 15-20 scientific personnel for up to 25 days. It will be equipped for both hydrographic and biological sampling.

organisms to be collected are euphausiids, pelagic shrimp, pteropods, salps, myctophid fish, amphipods and chaetognaths, several species of which are ubiquitous throughout the Mediterranean.

(iii) Benthic biota

Owing to the length of time necesary and the difficulties involved in bottom trawling at great depths, benthic biota will be sampled only at selected SOOS when time permits. Standard otter trawls, beam trawls and/or bottom dredges will be towed at or near the bottom for 60 minutes. Samples will be treated as mentioned above. The principal benthic organisms to be sampled are those species found throughout the entire Mediterranean such as shrimp, crabs, echinoderms, molluscs, holothuridians and certain species of benthic fish.

(iv) Other

Periods of time will also be allotted to ancillary biological studies which are closely related to the core SOOS sampling programme. Examples of studies such as these may be collecting phytoplankton under "bloom" conditions or sampling certain commercial species of pelagic fish for the purpose of measuring concentrations of heavy metals and chlorinated hydrocarbons. Proposals for these special projects will be submitted to the Steering Committee in charge of the ship's scientific programme and accommodated in the MED CRUISE plan whenever possible.

(B) Water

(i) Chlorinated hydrocarbons

Large-volume water samples will be taken with a 60 litre aluminium and stainless steel Bodman bottle at each station and analysed for chlorinated hydrocarbons. Several depths will be sampled at each station. Samples will be analysed for PCBs and pesticides using the technique of adsorption on XAD-2 resin. If it is possible to install a gas chromatograph on board ship, water samples will also be analysed for low molecular weight chlorinated hydrocarbons by the adsorption/desorption technique using Tenax cartridges.

(ii) Metals

Water samples taken for trace metal analyses will be collected using a 30 litre PVC Niskin bottle and will also be taken at various depths. After necessary pre-treatment, these samples will be stored on board and off-loaded periodically for dispatch to laboratories for analysis.

(iii) Temperature, salinity, oxygen and nutrients

Aliquots of water from each sample will be used to determine temperature, salinity, dissolved oxygen, phosphates, nitrates and silicates. All measurements can be made on board; nutrients will be determined by means of an autoanalyser, salinity by an induction salinometer and oxygen measured by the Winkler technique.

(C) Sediment

Sediment will be sampled using a 21cm diameter gravity corer (Sphincter). These cores will be extruded on board ship immediately after they are taken. They will be sub-sectioned in 1 or 2 cm slices to a depth of 10 or 15cm and frozen at -20°C. These sub-samples will be used for both metal and chlorinated hydrocarbon analyses. If possible, a box-type corer will be used at selected stations in order to obtain a

Table 1 Continued...

Leg	Port	Station No.	Location Lat.	Long.	Remarks / Rationale
	Athens (1 day)				
		(41)	35°15'N	23°05'E	Outflow of bottom water from sea of Crete
Leg 10 (8 days)		(42)	36° 0'N	23°55'E	
		(43)	35°40'N	26°10'E	
		(44)	36°30'N	25°35'E	Extinct volcano (Thira Island)
		(45)	38°15'N	25°15'E	
		(46)	39°15'N	25° 0'E	
		(47)	40° 0'N	26°10'E	Mediterranean bottom water and Black Sea exchange through Sea of Marmara and Dardenelles
		(48)	40°51'N	28°52'E	Mediterranean bottom water and Black Sea exchange through Sea of Marmara and Dardenelles
		(49)	41°28'N	29°30'E	Mediterranean bottom water and Black Sea exchange through Sea of Marmara and Dardenelles
	Izmir (2 days)				
		(50)	35°50'N	27°35'E	Outflow of Aegean bottom water, formation of Mediterranean water (4,338m)
		(51)	36° 0'N	28°35'E	
Leg 11 (5 days)		(52)	36°30'N	28°20'E	
		(53)	35°40'N	32°30'E	
	Limassol (2 days)				
		(54)	35°25'N	35°10'E	Eastern Mediterranean loop
		(55)	35°55'N	34°05'E	
		(56)	36°10'N	35°15'E	
		(57)	35°25'N	34°40'E	
Leg 12 (4 days)		(58)	33°55'N	35°05'E	
		(59)	33° 0'N	34°30'E	
		(60)	33° 0'N	33°15'E	
	Limassol (2 days)				
Leg 13 (2 days)		(61)	32°40'N	31° 0'E	Nile Delta region
		(62)	32°40'N	29°42'E	
	Alexandria (1 day)				
		(63)	33°45'N	28°50'E	Deepest area of Levantine basin
		(64)	33° 0'N	28°50'E	
		(65)	32°25'N	26°50'E	See Station 63
		(66)	33°35'N	26°30'E	
Leg 14 (11 days)		(67)	34°30'N	26°15'E	See Stations 50, 51 and 52
		(68)	33°40'N	23° 0'E	
		(69)	35°30'N	18°25'E	Deep central Ionian Sea
		(70)	36°35'N	18°30'E	
	Valletta (3 days)				
		(71)	38°55'N	10°50'E	See Stations 23, 24 and 25
		(72)	40°20'N	11°15'E	Deep Tyrrhenian Sea, see also Station 21
		(73)	41°15'N	10°25'E	
Leg 15 (7 days)		(74)	40°15'N	5°45'E	
		(75)	41°25'N	5°45'E	To be correlated with Station 6
	MONACO				

(Total cruise time = 121 days)

Table 1 : Proposed MED CRUISE Schedule

Leg	Port	Station No.	Location Lat.	Long.	Remarks / Rationale
	MONACO (14 days)				Initial port of call to be Monaco in order to load all equipment necessary for all 16 legs of MED CRUISE. To conduct a "shake-down" cruise with ship's crew and relevant scientific personnel.
		(1)	43°10'N	8°10'E	
		(2)	42°40'N	8°40'E	All equipment for standard open ocean stations (SOOS) will be tested. This includes large volume water samplers, nets, trawls, salinometers, etc. Intercalibration run.
Leg 1 (3 days)		(3)	42°50'N	9°55'E	
		(4)	43°35'N	9°30'E	
	Monaco (3 days)				Revision and modification depending on outcome of "shake-down" cruise.
		(5)	43° 0'N	6°30'E	Region of up-welling
		(6)	42°20'N	5°60'E	Area of high surface evaporation due to Mistral
Leg 2 (3 days)		(7)	43° 0'N	5°10'E	High particulate content near mouth of Rhone River
		(8)	40°50'N	3°10'E	
	Barcelona (2 days)				
		(9)	40°40'N	1°30'E	Ebro fan
		(10)	37° 0'N	1°05'W	
		(11)	35°55'N	7°15'W	Correlation of pollutants with Atlantic inflow and Mediterranean outflow across Gibraltar Sill
		(12)	36° 0'N	4°15'W	
Leg 3 (6 days)		(13)	35°45'N	2°30'W	Possible correltation of pollutants with well known nephaloid layers in this region.
	Algers (2 days)				
		(14)	37°20'N	2°50'E	
Leg 4 (2 days)		(15)	38°30'N	2°45'E	Balearic Islands region
	Palma (2 days)				
		(16)	38°20'N	4°55'E	Relatively high biological productivity
		(17)	37°40'N	6°55'E	
Leg 5 (5 days)		(18)	40° 0'N	7°10'E	
		(19)	41°30'N	7°15'E	
	Monaco (4 days)				
		(3)	42°50'N	9°55'E	Repeat of station occupied on "shake-down" cruise to test reproducibility of sampling. (intercalibration tests)
Leg 6 (4 days)		(20)	42° 0'N	10°30'E	
		(21)	40°20'N	12°45'E	Deep Tyrrhenian Sea
		(22)	38°50'N	15°20'E	Correlation of metal content with region of high volcanic activity, e.g. Stromboli
	Messina (1 day)				
		(23)	38° 0'N	11°30'E	
Leg 7 (3 days)		(24)	36°45'N	10°35'E	Pollutants levels across sicullo-Tunisia Sill
		(25)	36°10'N	13°45'E	
	Valletta (2 days)				
		(26)	33°55'N	14° 0'E	
Leg 8 (5 days)		(27)	32°35'N	17° 0'E	Gulf of Sidra circuit
		(28)	32°55'N	25° 0'E	Gulf of Sidra circuit
		(29)	34°15'N	20°25'E	Gulf of Sidra circuit
		(30)	34°25'N	17°35'E	Gulf of Sidra circuit
	Valletta (1 day)				
		(31)	37°40'N	15°30'E	Metal levels of region of high volcanic activity (Mt. Etna). Correlation with Station 22 which is on opposite side of Straits of Messina
		(32)	38°10'N	18°40'E	
Leg 8 (6 days)		(33)	39°50'N	19°15'E	Mouth of Straits of Otranto
		(34)	41°45'N	17°45'E	Deepest point in Adriatic. Bottom water formation zone
		(35)	42°35'N	14°45'E	
		(36)	44°50'N	12°50'E	Mouth of Po river
		(37)	45°30'N	13°10'E	Zone of high biological productivity
	Rovinj (1 day)				
		(38)	43°50'N	14°40'E	Dregica rise region
Leg 9 (5 days)		(39)	40°45'N	18°45'E	Shallow point of Otrento sill
		(40)	36°35'N	21°10'E	Deepest point in Mediterranean Sea. Bottom water formation

No. 21 CPPS/UNEP: Sources, levels and effects of marine pollution in the South-East Pacific. (1983) (In Spanish only)

No. 22 Rev. 1. UNEP: Regional Seas Programme in Latin America and Wider Caribbean. (1984)

No. 23 FAO/UNESCO/IOC/WHO/WMO/IAEA/UNEP: Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL) - Phase I: Programme Description. (1983)

No. 24 UNEP: Action Plan for the protection and development of the marine and coastal areas of the East Asian region. (1983)

No. 25 UNEP: Marine pollution. (1983)

No. 26 UNEP: Action Plan for the Caribbean environment programme. (1983)

No. 27 UNEP: Action Plan for the protection and development of the marine environment and coastal areas of the West and Central African region. (1983)

No. 28 UNEP: Long-term programme for pollution monitoring and research in the Mediterranean (MED POL) - Phase II. (1983)

No. 29 SPC/SPEC/ESCAP: Action Plan for managing the natural resources and environment of the South Pacific region. (1983)

No. 30 UNDIESA/UNEP: Ocean energy potential of the West and Central African region. (1983)

No. 31 A. L. DAHL and I. L. BAUMGART: The state of the environment in the South Pacific. (1983)

No. 32 UNEP/ECE/UNIDO/FAO/UNESCO/WHO/IAEA: Pollutants from land-based sources in the Mediterranean. (1984)

No. 33 UNDIESA/UNEP: Onshore impact of offshore oil and natural gas development in the West and Central African region. (1984)

No. 34 UNEP: Action Plan for the protection of the Mediterranean. (1984)

No. 35 UNEP: Action Plan for the protection of the marine environment and the coastal areas of Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates. (1983)

No. 36 UNEP/CEPAL: The state of marine pollution in the Wider Caribbean region. (1984)

No. 37 UNDIESA/UNEP: Environmental management problems in resource utilization and survey of resources in the West and Central African region. (1984)

No. 38 FAO/UNEP: Legal aspects of protecting and managing the marine and coastal environment of the East African region. (1983)

No. 39 IUCN/UNEP: Marine and coastal conservation in the East African region. (1984)

PUBLICATIONS IN THE UNEP REGIONAL SEAS REPORTS AND STUDIES SERIES

No. 1 UNEP: Achievements and planned development of UNEP's Regional Seas Programme and comparable programmes sponsored by other bodies. (1982)

No. 2 UNIDO/UNEP: Survey of marine pullutants from industrial sources in the West and Central African region. (1982)

No. 3 UNESCO/UNEP: River inputs to the West and Central African marine environment. (1982)

No. 4 IMCO/UNEP: The status of oil pollution and oil pollution control in the West and Central African region. (1982)

No. 5 IAEA/UNEP: Survey of tar, oil, chlorinated hydrocarbons and trace metal pollution in coastal waters of the Sultanate of Oman. (1982)

No. 6 UN/UNESCO/UNEP: Marine and coastal area development in the East African region. (1982)

No. 7 UNIDO/UNEP: Industrial sources of marine and coastal pollution in the East African region. (1982)

No. 8 FAO/UNEP: Marine pollution in the East African region. (1982)

No. 9 WHO/UNEP: Public health problems in the coastal zone of the East African region. (1982)

No. 10 IMO/UNEP: Oil pollution control in the East African region. (1982)

No. 11 IUCN/UNEP: Conservation of coastal and marine ecosystems and living resources of the East African region. (1982)

No. 12 UNEP: Environmental problems of the East African region. (1982)

No. 13 UNEP: Pollution and the marine environment in the Indian Ocean. (1982)

No. 14 UNEP/CEPAL: Development and environment in the Wider Caribbean region: A Synthesis. (1982)

No. 15 UNEP: Guidelines and principles for the preparation and implementation of comprehensive action plans for the protection and development of marine and coastal areas of regional seas. (1982)

No. 16 GESAMP: The health of the oceans. (1982)

No. 17 UNEP: Regional Seas Programme: Legislative authority. (in preparation)

No. 18 UNEP: Regional Seas Programme: Workplan. (1982)

No. 19 Rev. 1. UNEP: Regional Seas Programme: Compendium of projects. (1984)

No. 20 CPPS/UNEP: Action Plan for the protection of the marine environment and coastal areas of the South-East Pacific. (1983)

IMCO (through ROCC) will be specifically responsible for the formulation of a model for the movement, dispersion and fate of oil slicks for specific Mediterranean subregions.

UNESCO will be responsible for the remaining outputs of the project.

4. WORKPLAN AND TIMETABLE

Preparatory phase

June 1978	Appointment of a consultant by UNESCO to develop components of the project document and draw up a detailed workplan
June 1978	Consultants' visits to FAO (Rome), ROCC (Malta), Shell Co. (the Hague), University of Paris (Paris), UNESCO (Paris) and UNEP (Geneva) to prepare the project document
August/September 1978	Submission and approval of the project document
October 1978	Submission of the detailed work plan for the operational phase by UNESCO to UNEP
November 1978	Preparatory meeting convened by UNESCO to draw up the curriculum for the workshop on marine ecosystem analysis aimed at formulating a detailed plan for the modelling of certain subregions of the Levantine Sea
February 1979	Approval of the detailed workplan for the operational phase by the First Meeting of the Contracting Parties of the Barcelona Convention
March 1979	Final version of a surface currents model for the Ligurian Sea based on the 1977 MED VI DRIFTEX experiment

Operational phase

April 1979 - March 1981	The work is performed by participating institutions or research groups of the Mediterranean region
September 1979	Progress reports on all activities
September 1979	Final version of the oil slick model as a part of the contingency plan
November 1979	Workshop on marine ecosystem analysis to develop a detailed plan for the modelling of the Levantine Sea
January 1980	First year progress report
February 1980	Review meeting on progress achieved and workshop on the eleboration of details of future work
April 1980	First year report is submitted to UNEP
September 1980	Progress reports on all activities
February 1981	Review meeting on progress achieved and workshop on the elaboration of details of future work
March 1981	Final report on all activities

- a general model of the water balance of the Mediterranean, including the exchange processes with adjacent sea areas (Atlantic, Black Sea) will be developed;

- the hydrodynamical circulation model of the North-West Mediterranean and the Northern Adriatic will be developed to show the main pathways which can be used for the prediction of the transport of pollutants. Both models will be tested and, depending on the result, similar models will be developed for other subregions;

- models of the biogeochemical cycle of selected pollutants (mercury, oil, nutrients, etc.) in the Mediterranean Sea will be developed;

- detailed models of specific parts of the ecological system (e.g. nutrient-phytoplankton -zooplankton or phytobenthos- zoobenthos) will be prepared for certain subregions of the Mediterranean; and

- conceptual models and detailed plans for the modelling of certain areas of the Levantine Sea will be prepared.

3.2 Activities

The main activity of this project will be carried out by selected scientists from Mediterranean institutions. Specific activities requiring complex involvement of Mediterranean scientific institutions will be based on subcontracts.

The project support component and the training component are strongly interrelated and cannot be separated. Opportunities for on-the-job training will be promoted by providing fellowships for scientists from Mediterranean laboratories to work jointly with the already active modelling groups.

Meetings, seminars and workshops will be convened to formulate detailed workplans and review the progress achieved, as well as to discuss problems, exchange opinions and prepare plans for future work. These meetings will be attended not only by scientists already engaged in modelling, but also by scientists from institutions who are developing their modelling expertise.

A workshop on marine ecosystem analysis to develop a detailed plan for the modelling of certain subregions of the Levantine Sea will be convened.

The results of the project are primarily intended for the Governments of the Mediterranean States, to facilitate their participation in the Mediterranean Action Plan and assist them in discharging their obligations under the Barcelona Convention and its Protocols. Furthermore, the results of the project will help scientists to improve their efficiency in pollution monitoring and research activities.

3.3 Institutional framework

Under the general co-ordination of UNEP, UNESCO will be responsible for the implementation of this project in close co-operation with IOC, IMCO (through the Regional Oil Combating Centre - ROCC) and and other bodies of the United Nations system participating in activities relevant to this project.

IOC will be specifically responsible for the formulation of the model of surface currents for the Ligurian Sea based on the DRIFTEX experiments and for the identification of specific problems not yet solved which are of considerable importance for the required models.

- to develop detailed models of specific parts of the ecological systems of certain Mediterranean subregions as well as detailed models of biogeochemical cycles of selected pollutants in the Mediterranean.

3. DESCRIPTION OF THE PROJECT

3.1 Outputs

The present knowledge (theory and available laboratory and field data) of the hydrodynamics, biogeochemical cycle and ecology of the Mediterranean is sparse and fragmentary.

Consequently, models of smaller, well-defined subregions should be prepared first and afterwards regional Mediterranean models should be developed. To select subregions for such models, the following requirements should be fulfilled, as recommended by the Second UNESCO Workshop on Marine Ecosystem Modelling, Dubrovnik, 18-22 October 1976:

(a) existing expertise (minimum number of modelling experts and experts for various problems of interest for the particular model);

(b) well-defined physical boundaries;

(c) existing data base; and

(d) existing initial stage modelling (conceptual).

3.1.1 Outputs of the preparatory phase

- a programme with a detailed workplan for the modelling activities relating to the Mediterranean Action Plan; and

- a model of surface currents for the Ligurian Sea based on the 1977 MED VI DRIFTEX experiment. Depending on the outcome of this model, experiments for other Mediterranean subregions might be proposed, as well as the application of the experience gained from the Ligurian Sea experiment to the data already obtained from the other areas.

3.1.2 Outputs of the operational phase

- to educate and train scientists from developing countries of the Mediterranean interested in modelling research to allow a broader study of pollutants in the Mediterranean;

- the identification of, as yet unsolved specific problems which are of considerable importance for the required models. Such information will be used to formulate new, or modify existing pollution monitoring and research programmes undertaken in the framework of the Mediterranean Action Plan;

- based on existing models that have been developed for other areas (SLICKTRAK, OILSIM, etc.) a model of the movement, dispersion and fate of oil slicks for specific Mediterranean subregions will also be prepared. These subregions will be selected on the basis of the probability of the occurrence of oil slicks;

In addition, the fifth session of the Governing Council also endorsed activities which "enhance ongoing programmes for understanding the sources, pathways and the effects of marine pollution of the marine environment" (UNEP/GC/90, para. 741, Activity B).

2. PURPOSE OF THE PROJECT

The following are the long-term objectives of the project:

- to develop the capability of the Mediterranean scientific community to produce scientific models for understanding and predicting pollution processes in the Mediterranean marine environment;

- to produce a general hydrodynamic model of the Mediterranean Sea describing the hydrodynamic characteristics of the Mediterranean and clarifying the problems related to large-scale physical transport of pollutants within the Mediterranean, as well as the exchange of pollutants with adjacent sea areas (Atlantic, Black Sea);

- to produce detailed hydrodynamic models for selected areas of the Mediterrranean Sea (Northern Adriatic, Ligurian Sea, Levantine Basin) having specific problems relevant to the physical transport of pollutants;

- to provide the basis for contingency plans which could be developed by the Regional Oil Combating Centre (ROCC) in Malta; and

- to develop specific ecosystem models in selected Mediterranean areas in order to improve the understanding of the biogeochemical cycles of pollutants and their impact on marine ecosystems and human health.

2.1 Objectives of the preparatory phase

- to propose the detailed programme of the modelling activities for the Mediterranean Action Plan; and

- to develop a surface layer model of the Ligurian Sea on the basis of the Ligurian Sea 1977 DRIFTEX experiment.

2.2 Objectives of the operational phase

- to develop the ability of the Mediterranean scientific community to build specific models relevant to marine pollution;

- to develop a general model of the water balance in the Mediterranean;

- to develop hydrodynamic models for the North-West Mediterranean and the Northern Adriatic;

- to develop a model of movement, dispersion and fate of oil slicks in specific Mediterranean subregions, as part of the oil combating contingency plans; and

1. BACKGROUND

The various components of the Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL) are providing a sound data base for the present level of pollution of the Mediterranean Sea. However, the analysis of the trends in pollution of the Mediterranean without an adequate model of the pollutant's biogeochemical cycle is practically impossible.

The data available on the circulation of the Mediterranean water masses, and those which are collected through the MED POL pilot projects, could be used for the construction of a general hydrodynamic model needed for the understanding of the physical transport of pollutants by currents and in particular for the development of contingency plans in cases of accidental oil spills.

Adequate hydrodynamic and ecological models are required to assess the Mediterranean's waste-receiving capacity needed for the implementation of the Protocol on Pollutants from Land-Based Sources.

During the IHP/UNESCO Symposium on the Eastern Mediterranean held in Malta in September 1973, scientists from Eastern Mediterranean countries expressed interest in developing the concept of ecosystem modelling in the Eastern Mediterranean Sea. Following the recommendation of this Symposium, UNESCO convened the First Workshop on Marine Ecosystem Modelling in the Eastern Mediterranean, (Alexandria, Egypt, December 1974).

The Second UNESCO Workshop on Marine Ecosystem Modelling in the Mediterranean was convened in Dubrovnik, Yugoslavia, in October 1976. This workshop took into consideration the development of MED POL since the 1973 Malta Symposium, and how this programme could benefit from the development of modelling concepts and methodology among participating marine scientists in the Mediterranean. As a result, the Dubrovnik Workshop oriented its work to the application of modelling to the relevant MED POL pilot projects, particularly in the areas of physical processes (MED POL VI), heavy metals in marine ecosystems (MED POL II), and ecosystems and communities (MED POL IV and V). The Workshop further recommended that a project on ecosystem modelling be established within the framework of the Mediterranean Action Plan.

Subsequently, at several expert meetings, Mediterranean scientists participating in the MED POL programme recommended that modelling activities should be developed in the Region (Mid-term Expert Consultation on the Joint FAO(GFCM)/UNEP Co-ordinated Projects on Pollution in the Mediterranean (MED II, III, IV and V), Dubrovnik, 2-13 May 1977; Mid-term Review Meeting on the IOC/WMO/UNEP Co-ordinated Project on Pollution in the Mediterranean (MED I and VI), Barcelona, 23-27 May 1977; Mid-term Review Meeting on the Progress of the Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL) and Related Projects of the Mediterranean Action Plan, Monaco, 18-22 July 1977).

As a follow-up to the recommendations formulated at the above-mentioned meetings, the promotion of modelling in the Mediterranean was recommended by the Intergovernmental Review Meeting of the Mediterranean Coastal States on the Mediterraenan Action Plan (Monaco, 9-14 January 1978), and UNEP was requested to organize such activities.

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ANNEX X

PROPOSAL FOR THE IMPLEMENTATION OF THE UNESCO/FAO/IOC/UNEP PROJECT ON

MODELLING OF MARINE SYTEMS

(MED POL XIII)

The text of this project proposal is an extract from the project document prepared by UNESCO and UNEP in 1978

3. DESCRIPTION OF THE PROJECT

Because of the complex scientific nature of the problem of the assessment of the atmospheric input of pollutants to the seas, the project will be implemented in two phases. During the preliminary phase the scientific approach will be developed and the outline of the pilot project will be prepared. The subsequent operational phase will be launched after a study of the outcome of the preliminary phase has taken place. IAEA, ECE, UNIDO and WHO will collaborate in implementing the preparatory phase of the project.

4. WORKPLAN AND TIMETABLE

May 1978	The selection of experts for an ad hoc meeting on medium-range atmospheric transport of pollutants to seas and estuaries is made by WMO in consultation with UNEP.
June 1978	Meeting of the ad hoc group of experts.
July - August 1978	Employment of a consultant to prepare an outline of a pilot project on input of pollutants to the Mediterranean Sea via the atmosphere.
September 1978	The outline of the pilot project is considered by a GESAMP Working Group on Interchange of Pollutants between the Atmosphere and Oceans.
October 1978	The outline of the pilot project and the report of the ad hoc group of experts are submitted to UNEP.
March 1979	Final report on the Project is submitted to UNEP (the date is conditional on the schedule of the First meeting of Contracting Parties to the Barcelona Convention).

1. BACKGROUND

At several expert meetings related to both the Preliminary Draft Protocol for the Protection of the Mediterranean Sea from Land-Based Sources and the Co-ordinated Pollution Monitoring and Research Programme (MED POL) of the Mediterranean Action Plan, the question of the atmospheric transport of pollutants was raised. However, it appears that no data are available to provide assessment of the atmospheric contribution to pollution of the sea. In addition, the Intergovernmental Review meeting of Mediterranean Coastal States on the Mediterranean Action Plan (Monaco, 9 - 14 January 1978) concluded that the input of riverborne and airborne pollutants into the Mediterranean may turn out to belong to one of the major unknown parameters needed to assess the state of pollution in the Mediterranean Basin and, consequently, requested UNEP to organize their assessment.

Moreover, decision 88(V), A and C of the fifth session of the Governing Council, stressed "the desirability of promoting any measures designed to reduce pollution of the seas and measures to combat marine pollution in the Mediterranean with existing international Conventions". The fifth session of the Governing Council also endorsed activities which "enhance ongoing programmes for understanding the sources, pathways and the effects of marine pollution on the marine environment". (GC 90 471, Activity B).

2. OBJECTIVES

2.1 Long-term objectives

The long-term objective of the project is to assess the input of pollutants to the Mediterranean via the atmosphere.

The project will contribute to the assessment of the state of pollution in the Mediterranean basin and to the further development of the Protocol for Protection of the Mediterranean Sea against Pollution from Land-Based Sources.

2.2 Immediate objectives

(a) To propose an approach for the assessment of the input of pollutants to the Mediterranean via the atmosphere;

(b) To select pollutants which are of significance and which can be adequately assessed; and

(c) To propose criteria for selection of appropriate sampling sites and of sampling and analytical methodology.

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ANNEX IX

PROPOSAL FOR THE IMPLEMENTATION OF THE WMO/IAEA/WHO/UNIDO/ECE/UNEP PROJECT ON

INPUT OF POLLUTANTS INTO THE MEDITERRANEAN SEA VIA THE ATMOSPHERE

(MED POL XII)

The text of this project proposal is an extract from the project document prepared by WMO and UNEP in 1978

As results are obtained, an information letter will be forwarded to participating laboratories showing the results of the measurements made and listing the participants by code number only. This will permit a comparison of your results with those of the other participants. A stock of each sample will be maintained at Monaco for those laboratories requiring further material.

Please address all correspondence regarding results or enquiries to:

The International Laboratory of Marine Radioactivity
Musée Océanographique
Principauté de Monaco

Attn: Chlorinated Hydrocarbon Intercalibration Programme.

Your participation is greatly appreciated.

Yours sincerely,
The Director

Appendix I

INFORMATION SHEET ACCOMPANYING SAMPLE
(example)

Dear .....

Based on your positive response regarding participating in an inter-calibration exercise for the measurement of chlorinated hydrocarbons in marine samples, we have today dispatched to you, under separate cover, the following samples:

Sample	Bottle No.	Sample weight	(x)	(xx)
Sea plant	SP-M-1 ( )	30 g	20 g	0.2 g
Oyster	MA-M-1 ( )	30 g	10 g	0.3 g
Sediment	SD-M-1 ( )	90 g	80 g	
Amberlite XAD-2	AB-M-1 ( )	50 cm^3	50 cm^3	

The homogeneity of this/these sample(s) was verified by analysing extractable organic matter, chlorinated hydrocarbons and trace metals. In the case of chlorinated hydrocarbons, the variations observed indicate that the samples are homogeneous at sample weights of (x)..... grams. Trace metal analysis on the total sample showed homogeneity at sample weights of (xx)..... grams.

In reporting the results, the following information should be included:

(a) chlorinated hydrocarbon residue concentrations on both a dry weight and extractable organic matter basis (samples should be dried following your laboratory's normal procedure. Please indicate method of drying and temperature employed);

(b) detailed information on the chemical procedure used in extraction clean-up, hydrolysis, chromatographic conditions (including type of instrument, column composition, operating temperatures); include a copy of the chromatograms obtained. Indicate standards used in quantifying the chlorinated hydrocarbon residues and where they were obtained.

The majority of the participants in the intercalibration exercise prefer to remain anonymous. Therefore, we have assigned your laboratory the following code number:

Code number (/) Sample

The homogeneity of the samples was tested by the Monaco Laboratory with the assistance of the IAEA's Seibersdorf Laboratory (Vienna) as well as other national institutions and found to be suitable for achieving the stated objectives.

The samples are distributed to research centres from the Mediterranean region participating in MED POL II or MED POL III as well as national institutions in other areas which are willing to participate in the intercalibration exercises. All participating institutions are requested to analyse the distributed samples by applying the analytical methods currently in use for environmental studies and to report the results with the description of the analytical procedures, methods of calibration, methods of calculation and quantification, etc. In addition to the intercalibration samples, all participating Mediterranean research centres receive NBS reference material for heavy metal analysis or primary standards of PCBs for chlorinated hydrocarbon analysis in order to check their analytical procedures within the laboratories in advance.

The distribution of the intercalibration samples is made step-wise. In the course of the progress of the MED POL projects, samples of different matrices are forwarded to participating research centres at varying intervals depending on the design of involvement of the research centres in the project and on the installation of technical facilities.

2.2 Survey of the reported results and follow-up action

The results of the analyses reported from the world-wide intercalibration are treated statistically in order to deduce "consensus values" for the components of interest. The results of laboratories selected on the basis of their analytical reputation and performance, are treated similarly to derive "probable concentrations" of the components in the distribution samples. Based on " probable concentrations" ranges of acceptable values are estimated for each component.

The compilation of reported results, overall averages and consensus values of the components of interest are made available to the participating laboratories as soon as sufficient numbers of results from the statistical treatment are assembled, but, in any case, the participating laboratories do not receive the information until they send in their results. In this way, the participating research centres can judge their analytical performance for themselves, comparing their results with those of others. Should considerable differences be found, it would be important to look into the cause of the discrepancy in each individual case. When necessary, repeated distribution of the samples should be undertaken in order to clarify the cause of the discrepancy. Whenever specific technical difficulties concerning analytical performance are found in individual centres, follow-up action to remedy the difficulties by additional supply of material, technical guidance, special assistance etc., are arranged through FAO(GFCM) channels.

1. OBJECTIVES

In view of the rapid development of modern analytical technology, it is generally not advisable to recommend any single method as the standard procedure for the analysis of heavy metals and chlorinated hydrocarbons in environmental samples. To ensure the comparability of such measurements, intercalibration analyses, using aliquots of homogeneous samples of reference materials, must be made. In determining the values for the concentration of pollutants in these materials, the analyses should be performed by several competent methods .

The objectives of the intercalibration programme in the framework of the UNEP Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL) is to give specific assistance to Mediterranean laboratories participating in the pilot projects on baseline studies and monitoring of heavy metals (MED POL II) and halogenated hydrocarbons (MED POL III) in marine organisms within the UNEP Mediterranean Action Plan.

Therefore, this project is co-ordinated with the needs of these pilot projects using the mechanisms defined for the implementation of the MED POL programme.

2. PROCEDURES

2.1 Sample preparation and distribution

In the framework of the present project, samples have been prepared by the International Laboratory of Marine Radioactivity of the International Atomic Energy Agency (Monaco Laboratory) as described in the following table.

Sample	Type of Analysis	
	for heavy metals	for chlorinated hydrocarbons
Oyster tissue homogenate	X	X
Sea plant homogenate	X	X
Copepod homogenate	X	X
Fish flesh homogenate	X	X
Mediterranean sediment		X
XAD-II Resin		X

No. 40 SPC/SPEC/ESCAP/UNEP: Radioactivity in the South Pacific. (1984)

No. 41 UNEP: Socio-economic activities that may have an impact on the marine and coastal environment of the East African region. (1984)

No. 42 GESAMP: Principles for developing coastal water quality criteria. (1984)

No. 43 CPPS/UNEP: Contingency plan to combat oil pollution in the South-East Pacific in cases of emergency. (1984)

No. 44 IMO/ROPME/UNEP: Combating oil pollution in the Kuwait Action Plan region. (1984)

No. 45 GESAMP: Thermal discharges in the marine environment. (1984)

No. 46 UNEP: The West and Central African marine environment. (1984)

No. 47 UNEP: Prospects for global ocean pollution monitoring. (1984)

No. 48 SPC/SPEC/ESCAP/UNEP: Hazardous waste storage and disposal in the South Pacific. (1984)

No. 48/Appendices SPC/SPEC/ESCAP/UNEP: Hazardous waste storage and disposal in the South Pacific. (1984)

No. 49 UNEP: Legal aspects of protecting and managing the marine and coastal environment of the East African region: National Reports. (1984)

No. 50 UNEP: Marine and coastal conservation in the East African region: National Reports. (1984)

No. 51 UNEP: Socio-economic activities that may have an impact on the marine and coastal environment of the East African region: National Reports. (1984)

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ANNEX VIII

DESCRIPTION OF THE JOINT IAEA/FAO/IOC/UNEP PROJECT ON INTERCALIBRATION OF ANALYTICAL TECHNIQUES AND COMMON MAINTENANCE SERVICES

(MED POL XI)

This annex contains guidelines for intercalibration measurements of heavy metals and chlorinated hydrocarbons in the framework of MED POL XI prepared by IAEA and UNEP in 1976.

4.5 Project structure

The following elements are part of the institutional arrangements for this joint project:

(i) UNEP will be responsible for co-ordinating the project activities with those either under way or planned in the framework of the Mediterranean Action Plan to ensure the full participation of the Mediterranean Governments in the project.

(ii) The co-operating UN agencies will implement their section of the project under their own responsibility.

During the implementation of the second phase of the project, two major activities will be carried out: the collection of data and the assessment of all pertinent information.

Studies for the above-mentioned waste categories will be conducted in each country. Wherever possible, these data surveys will be based on existing and available national information. Missions will also be conducted to assist countries in completing the inquiries for municipal and industrial wastes.

Separate data collection will be initiated for river pollution inputs and for agricultural run-off pollutants due to the different nature of these pollution sources. The possible contributions from fertilizers and pesticides will be estimated through a survey of present application rates of relevant chemicals in agricultural practices in the coastal regions draining into the Mediterranean.

Waste disposal and management practices will be reviewed and common methods and approaches identified. The summary report is expected to provide a quantitative picture of all waste sources and pollutant categories for the entire basin in the form of tables, maps, and other graphical presentations.

A final report consolidating all the results of the various sectoral studies is the expected output of the third phase of the project.

4.4 Project implementation

This project is a joint undertaking to which each co-operating United Nations agency will contribute according to its field of expertise and geographical representation. Taking into account these specifications, the following distribution of tasks and responsibilities is agreed upon:

(i)	inventory and assessment of municipal sources	:	WHO
(ii)	inventory and assessment of industrial sources	:	ECE/UNIDO
(iii)	inventory and assessment of agricultural run-off	:	FAO
(iv)	inventory and assessment of river discharges[1/]	:	UNESCO
(v)	inventory and assessment of radioactive discharges	:	IAEA
(vi)	review of municipal waste disposal and management	:	WHO
(vii)	review of industrial waste disposal and management	:	ECE/UNIDO
(viii)	project co-ordination	:	WHO

Each co-operating agency will carry out its activities through the entire project on the sector for which it assumed responsibility.

1/ See annex VI.

Issued and printed by:

Regional Seas Programme Activity Centre
United Nations Environment Programme

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