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ADMINISTRATIVE REPORT

ON THE IMPLEMENTATION OF THE CO-ORDINATED MEDITERRANEAN POLLUTION MONITORING AND RESEARCH PROGRAMME (MED POL) AND RELATED PROJECTS OF THE MEDITERRANEAN ACTION PLAN

Note: This document is an updated and revised version of a draft (UNEP/WG.11/3 (Prov.)) which was presented to and reviewed by 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).

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1. INTRODUCTION

1.1 The United Nations Environment Programme (UNEP) was established in 1972 by the United Nations General Assembly to act as a co-ordinating body within the United Nations system to ensure that comprehensive approaches be developed to deal with the world's most pressing environmental problems.

1.2 While it was recognized that environmental deterioration was far advanced in many areas of the globe, the Mediterranean region was selected by UNEP as a "concentration area" where UNEP would attempt to fulfil its catalytic role in assisting the coastal States in an ambitious and consistent manner.

1.3 After extensive preparatory activities involving a number of United Nations bodies, UNEP convened the Intergovernmental Meeting on the Protection of the Mediterranean (Barcelona, 28 January - 4 February 1975). The meeting was attended by representatives of 16 States bordering on the Mediterranean Sea.[1] At the end of the two-week meeting they approved an Action Plan[2] consisting of three substantive components:

- legal (framework convention and related protocols)
- scientific (research and monitoring)
- integrated planning

1.4 All components of the Action Plan are interdependent and provide a framework for comprehensive action to promote both the protection and the continued development of the Mediterranean ecoregion. No component is an end in itself. Each activity is intended to assist the Mediterranean Governments in improving the quality of the information on the basis of which they formulate their national development policies. Each should also improve the ability of Governments to identify various options for alternative patterns of development and to make rational choices and appropriate allocations of resources.

1.5 The environmental assessment (scientific) component of the Mediterranean Action Plan has as its over-all objectives:

- to assess the present state of pollution of the Mediterranean Basin,
- to identify the sources, pathways, amounts and effects of pollutants affecting the Mediterranean Sea,
- to establish the trends in the level of the pollution,
- to provide the basis for building predictive models of the biogeochemical cycle of pollutants and of their 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 the environmentally compatible socio-economic development strategies,

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

1.6 This document is an administrative progress report on the implementation of the environmental assessment component of the Mediterranean Action Plan. The results obtained through its implementation are incorporated in document UNEP/IG.11/INF.4.

2. BACKGROUND

2.1 As early as 1969 the General Fisheries Council for the Mediterranean (GFCM) of FAO formed a Working Party on Marine Pollution in the Mediterranean and its Effects on Living Resources and Fishing which, in co-operation with experts from the International Commission for the Scientific Exploration of the Mediterranean Sea (ICSEM), produced the first comprehensive review of the state of marine pollution in the Mediterranean in 1972. [3]

2.2 The next important step was the UNEP-sponsored International Workshop on Marine Pollution in the Mediterranean [4], convened in Monaco (9 - 14 September 1974) by the Intergovernmental Oceanographic Commission (IOC) of UNESCO, GFCM of FAO and ICSEM. This meeting, attended by 40 scientists from Mediterranean research centres, defined pollution of coastal waters as the main environmental problem in the Mediterranean Sea 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 petroleum hydrocarbons, and to the presence of disease-causing micro-organisms. The Workshop also reviewed information on current subregional programmes as well as on existing research and monitoring facilities in the Mediterranean.

2.3 Based on the recommendation of the Monaco Workshop and on a subsequent study of the capabilities of existing national research institutions, conducted by IOC on behalf of UNEP, the 1975 Intergovernmental Meeting in Barcelona approved a Co-ordinated

Mediterranean Pollution Monitoring and Research Programme (MED POL) consisting of seven pilot projects and requested UNEP's Executive Director to implement the Programme in close collaboration with the relevant specialized United Nations bodies (GFCM of FAO, IOC of UNESCO, WHO, WMO and IAEA).

2.4 The following pilot projects were approved at the Barcelona Meeting as parts of MED POL:

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

MED II : Baseline Studies and Monitoring of Metals, Particularly Mercury and Cadmium, in Marine Organisms;

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

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

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

MED VI : Problems of Coastal Transport of Pollutants;

MED VII : Coastal Water Quality Control.

2.5 Following governmental approval for the creation of seven networks of co-operating national research centres to carry out the work on the seven pilot projects, a number of technical meetings were held at which operational documents [5] were drawn up and used as the basic documents in the implementation of the pilot projects.

2.6 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 matrix and the pollutants to be monitored, the sampling and analytical methodology to be followed, the procedures of 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 any other question relevant to the execution of the pilot projects.

2.7 The pilot projects are being carried out by existing national institutions. Participation in the projects is open to all institutions in the region, subject to nomination by their national authorities (Annex I). At present 76 research centres from 15 Mediterranean countries [6] have been identified as active partici-

pants in one or more of the pilot projects (Annex II), but additional nominations are still expected. The participation in the pilot projects is not limited to well developed research centres able to deal with the task in a complex way but is open to all institutions capable of a limited contribution in order to further their own development.

2.8 The monitoring and research activities to be undertaken by the research centres nominated are specified in a signed agreement between them and the relevant specialized United Nations organization co-operating with UNEP on the implementation of the programme. As at the end of October 1977, 107 individual research agreements had been signed, 20 cleared and prepared for signature, while 78 agreements were still being negotiated. UNEP is acting as over-all co-ordinator for the work carried out on the basis of these agreements by the individual research centres to ensure the most effective and harmonious development of the whole research and monitoring programme.

2.9 The pilot projects are organized in close collaboration between UNEP and the specialized United Nations bodies (GFCM of FAO, IOC of UNESCO, WMO and WHO) which have a major role in their implementation. Throughout the planning period, and in particular during the whole of the pilot project phase lasting until the end of 1978, a high degree of co-operation has been and is being maintained between UNEP, acting as the over-all co-ordinator, and these specialized United Nations bodies.

2.10 Substantive support has already been 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 includes a large training programme, furnishing of necessary equipment, organization of a permanent intercalibration of analytical techniques mandatory for all participants, and provision of common maintenance services for the more sophisticated instruments used in analytical work. By the end of October 1977, a total of 156 m/m of training and equipment worth $808,569 has been granted to the participants in the seven pilot projects.

2.11 As an aid to participants in the programme several technical documents such as bibliographies, manuals and guidelines, have been prepared or are under preparation. 7)

2.12 In consultation with the Mediterranean Governments and the specialized United Nations bodies concerned, in August 1976, one research centre in each of the seven networks of co-operating institutions was nominated by UNEP (Annex III) as a Regional Activity Centre (RAC). The role of the RACs is to assist UNEP and the relevant specialized United Nations bodies in the organization and execution of the pilot projects (see 20).

2.13 Close collaboration has been established between the Regional Activity Centre for the pilot project on baseline studies and monitoring of oil and petroleum hydrocarbons in marine waters and the Regional Oil Combating Centre (see 15) making use of their complementary role 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.

2.14 The first results of the seven MED POL pilot projects have been reviewed at recently convened mid-term review meetings [8].

2.15 The pilot projects of the monitoring and research programme deal mainly with the coastal waters of the Mediterranean, and therefore an additional pilot project (MED VIII) dealing with pollution levels of the open waters and the biogeocycle of the most important pollutants was later added to the original seven projects of MED POL (see 10).

2.16 Since 1975 UNESCO and UNEP have been undertaking a project (MED IX) on the role of sedimentation in the pollution of the Mediterranean Sea with special emphasis on the assessment of current knowledge in this field and on the development of guidelines for environmental impact assessment (see 11).

2.17 A related project was initiated by UNEP on pollutants from land-based sources (MED X). The project is being carried out in close co-operation with the Governments of the region and a number of specialized United Nations bodies, including the Economic Commission for Europe (ECE), the United Nations Industrial Development Organization (UNIDO), FAO, UNESCO, WHO, IAEA. Its objective is to provide the Governments of the Mediterranean coastal States with information on the type and quantity of pollution from major land-based sources and through rivers, and on the present status of waste discharge and water pollution management practices. The project also provides for the preparation of an inventory of land-based sources of pollutants being discharged into the Mediterranean. It is a concrete example of the linkage between environmental assessment and management in that it is intended to produce data which will assist Governments in the negotiation of the regional Protocol on land-based pollutants. The Protocol should contribute to the application of more efficient waste management practices (see 12).

2.18 Recently, in co-operation with UNESCO, plans have been developed to formulate conceptual models for the biogeocycle of selected Mediterranean pollutants, including models for their impact on marine ecosystems. Using data collected through the various pollution monitoring and research activities, these conceptual models should lead to the formulation of predictive models which might be useful tools for making appropriate management decisions (see 13).

2.19 Other projects may also be considered, inter alia: (i) to study the question of airborne pollutants, (ii) to evaluate the transfer of pollutants through the air/sea interface, (iii) to assess the

potential fisheries resources in the Mediterranean and the effects of pollutants on this potential, and (iv) to develop ecologically sound guidelines and principles for the establishment and management of specifically protected aquatic areas.

2.20 A Directory of Mediterranean Marine Research Centres describing more than 100 institutions was prepared and issued [9] by UNEP in 1976. A second, up-dated edition of this Directory providing detailed information on more than 140 institutions, (programmes, staff, publications, facilities, etc.) was issued in October 1977.

3. MED I : BASELINE STUDIES AND MONITORING OF OIL AND PETROLEUM HYDROCARBONS IN MARINE WATERS (IOC/WMO/UNEP)

Description

3.1 The pollution of the Mediterranean by oil and petroleum hydrocarbons is a serious problem for beaches and other coastal, recreational areas, and as yet too little is known about the present levels of the pollution and about its effects on the Mediterranean ecosystem. The pilot project involves the visual observation of oil slicks and other floating pollutants, tar ball sampling, survey of tar on beaches and sea-water sampling to analyse the amount and composition of the petroleum hydrocarbons dissolved.

3.2 The pilot project is considered as 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).

3.3 The measurement of present levels of petroleum in all its forms in the Mediterranean assumes greater importance in view of the reopening of the Suez Canal to the passage of oil tankers. The value of initiating the pilot project in the Mediterranean region rests mainly on three facts:

- an observational methodology (that of IGOSS) was available at the initiation of MED I which could be easily adapted to suit its purposes, and further developed during its first phase, bearing in mind the desirability of keeping its data fully comparable to those of the IGOSS Pilot Project,

- by using a common methodology and strategy, comparisons of effects of accidental and operational discharges from tankers, and shore facilities in the various parts of the Mediterranean Sea would become possible,

- within a common system of observation, the Mediterranean can be truly compared with other areas (e.g. the North Atlantic) with quite different oceanographic regimes, in which the possibilities for dispersion and dilution are greater and the possibilities of evaporation generally lower.

Objectives

3.4 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 oil and petroleum hydrocarbons. This assessment would be achieved by using an accessible, commonly-agreed upon technique and methodology, verified by a carefully co-ordinated intercalibration exercise. The expected results would substantially contribute to the formulation of contingency plans for action, both in cases of emergency and for dealing with effects of point sources resulting from operational spills. These contingency plans will be developed by the Regional Oil Combating Centre in Malta (see 15).

Progress in Implementation

3.5 The operational document for this pilot project was developed at a joint IOC/WMO/UNEP Consultation (Malta, 8-13 September 1975) [5] which was attended by 36 participants from 12 Mediterranean countries.

3.6 At present 11 countries [10] have expressed a wish to participate in the pilot project and nominated 25 national laboratories as participants in the network dealing with the pilot project (Annex II; Annex V Fig.1)

3.7 The work on this project was started during 1976 and, by the end of October 1977, 10 research agreements had been signed, 3 cleared and are ready for signature, while the remaining 12 research agreements are still being negotiated.

3.8 On the basis of the research agreements signed, a training programme has been initiated. To date a total of 16 m/m training has been granted, of which, by the end of October 1 m/m has been realized. The participating laboratories are aided by field and laboratory equipment, such as fluorescence spectrophotometers, neuston nets, sampling bottles and solvents (see 18).

3.9 Methodological guidelines for the implementation of the project, based on those prepared for IGOSS, are under preparation [7].

3.10 The preliminary results obtained through the pilot project were reviewed at the IOC/WMO/UNEP Mid-term Review Meeting [8], Barcelona, 22 - 26 May 1977 and are incorporated in document UNEP/IG.11/INF.4. The individual summary reports of the participants are attached to this document (Annex IV).

Preliminary Results

3.11 Concentrations of dissolved/dispersed hydrocarbons have been monitored in the regions of Banyuls-sur-Mer, France; Patraikos and Messiniakos Gulfs, the islands of Crete, Rhodes and Lesbos, Greece; Thessaloniki and Kavalla harbours and Strymonikos Bay, Greece; Cadiz Bay and Cadiz Port, Spain; Rijeka Bay, Yugoslavia. Investigations were carried out in three different Mediterranean areas; in total 108 samples were taken, of which 40 were from the surface, 32 at 10 m depth, and 36 at 50 m depth. No significant variation was found with depth and results ranged from 100 to 3,500 ppb, with an average of 2,000. The relatively low number of analysed samples does not allow for a comparison of the three areas studied.

3.12 Tar has been monitored on beaches of Limassol Bay, Larnaca Bay and north of Paphos, Cyprus; Alexandria, Egypt; along the coast of Israel; Anchor Bay, Quawra and Marsaxlokk Bay, Malta. On beaches in the Central Area tar varied from 0 - 800 g/m in 18 samples, with an average of 118 g/m. In one location of the South Levantine Area results from 260 samples varied from 30 to 14,759 g/m, with an average of 3,625, while in another location in the same Area 18 samples gave results varying from 1 - 5.6 g/m.

3.13 A survey made to determine the sources of tar balls on the Mediterranean coast of Israel showed that 76% of the tar balls were formed from weathered crude oil (GC-1) and crude oil sludge (GC-2) from Middle-Eastern sources and 18% from weathered fuel oil (GC-3). The degree of weathering indicated that 46% of the crude oil tar balls were exposed at sea for about a fortnight, 41% for more than 2 months and 13% for 1 - 2 years.

3.14 Data of the kind referred to above, particularly those on beach tar and dissolved hydrocarbons, did not exist or not in significant quantities, in the Mediterranean prior to MED POL. The continuation of this monitoring, together with appropriate and constant evaluation of data and the system providing them, is the important scientific achievement of the MED -I Pilot Project.

4. MED II : BASELINE STUDIES AND MONITORING OF METALS, PARTICULARLY MERCURY AND CADMIUM, IN MARINE ORGANISMS (FAO(GFCM)/UNEP)

Description

4.1 Metals, and particularly heavy metals like mercury, are more or less toxic to man and to practically all marine organisms. They can reach man through the food chain, and the source of greatest concern is, therefore, the level of concentration of such metals in fish, shell-fish and other edible marine organisms.

4.2 It is recognized that the Mediterranean is a tectonically rich region and that some metals may have high natural levels and great variations in their concentration in sea-water and sediments. The bluefin tuna, as well as other tuna, is known to accumulate mercury and, although there is no strong evidence that the Mediterranean stock is separate from the Atlantic stock as a whole, Mediterranean tuna apparently have much higher levels than those from the Atlantic.

4.3 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 used. The striped mullet, the Mediterranean mussel and the bluefin tuna have been selected for the monitoring programme so that representative ecotypes are included. The sampling frequency is seasonal.

Objectives

4.4 The information on the level of selected metals in representative marine organisms is collected primarily to assess the eventual risk stemming from consumption of seafood. Furthermore, data collected through the project will contribute to the understanding of the causes of relatively elevated concentrations of some metals in Mediterranean organisms which, after all, may be due to natural phenomena.

Progress in Implementation

4.5 The operational document for this pilot project was formulated at a joint FAO(GFCM)/UNEP Expert Consultation (Rome, 23-27 June 1975) [5] attended by 35 participants from 13 Mediterranean countries.

4.6 Fourteen countries [11] have expressed a wish to take part in the pilot project and nominated 37 national laboratories as participants in the network dealing with the pilot project (Annex II; Annex V Fig.3).

4.7 The work on this pilot project started in late autumn 1975 and, by the end of October 1977, 28 research agreements had been signed, 1 cleared and ready for signature, while the remaining 8 research agreements are still being negotiated.

4.8 As part of the pilot project's implementation, a training programme has been initiated. To date a total of 46 m/m has been granted, of which by the end of October 1977, 6 m/m have been realized. In addition, participating research centres will receive, or have already received, varied equipment (11 atomic absorption spectrophotometers and others) and material needed for their full participation in the pilot project (see 18).

4.9 Guidelines for sampling and analyses of biological material and for the use of biological accumulators in marine pollution monitoring have been prepared [7] for the use of participants in the pilot project.

4.10 A common reference methodology for analytical procedures to be followed in measuring the concentration of metals was adopted by participants in the project. The comparability of the results obtained by the various research centres is assured by a mandatory and permanent intercalibration exercise through which reference materials and standards are distributed to the participants in the project.

4.11 The results obtained from the first phase of the pilot project were reviewed at the FAO(GFCM)/UNEP Mid-term Expert Consultation [8], Dubrovnik, 2 - 6 May 1977 and are incorporated in document UNEP/IG.11/INF.4. The individual summary reports of the participants are attached to this document (Annex IV).

Preliminary Results

4.12 Mercury and cadmium concentrations in Mediterranean marine organisms appear to vary with species, habitat, trophic level and growth phase. Direct relationship between size and mercury and/or cadmium concentration has been found in Engraulis and tuna. This was not detected in Mytilus and is also not valid for most of the other metals studied. In one area of the North-West Basin during the January-June 1976 sampling period the highest levels were found in Mytilus in February and March, but no apparent relationship between water and tissue concentration was established.

4.13 Mercury concentrations were determined in molluscs (principally in Mytilus galloprovincialis, range <5-8310 ug/kg wet weight), crustaceans (Aristeus antennatus, 140-1960 ug/kg w.w.; Nephrops norvegicus, 140-2376 ug/kg w.w. and Penaeus sp., 21-184 ug/kg w.w.) and fishes (Mullus barbatus, 10-3450 ug/kg w.w., Merluccius merluccius, 60-870 ug/kg w.w., Engraulis encrasicolus, 4-424 ug/kg w.w., Sardina pilchardus, 40-760 ug/kg w.w. and Thunnus thynnus, <10-4100 ug/kg w.w.). Mercury, determined in more than 700 Mediterranean specimens of Thunnus thynnus and Thunnus alalunga shows on average 3-4 times higher concentration than in oceanic specimens.

4.14 Information on cadmium levels is limited; however, some were obtained for molluscs (Mytilus galloprovincialis <10-5900 ug/kg w.w.), crustaceans (Nephrops norvegicus, <5-4.7 ug/kg w.w.) and fishes (Engraulis encrasicolus, 5-100 ug/kg w.w. and Mullus barbatus, <5-15 ug/kg w.w.

4.15 These preliminary data are insufficient to permit firm conclusions, particularly since some critical areas have not as yet been monitored, notably the Tyrrhenian coast of Italy and the Adriatic/Ionian coasts of Greece. Nevertheless, the data obtained indicate that most probably due to natural conditions prevailing in the Mediterranean the levels of some metals in selected edible organisms, mercury in particular, are at or above the levels considered as permissible by most national legislations.

5. MED III : BASELINE STUDIES AND MONITORING OF DDT, PCBs AND OTHER CHLORINATED HYDROCARBONS IN MARINE ORGANISMS (FAO(GFCM)/UNEP)

Description

5.1 Similar arguments to those advanced for the monitoring of metals (MED II) apply to chlorinated hydrocarbons. They are persistent, they are usually accumulated by organisms, they are usually harmful to man indirectly, through effects on the stocks of marine organisms he exploits. Even less is known about the present concentrations of these chemicals than about the concentrations of heavy metals. Since virtually all chlorohydrocarbons are generated by man, natural background levels of these substances are not a problem in baseline studies.

5.2 The pilot project deals with levels of selected organochlorine compounds which are considered as specially relevant to representative elements of the Mediterranean ecosystem. DDT, PCBs, dieldrin and their metabolites were singled out as falling into this category. Whenever possible, other persistent organic compounds are also identified in analysed samples. The organisms selected as monitoring targets (striped mullet, Mediterranean mussel, pink shrimp) are representative of the different Mediterranean ecotypes, of great economic importance and almost ubiquitous in the whole Mediterranean. The sampling frequency is seasonal.

Objectives

5.3 There is no evidence of direct harm to man from the present levels of chlorinated hydrocarbons accumulated through marine food-chains but, due to the nature of these substances, one can reasonably expect that their build-up may lead to damage of certain components of the marine ecosystems, in particular the crustaceans. Therefore, the results of the project will primarily 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.

Progress in Implementation

5.4 The operational document for the pilot project was developed by the same Expert Consultation [5] that formulated the preceding pilot project.

5.5 Currently, 13 countries [12] have nominated 30 national laboratories to participate in the pilot project (Annex II; Annex V, Fig.4).

5.6 The first samples to be analysed were collected in late autumn 1975 and, by the end of October 1977, 19 research agreements had been signed, 2 cleared and are ready for signature, while the remaining 9 research agreements are still being negotiated.

5.7 Since not too many Mediterranean research institutions have been able to analyse marine samples for chlorinated hydrocarbons, a total of 33 m/m training was granted to the participants in the pilot project and by the end of October 1977, 3 m/m of training had been carried through. Six gas chromatographs have been, or soon will be, delivered and installed at selected Mediterranean laboratories in addition to other types of equipment and material necessary for monitoring of chlorinated hydrocarbons (see 18).

5.8 Guidelines for sampling and analyses of biological material and for the use of biological accumulators have been prepared [7] for the use of participants in the pilot project.

5.9 A common reference methodology for analytical procedures to be followed in measuring the concentration of chlorinated hydrocarbons was adopted by participants in the project. The comparability of the results obtained by the various research centres is assured by a mandatory and permanent intercalibration exercise through which reference materials and standards are distributed to the participants in the project.

5.10 The participants in this pilot project reviewed their first results during the FAO(GFCM)/UNEP Mid-term Expert Consultation [8] in Dubrovnik, 2 - 6 May 1977. These are incorporated in document UNEP/IG.11/INF.4. The summaries of the reports presented at that meeting are attached to this document (see Annex IV).

Preliminary Results

5.11 The determinations of chlorinated hydrocarbons in Mediterranean marine organisms are, with few exceptions, limited to the North-West Basin and the Adriatic. The following values and ranges, in µg/kg of wet weight, were found in selected organisms:

Area and Organism	DDT	PCBs
North Adriatic		
Mytilus galloprovincialis	32.4-107.0	216-450
Carcinus maenas	16.6-44.0	245-348 (PCB 1254)
Mullus barbatus	82.0-93.0	81-228 (PCB 1254)
South Adriatic		
Mytilus galloprovincialis	6	<10-30
Pachygrapsus marmoratus	18	60
Mullus surmuletus	50	240
North-West Basin		
Mytilus edulis	2.2-177.0	68-670
Carcinus mediterraneus	40.4-137.5	960-1513
Mullus barbatus	56.0-690.0	170-2250
Sardina pilchardus	164.1-880.0	519-1600

5.12 Seasonal variations of residue levels were observed at different sites. In mussels of the North-West Basin the DDT decreased to the lowest values in June while the PCB values increased over this period in some sites. In the North Adriatic DDT was the most abundant residue in mussels but PCBs (Arochlor 1260) have not been reported, although present in other organisms. In Carcinus of the North-West Basin the DDT levels were relatively lower and the PCB levels were uniformly high. In the North Adriatic DDT was more abundant, but Arochlor 1260 and 1254 were present at the ratio 1:3. In Mullus of the North-West Basin all chlorinated hydrocarbons reached an annual peak in December/January which decreased to the lowest level in September. In the North Adriatic DDT was the most important residue and Arochlor 1260 and 1254 were present in approximately equal amounts. In Sardina the same seasonal patterns were found as in Mullus. In zooplankton of the South Adriatic the PCB levels are notable, but that of other chlorinated hydrocarbons relatively low. In the North Adriatic analysis for DDT in sediments has also been carried out.

5.13 The geographic distribution of participating laboratories in this project is not entirely satisfactory as monitoring does not cover the

Tyrrhenian Sea, Ionian Sea (except Malta), South Adriatic (except Dubrovnik), Cyprus, as well as the greater part of the eastern and southern coastline of the Mediterranean. Accordingly, only few data are available on the concentration of chlorinated hydrocarbons in marine organisms.

6. MED IV : RESEARCH ON THE EFFECTS OF POLLUTANTS ON MARINE ORGANISMS AND THEIR POPULATIONS (FAO(GFCM)/UNEP)

Description

6.1 The marine environment is characterized by relatively constant physical and chemical conditions. Most marine organisms are therefore 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 normally appear only as sea-water microconstituents.

6.2 The project does 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 sub-lethal effects of potential pollutants, and functional as well as morphological changes.

6.3 The experiments are not limited to individual organisms but 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, is not neglected.

6.4 Due attention is paid to establishing the most sensitive stages in the life-cycle of the organisms tested. Physiological and biochemical studies are conducted in order to provide information on the mechanisms involved in the effects and transport of pollutants.

6.5 The functional and structural damage to the genetic material of individuals and their populations is also studied.

Objectives

6.6 The objective of the project is to develop the necessary scientific background for biological monitoring and to contribute data required as the scientific rationale for the Protocol on Land-Based Sources

of Pollution (see 1.3) and for the development of water quality criteria in general. Naturally, these criteria cannot be based solely on biological tests, but the results expected might provide a basis for a better understanding of the potential hazard to the ecosystem, including man, from the increased level of pollutants in the marine environment.

Progress in Implementation

6.7 The operational document for this pilot project was developed at a joint FAO(GFCM)/UNEP Expert Consultation (Rome, 30 June - 4 July 1975) [5] attended by 25 participants from 13 Mediterranean countries.

6.8 At present 13 countries [13] have expressed a desire to participate in the pilot project and nominated 26 national laboratories as participants in the network dealing with the pilot project (Annex II; Annex, V Fig.6).

6.9 The work on this pilot project started in late autumn 1975 and, by the end of October 1977, 11 research agreements had been signed, 3 cleared and are ready for signature, while the remaining 12 research agreements are still being negotiated.

6.10 To facilitate the participation of the nominated research centres in the work, a total of 24 m/m training was granted up to October 1977 of which 10 m/m have been realized. Additional assistance provided to the participants included donation of varied and specific laboratory equipment (e.g. research microscopes, analytical balances, and laboratory centrifuges) and material (see 18).

6.11 Several manuals have been developed [7] as guidelines for the participants in the pilot projects.

6.12 At the FAO(GFCM)/UNEP Mid-term Expert Consultation [8] in Dubrovnik, 9 - 13 May 1977, the results of the first phase of the project were reviewed and are incorporated in document UNEP/IG.11/INF.4. The individual summary reports are attached to this document (Annex IV).

Preliminary Results

6.13 The participating research centres have selected twenty species of which only seven are relevant to the MED II and MED III monitoring programmes. Experiments were initiated in the following fields: toxicity; pollutant dynamics; morphology and histopathology; development, reproduction and population genetics and physiological and behavioural effects.

6.14 Toxicity studies were made on sea-urchins (Arbacia lixula and Paracentrotus lividus), copepods (Acartia clausi and Oncea mediterranea), polychaetes (Scolepsis fuliginosa and Capitella

capitata), algae (Phaedactylon tricornutum), crustaceans (Palaemon elegans), Palaemonetes varians, Penaeus kerathurus and Artemia salina), fishes (Mugil cephalus and Sparus aurata), and molluscs (Murex brandaris). These studies have been performed to determine toxicity of different pollutants (mainly heavy metals and chlorinated hydrocarbons). The investigators have often chosen sensitive organisms and early responses as criteria in static bioassays (LC_{50}, 24-72 h). There is a tendency to improve these experiments with a flow-through system.

6.15 Experiments on accumulation and distribution of pollutants (heavy metals and chlorinated hydrocarbons) were made with decapods (Pagurus sp.) and fishes (Sparus aurata, Mugil spp. and Halobatrachus didactylus). For example, the mercury values reached in Halobatrachus (N=6) after 49 days of exposure to concentration of 0.1 mg/l were 50.3 ug/kg in liver and 9.6 in muscle.

6.16 Morphological and histopatholigical changes were observed on different tissues of fishes (Mugil auratus, Sparus aurata and Halobatrachus didactylus) exposed to heavy metals. Some of these effects were characterized by hyperchromatism of the intestine villi, increased epithelium thickness, vacualization in liver, kidney tubules with nuclear disorientation, etc.

6.17 Effects of pollutants on development, reproduction and population genetics were studied in sea-urchins (Paracentrotus lividus), algae (Phaeodactylon tricornutum), crustaceans (Balanus amphitrite) and fish (Mugil cephalus). Physiological and behavioural effects of pollutants were studied in sea-urchins (Arbacia lixula), molluscs (Monodonta articulata) and also some biochemical changes in fishes (Blennius pavo and Sardina pilchardus) and Coelenterata (Microcosmos sulcatus). During the experiments a reduced oxygen consumption was found in Monodonta; while an "adhesion distress syndrome", cytolysis and release of pigment were observed in Arbacia.

6.18 Basic research has also been stimulated. Thus, programmed biosynthesis studies in Coelenterata proved to be an extremely sensitive instrument for the assessment of the effect of pollutants. Research on the effects of thermal pollution showed that this environmental stress may lead to reduction of heterozygosity.

7. MED V : RESEARCH ON THE EFFECTS OF POLLUTANTS ON MARINE COMMUNITIES AND ECOSYSTEMS (FAO(GFCM)/UNEP)

Description

7.1 Theoretically, several types of marine communities and ecosystems could be studied in the framework of this pilot project. For practical purposes, the project deals 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.

7.2 Ecosystems are particularly investigated in areas which have been repeatedly studied in the past in order to detect long-term changes.

7.3 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 paid to the role of those organisms which are used in the monitoring pilot projects (MED II and MED III), in the transport of pollutants through the trophic levels (see 4 and 5).

7.4 The parameters and effects to be studied vary, depending on the community and ecosystem. The most common ones are: community structure, functional indices and body burden of pollutants.

Objectives

7.5 The over-all objective of the project is to provide information on the structural and functional state of Mediterranean marine communities and ecosystems as the basis for analysing the trends in their changes. Furthermore, it is expected that through this project a methodology could be developed and tested for the possible use of observed community and ecosystem modifications in determining the waste-receiving capacity of various parts of the Mediterranean, and maybe of the Mediterranean Sea as a whole. In connection 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.

Progress in Implementation

7.6 The operational document for this pilot project was formulated at the same Expert Consultation [5] that developed the previous pilot project.

7.7 At present, 13 countries [14] have expressed a wish to participate in the project and nominated 23 national laboratories as participants in the network dealing with the pilot project (Annex II; Annex V, Fig.6).

7.8 The work started in late autumn 1975 and, by the end of October 1977, 14 research agreements had been signed, 4 cleared and are ready for signature, while the remaining 10 research agreements are still being negotiated.

7.9 The training programme for participants in this pilot project is under way. A total of 16 m/m training up to October 1977 was agreed

upon of which 2 m/m have already been fulfilled. Further assistance is provided to many of the participants in this project by donation of varied equipment and material, which include such items as salinometers, dredge samplers, portable pH meters and many others. (see 18).

7.10 The FAO(GFCM)/UNEP Mid-term Expert Consultation [8] held in Dubrovnik, 9 - 13 May 1977, reviewed the first results of the pilot project which are incorporated in document UNEP/IG.11/INF.4. The summary reports of the participants at the meeting are attached to this document (Annex IV).

Preliminary Results

7.11 Attempts were made to study effects of untreated effluents (domestic and industrial) on the structure and dynamics of plankton and benthos communities. However, the research was limited to the North-West Basin, South-West Basin, Adriatic, Aegean and North Levantine Seas and the results reported at this stage are confined mainly to effects at the level of population dynamics and productivity. Benthos surveys were made on various hard substrates (North-West Basin, Aegean and North Adriatic), semi-hard substrates such as Posidonia and Cymodocea communities and coastal terrigenous ooze (North-West Basin, South-West Basin, North Levantine and North Adriatic) and soft substrates (North-West Basin, South-West Basin and North Adriatic). In the neritic zone bacterial counts were made, structure of plankton communities registered and phytoplankton photosynthetic activity measured.

7.12 Through cartography of communities, rather difficult and time-consuming, the following studies have been started in three different areas (North-West Basin, South-West Basin and North Adriatic): species composition, diversity, density, biomass, production potential and dynamics of populations and communities, etc. Some environmental parameters were also surveyed such as temperature, salinity and dissolved oxygen, sediment granulometry, organic content of sediments, etc. Species distribution seems to be correlated with the degree of pollution, i.e. a marked decrease in the number of species with the progression from unpolluted to polluted waters. As an example, from the North-West Basin where the crustaceans are most numerous in unpolluted areas (up to 71%) they are the first species to decrease with pollution, while molluscs become more common in moderately polluted areas (37%-54%) and, as pollution increases, molluscs also decrease and polychaetes become most numerous (85%). The diversity indices demonstrate an inverse relationship between species diversity and pollution.

7.13 Efforts have been made to determine indicator species that may help in identifying the changes within an ecosystem, thus permitting a relatively simple analysis of the status of a community. It is known from the North-West Basin that for example Cystoseira (algae) is

dominant in relatively pure water, Mytilus (mollusc) and Corallina (algae) are common in moderately polluted waters and Ulva (algae) in heavily polluted waters. An experiment with "biofouling" panels, for controlled study of colonization, growth and community structure, has started in the Aegean. Experimental lagoons, polluted and unpolluted by sewage, were studied and have shown a number of important modifications of the ecosystems within the polluted lagoons. Some of the effects which have been recorded are: accelerated eutrophication and, near the bottom, increased CO_2, decreased dissolved oxygen, negative presence of H_2S, and increased turbidity.

7.14 Efforts have also been made to select so-called reference zones for control of pollution in the North-West Basin, South-West Basin, Adriatic, Aegean and North Levantine Seas.

7.15 Marine communities and ecosystems are characterized by response and recovery times of long duration. These facts make long-term studies on pollution effects essential and results of these or similar studies performed in the past could be most valuable. Prolonged observations are, however, inadequate for an exercise that requires immediate information and solution of a problem, but, as shown earlier, these observations could well be replaced by short-term (two or three years), experimental approaches (biofouling panels, experimental lagoons) and laboratory experiments.

8. MED VI : PROBLEMS OF COASTAL TRANSPORT OF POLLUTANTS (IOC/UNEP)

Description

8.1 The mean pattern of sea surface transport in the Mediterranean is generally cyclonic (counterclockwise) in both the eastern and western basins. But coastal currents are very complex and manifest a strong variability. Due to the large ratio of coastline to the surface in the Mediterranean, and to the presence of divergence zones, the circulation pattern 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 Straits 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 Straits. On the basis of the general hydrography of the Mediterranean and of mass transport measurements in the Straits the residence time of entering water is estimated to be of the order of magnitude of 100 years.

8.2 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.

8.3 As part of this project the water circulation in coastal areas and the exchange of water between the coastal and off-shore regions is investigated. Special attention is paid to the movement of the surface layer as this contributes considerably to the rapid spread of certain pollutants (e.g. petroleum hydrocarbons, floating litter,etc.).

Objectives

8.4 The main objective of the pilot project is to provide the necessary information on the physical processes contributing to the transport of pollutants in the Mediterranean Sea and thus to facilitate the interpretation of data obtained through the other pilot projects when the Mediterranean models of the pollutants' biogeocycles are formulated and tested.

Progress in Implementation

8.5 The operational document for this pilot project was developed in Msida by the same Expert Consultation [5] that formulated the pilot project on Baseline Studies and Monitoring of Oil and Petroleum Hydrocarbons in Marine Waters (MED I).

8.6 At present 13 countries [15] have expressed a desire to participate in the project and nominated 23 national laboratories as participants in the network dealing with the pilot project (Annex II; Annex V, Fig.7).

8.7 The work on this project started in 1976 and, by the end of October 1977, 10 research agreements had been signed, 3 cleared and are ready for signature, while the remaining 10 research agreements are still being negotiated.

8.8 The need for training was early recognized and as an aid to the participants in the project 6 m/m of training were granted up to the end of October 1977, of which 1 m/m has been realized. As a further aid, current meters, salinometers and other types of equipment were, or soon will be, put at the disposal of the institutions participating in the project (see 18).

8.9 Methodological guidelines for the implementation of the project are under preparation [7].

8.10 The first results of the project were reviewed and discussed at the IOC/WMO/UNEP Mid-term Review Meeting [8] in Barcelona, 23 - 27 May 1977 and are incorporated in document UNEP/IG.11/INF.4. The individual

summary reports of the participants at the meeting are attached to this document (Annex IV).

Preliminary Results

8.11 Mechanisms and processes contributing to the physical transport of pollutants in the Mediterranean Sea have been studied by direct current measurements, drift cards and indirect methods.

8.12 In the Barcelona area, time-series data on temperature and salinity, as well as vertical sections, have been taken and used to calculate currents. No direct current measurements have yet been taken. The predominant current direction is from north-east to south-west, along the Barcelona coast, although there are various local circulation patterns.

8.13 A large number of parameters have been measured in the northern Adriatic Sea, including direct sub-surface current measurements and drift card experiments. Velocity of about one knot was measured, although locally values of up to 5 knots have been observed. Generally, the flow is northwards on the eastern side and southwards on the western side (cyclonic), in June and August and generally anti-cyclonic in September and December. In the central Adriatic Sea, in the vicinity of Split, the surface currents flow predominantly north-westwards. This direction predominates throughout the year. At depth there is a coastal current. Variations in the currents appear to have a period of several days. Tidal currents are weak and usually describable by eliptic vectors.

8.14 In the eastern Mediterranean work has so far been limited to standard hydrographic observations and one drift-card experiment for which projectory plots are awaited.

8.15 In the Aegean Sea (Gulf of Saronikos) currents tend to flow cyclonically. The surface and bottom currents have similar patterns not closely correlated to wind patterns. Bottom currents show strong models at 70° and 280°.

8.16 A few observations have been taken in the vicinity of Malta which indicate that the main features of the circulation is the flow of surface water from the western basin to the eastern basin, with some eddy formation to the east of Malta.

8.17 In the DRIFTEX programme, 4978 drift cards were released in the Ligurian Sea. After 6 months, 472 were returned, about half of these in the first month. The recovered cards indicated that the main flow was westwards. Recoveries in the next 5 months were, in the absence of precise knowledge of the tracks of the drift cards, and the large distances covered by some of them, less useful in determining local current patterns.

9. MED VII : COASTAL WATER QUALITY CONTROL (WHO/UNEP)

Description

9.1 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 exchange of disease-causing micro-organisms.

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

9.3 Using a commonly agreed methodology the project initiates a sanitary and health surveillance of coastal recreational waters and of shellfish-growing waters in selected coastal 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 molluscs.

9.4 Scientific studies are prepared on the epidemiological evidence of effects on health caused by inadequate sanitary conditions in coastal areas.

Objectives

9.5 The over-all objective of the project is to 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 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.

Progress in Implementation

9.6 The operational document for this pilot project was prepared at a joint WHO/UNEP Expert Consultation (Geneva, 15-19 December 1975) [5] attended by 35 participants from 15 countries.

9.7 At present 10 countries [16] have expressed a desire to participate in the project and nominated 29 national institutions as participants in the network dealing with the pilot project (Annex II; Annex V, Fig.5).

9.8 The work on this pilot project started in late autumn 1976 and, by the end of October 1977, 7 research agreements had been signed, 5 were cleared and ready for signature, while 17 research agreements were still being negotiated.

9.9 The training programme for participants in this pilot project is under way. A total of 29 m/m training up to October 1977 was agreed upon. Further assistance to the research centres participating in the pilot project is being provided, including laboratory equipment and material (see 18).

9.10 Primarily for the use of participants in the project, but also with a view to wider use in the Mediterranean, guidelines were prepared and adopted by participants in the project for monitoring public health aspects of coastal water quality [7].

9.11 A document on health criteria and epidemiology of health risks related to beach and coastal pollution has been prepared [7] in order to promote the scientific studies required and develop reliable data for application in the field. Interim microbiological criteria for coastal waters have been adopted by participants in the project and were recommended to be used in assessment of the coastal water quality.

9.12 A report on principles and methodology for coastal marine pollution control planning resulted from a Workshop [7]. The report contributes to the over-all assessment of the pollution situation of the Mediterranean and to the intergovernmental consultation on the Protocol on Land-Based Sources of Pollution.

9.13 The first results of the project were reviewed at the WHO/UNEP Mid-term Review Meeting [8] in Rome, 30 May - 1 June 1977 and are incorporated in document UNEP/IG.11/INF.4. The summaries of the participants' individual reports are attached to this document (Annex IV).

Preliminary Results

9.14 The monitoring of the sanitary quality of beaches and recreational coastal waters as well as shellfish and shellfish-growing waters has covered the following areas: Thessaloniki, around the Attica Peninsula (area of Greater Athens), Saronikos Islands, Greece; Tel Aviv area, Kishon river area, Tirat Hacarmel area, Israel; estuarine zone of river Tiber, Castel Porziano on the Tyrrhenian Sea, the waters off Leghorn, Tuscany and the island of Elba in the Ligurian Sea, Stretto, Milazz, Patti, Vibo Valentia and Augusta coastal zones, Bay of Naples, Trieste to Ravenna zone including the Murano lagoon, Italy; coast of Lebanon; Mellena Bay, San Luciano and Renella, Malta; coast of Monaco; Antalya, Konya Alti beach area, Turkey; the west-Istrian coast of the Gulf of Trieste, Bay of Rijeka, Zadar, Split, Ston and Dubrovnik along the Adriatic coast of Yugoslavia. The three standard bacterial tests, namely, coliforms, faecal coliforms and faecal streptococci constitute the basic parameters for monitoring the above-mentioned areas.

9.15 Studies with the purpose of identifying better indicators or of monitoring the pathogenic organisms themselves as well as determining the correlation between them are continuing. Other biological indicators and pathogenic bacteria including bacteriophages, salmonella, shigella, vibrio cholerae, etc. are being investigated. Their presence, activity and survival in sewerage outfalls and the marine environment are studied and compared with each other and with the standard tests. These studies are complemented by data on the physical characteristics of the monitored coastal areas to ensure a better interpretation of the presence and concentration of the above parameters.

9.16 Studies on the correlation between total coliform and E. Coli indicated a correlation coefficient of 0.91. Total coliform counts are highest in winter. Similar studies are being carried out on enteric viruses. In this field, new studies are being planned, making use of more sensitive methods for detecting certain viruses in sea-water samples of 100-500 litres and also comparison of the three standard bacterial tests with enteric viruses concentration.

9.17 Based on the results of MED VII and other considerations as the interim standard for the quality of recreational waters it was recommended that "highly satisfactory bathing areas should show E. Coli counts of consistently less than 100 per 100 ml and, to be considered acceptable, bathing waters should not give counts consistently greater than 1000 E. coli per 100 ml", i.e. "no more than 10 per cent of at least ten samples collected during the bathing season should exceed 1000 E. coli per 100 ml" (see UNEP/IG.11/BD.8).

9.18 The first elements of a model code of practice (see UNEP/IG.11/BD.16) applicable in Mediterranean coastal water pollution control has been formulated and steps have been taken to develop the principles and guidelines for establishing criteria governing the issue of an authorization for the discharge of wastes containing substances from the "grey list" of the Protocol on pollutants from land-based sources (see UNEP/IG.11/BD.32).

10. MED VIII : BIOGEOCHEMICAL STUDIES OF SELECTED POLLUTANTS IN THE OPEN WATER OF THE MEDITERRANEAN (IAEA/IOC/UNEP)

Description

10.1 Heavy metals and chlorinated hydrocarbons are two types of pollutants identified in all oceans. Although the edges of the ocean are the most polluted, being the areas most affected by man's activities, the levels in the open Mediterranean are important for purposes of 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.

10.2 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 should provide the unifying concept that will help understand the MED II and MED III results in the coastal area.

10.3 The programme requires a large amount of ship-time to define the fate of these pollutants in the open ocean. It further requires the close co-operation of certain other Mediterranean laboratories to assist in all the analyses and sampling requested.

10.4 Data obtained through the project, combined with those which will be collected through the other Mediterranean projects, will provide a sound basis for a mode on the biogeochemical cycle of pollutants in the Mediterranean (see 13).

Objectives

10.5 The immediate goal of the project is to obtain data on pollution in open waters of the Mediterranean which are necessary for the assessmment of the total present load of pollutants in the Mediterranean, and, in particular, for an understanding of the dynamics of pollutants (entry, transport, transformation and decay) and thus complement the coastal monitoring undertaken by the original MED POL pilot projects.

10.6 Long-term goals are to carry out objective assessments of problems affecting the marine environment and its living resources and to contribute to the development of a programme for monitoring of marine pollution and its effects on marine ecosystems.

Progress in Implementation

10.7 The project formally started in October 1976 as a specific extension of an earlier programme of work.

10.8 In addition to the IAEA International Laboratory of Marine Radioactivity in Monaco which is the co-ordinator and the largest participant in the project, co-operative programmes have been formally inaugurated with a number of Mediterranean laboratories [17] to assist in the collecting analyses, and interpretation of the open ocean data.

10.9 The major problems were how to organize the necessary ship-time to carry out more or less synoptic analyses in the entire Mediterranean, and to get the necessary equipment through the bidding, ordering, setting-up and calibration stages in good time to take care of the onslaught of samples, all at relatively short notice.

10.10 Five cruises have been completed by scientists from Egypt, Greece, Israel, Monaco, Spain, Turkey and Yugoslavia and effectively covered all the principal open waters of the Mediterranean, with the major exception of the Adriatic. The ATLANTIS II cruise from

Suez to Malta (19-26 April 1977) collected 36 open ocean samples at various depths and 10 samples of sediments from four stations. The KANE cruise (11-18 April 1977) from Greece to Monaco collected over 100 water samples from the surface down to the bottom. The HAYES undertook a cruise (13-23 June 1977) from Greece to Corsica. The eight-day SHIKMONA cruise from Haifa to Crete (July 1977) collected water samples, plankton and sediments, and the CORNIDE DE SAAVEDRA completed a cruise from Civitavecchia, near Rome, to Barcelona. The data gathered during these cruises are in the course of analysis and will be ready by the end of 1977.

10.11 In the second half of 1977, CALYPSO, under the sponsorship of ICSEM, visited several Mediterranean countries and made investigations relevant to the pollution of the Mediterranean Sea.

10.12 The scientific programme for a 4-6 month cruise (MED CRUISE) of Mediterranean scientists has been formulated under the co-ordination of the IAEA Monaco laboratory (see Annex VI).

Preliminary Results

10.13 PCBs measured in the non-coastal surface waters ranged from 0.02 ng - 2.5 ng/l with an average of 0.6 ng/l based on Arochlor DP-5. Concentrations tended to be higher in the western Mediterranean, and closer to shore. Higher levels were also observed near the Straits of Otranto than further south in the Ionian Sea. The lowest concentrations were in the Levantine Basin and in the central Western Mediterranean Basin. These correlate well with higher temperature surface water in the first case, and high winds in the latter, both leading to increased evaporation. Over-all, surface water values seem slightly lower on the average than the values measured in 1975.

10.14 Only four sediment samples from the Levantine Basin and Ionian Sea have been analysed to date and these indicate that in the top layer there are less PCBs in the Levantine Basin than in the Ionian Sea. This parallels the trend in the water layers above. However, laboratory studies showed that benthic worms readily absorb PCBs from sediments. This indicates that sedimentation does not necessarily remove PCBs from the marine ecosystem.

10.15 In approximately 80 sea-water samples from 0-3500 m depth from the eastern Mediterranean, Ionian and Tyrrhenian Seas the concentration of analysed metals ranged as follows: Cu, less than 40 ng/l; Zn, 0.5 - 2.5 µg/l; Cd, less than 20 ng/l; Hg, 10 - 30 ng/l. The general pattern of the data distribution indicated little evidence of coastal contamination being reflected in the open sea.

10.16 Some preliminary data on arsenic in an open ocean food chain indicate that certain crustacean predators have higher levels than the microplankton upon which they feed. On the other hand, fish which

regularly eat these species of crustaceans have substantially less arsenic than their prey. In general, arsenic levels in the organisms which comprise this food chain are in the same range as those reported for similar species in other oceans.

10.17 Arsenic uptake by phytoplankton is very rapid and inorganic arsenate accumulated in the cells is metabolized almost completely into two forms: one associated with the lipid fraction (40%) and the second with the free amino acids (60%). Mussels take up arsenic roughly 10 times over the concentration in water and the uptake is dependent on temperature. Shrimp accumulate arsenic to a lesser degree than filter-feeding mussels. In both mussel and shrimp, the majority of the accumulated arsenic is associated with the internal tissues.

11. MED IX : ROLE OF SEDIMENTATION IN THE POLLUTION OF THE MEDITERRANEAN SEA (UNESCO/UNEP)

Description

11.1 The comparison between dissolved and particulate elemental concentrations in the aquatic environment shows that most heavy metals and organic pollutants are relatively higher in the solid phase than in the liquid phase with which they are in contact. Comparison of the relative amounts of pollutants transported in river waters and in the suspended sediments clearly shows the importance of the latter for any waste load assessment.

11.2 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 their contaminated load. Pollutants from sewage and industrial wastes may be adsorbed on to suspended particles or directly discharged in particulate form into the receiving waters. The solid/liquid equilibria are sometimes influenced by a change in the concentration of pollutants resulting in solubilization of heavy metals.

11.3 Development of common procedures for representative sampling of river-suspended sediments is initiated under this project. Also, compatible methods for separation of solids, analytical extraction and determination need to be established and agreed upon. Pollutants of concern are various organics and heavy metals.

11.4 In addition to the river-dissolved pollution load estimates carried out under project MED X, a selection has been made of Mediterranean rivers to be sampled and analysed for substances carried by suspended sediments. Results will be used in the over-all assessment of pollutants contributed by major rivers.

Objectives

11.5 The ultimate objective of the project is to allow for an over-all assessment of the total pollution load of the Mediterranean by including pollutants associated with suspended river sediments through the collection of a first set of river-sediment pollution data.

Progress in Implementation

11.6 The project was initiated in October 1975 as part of the programme of scientific support to the Mediterranean Action Plan. It was subsequently integrated into the activities carried out under project MED X.

11.7 A scientific study was prepared on the assessment of knowledge and development of guidelines for environmental impact assessment relevant to the role of sediments in pollution studies and to the sediment-pollutant interactions. It also describes sampling and analytical procedures.

11.8 A meeting of experts of Mediterranean countries, convened in December 1976, identified the relative importance of particulate pollutants in the total pollutant load of rivers. The meeting agreed upon a list of substances to be measured and suggested a small number of rivers to be sampled for suspended sediments analysis. The establishment of a five-year monitoring programme was also suggested.

11.9 In order to unify as much as possible the methods used, a description was prepared in 1977 on sampling methods and on the simplest available analytical procedures for determining heavy metals and chlorinated hydrocarbons in sediments.

11.10 Collection of sediment samples and analytical determinations are currently being carried out on a restricted number of rivers. In some cases, sediment samples are sent to the International Laboratory of Marine Radioactivity (IAEA, Monaco), for extraction and analysis. In addition, technical and financial assistance is being provided to the countries requesting it.

Preliminary Results

11.11 Although it is generally well established that most metals and organic pollutants are enriched in the solid phase by two to three orders of magnitude over the concentrations found in the liquid phase of rivers, only a few direct measurements have been reported in the framework of MED IX. The only available information is related to the heavy metal composition of the bulk suspended sediment of the Adige, Po, Rhone, Aude, Ebro and Llobregat rivers. Elevated concentrations of some metals, such as cadmium and zinc, have been found but they are in a much lower range than those found for instance in the Rhine.

12. MED X : POLLUTANTS FROM LAND-BASED SOURCES IN THE MEDITERRANEAN (WHO/ECE/UNIDO/FAO/UNESCO/IAEA/UNEP)

Description

12.1 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.

12.2 As part of the agreed Mediterranean Action Plan[2], in order to achieve a comprehensive picture of all major pollution inputs into the Mediterranean from land-based sources, several tasks are undertaken within this project:

- preparation of an inventory of land-based sources of pollutants discharging 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.

12.3 This project is closely linked to the pilot projects of MED POL and to the legal components of the Mediterranean Action Plan. In particular, it provides technical background information for the preparation of the protocol on the protection of the Mediterranean from land-based sources of pollution, for the forthcoming projects on integrated planning for the development of the region, and for the project on coastal water quality control (MED VII).

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

12.5 The project is implemented jointly by six United Nations agencies in co-operation with UNEP.

Objectives

12.6 The ultimate objective of the project is to provide the Governments of the Mediterranean coastal States, as the sole benficiaries 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. This information, combined with that collected through the MED POL pilot projects on the biogeocycles, levels and effects of

various pollutants on human health and marine ecosystems will be used to assist the Mediterranean Governments in their negotiation of the Protocol for the Protection of the Mediterranean Sea Against Pollution from Land-Based Sources (see UNEP/IG.11/INF.5).

Progress in Implementation

12.7 The document specifying all project operations was prepared by a series of inter-agency consultations and agreed upon among the six co-operating agencies and UNEP.

12.8 Concurrence of Mediterranean Governments for participation in the project was sought by UNEP in March 1976 and the majority of the riparian countries designated a special contact point for this task. UNEP focal points provided the contact in the remaining countries.

12.9 The project is a joint undertaking to which each co-operating agency contributes according to its field of expertise and geographical representation as follows:

- municipal waste sources, including tourist development areas, disposal and management practices are investigated by WHO;

- industrial waste sources, disposal and management practices are covered by ECE and UNIDO respectively;

- assessment of pollution stemming from agricultural run-off is undertaken by FAO;

- waste loads carried by rivers as well as the contribution of suspended sediments are studied by UNESCO;

- the amount of radio-active discharges in the Mediterranean is subject to an IAEA assessment.

12.10 During the first phase of project implementation ending October 1976 common methodology was developed for the collection of compatible data from Mediterranean countries. This includes standard forms for reporting on municipal, industrial and agricultural pollution sources as well as on rivers and nuclear installations.

12.11 During the second phase of the project, ending July 1977, sectoral surveys of existing information on all the above-listed categories of pollution sources are being conducted in almost all countries concerned, either directly through collaborating national institutions or with the assistance of consultant missions. Detailed source inventories have been established which will contribute to the assessment of the contribution of pollutants from land-based sources to the total pollution load of the Mediterranean.

12.12 A comprehensive summary report providing a quantitative picture of all waste sources and pollutant categories for the entire basin was prepared under the interagency project. The draft of the joint report was reviewed by the Meeting of Experts on Pollutants from Land-Based Sources which was held in Geneva, 19-23 September 1977. The meeting also discussed the technical aspects of the draft protocol on land-based sources of pollution.

Preliminary Results

12.13 The results of the project are contained in a separate document submitted to this meeting (UNEP/IG.11/INF.5).

13. MODELLING OF MARINE SYSTEMS IN THE FRAMEWORK OF MED POL (UNESCO/FAO/IOC/UNEP)

Description

13.1 The modelling of ecosystems is an essential component of any over-all plan designed to assess the impact of pollutants on natural ecosystems, and to provide output information on their management.

13.2 The Mediterranean scientific community has recognized that a great need exists to explore the functioning of marine ecosystems in all the aspects related to their response to the environmental stresses imposed upon them, and that modelling is one of the most comprehensive scientific tools for this purpose.

13.3 Modelling should involve some important mechanisms like pathways, fate and impact of heavy metals, oil and other organic pollutants on marine organisms and communities including synergistic effects of various pollutants. Such comprehensive models of the biogeochemical cycles of pollutants should include, as an integral part, a hydrodynamic model of the area of interest.

Objectives

13.4 The objective of modelling is to provide an efficient tool for the design, co-ordination and balance of sampling programmes such as the one carried out under MED POL, 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 would provide the means by which the results of the individual projects of the Mediterranean Action Plan, and of MED POL in particular, could be synthesized and better understood.

13.5 These models, having predictive capabilities, could be offered to the Governments of Mediterranean Coastal States for use as effective management tools in the prevention and control of marine pollution affecting the Mediterranean Basin.

Implementation

13.6 Several scientific and expert group meetings [18] have been convened since 1973 by UNESCO and this activity was expanded after 1976 with assistance from UNEP. At the Expert Consultation in Paris [18] working groups were proposed, each concerned with one specific region in the Mediterranean. A group for the north-western Mediterranean gathered at Banyuls-sur-Mer, January 1977, and elaborated the framework in which studies of marine processes would have to be undertaken.

13.7 At the Mid-term Review Meetings on individual pilot projects of MED POL in Dubrovnik (May 1977), Barcelona (May 1977) and Rome (June 1977), it was recommended that an interdisciplinary task team should be created to formulate conceptual models for the most critical pollutants in the Mediterranean, to advance these to the level of mathematical models for certain Mediterranean areas by using data generated in the various pilot projects of the Mediterranean Action Plan, and to test their predictive capabilities as a management tool.

13.8 Ecosystem modelling is a relatively new approach in marine science, particularly with regard to application in problems of pollution research. Since most Mediterranean institutions have yet to acquire a sufficient level of competence and experience in this field, it is recommended that an effort should be made to upgrade the capability of ecosystem modelling in the Mediterranean through suitable educational and training programmes.

14. ESTABLISHMENT AND MANAGEMENT OF SPECIALLY PROTECTED AREAS (IUCN/UNEP)

Description

14.1 In the framework of the over-all protection of the Mediterranean basin from pollution, certain aquatic (marine and estuarine) and terrestrial (coastal and island) areas deserve and need special protection and management. They are as follows:

- biotopes (habitats) on the maintenance of which the proper functioning of the Mediterranean ecosystem as a whole depends,

- breeding grounds necessary for the maintenance of exploitable stocks of economically important marine species,

- natural habitats for birds migrating to, from or through the Mediterranean region,

- reference areas for scientific research, including monitoring of the levels and effects of pollutants,

- pools of genetic material and safe "sanctuaries" for endangered indigenous Mediterranean species,

- areas for public environmental education,

- sites of historical, geographical, archaeological, hydrological and ecological interest.

14.2 The existing specially protected Mediterranean zones, such as marine parks, protected wetlands, national parks and other protected areas, do not satisfy the ecological and economic needs of the region, although their number is growing steadily. These needs can be met only through common principles and guidelines for the selection, establishment and management of specially protected areas jointly agreed by the Governments of the region, because their protection should rest on harmonized action taken at national level.

Objectives

14.3 The over-all objectives of activities relevant to the establishment and management of specially protected areas are:

- to develop common principles and guidelines for the establishment and management of specially protected areas and thus to provide the means for the national authorities to take co-ordinated action on the selection of unique or vitally important ecosystems which require special protection, and

- to create a mechanism for co-operation and consultation between the national administrators and scientists responsible for the selection, establishment and management of Mediterranean areas under special protection.

Implementation

14.4 A preliminary survey of existing Mediterranean aquatic protected areas (marine and wetlands) was carried out in 1974 by an IUCN consultant on behalf of UNEP. The survey also identified some areas which would deserve special protection.

14.5 An expert consultation on Mediterranean Marine Parks and Wetlands [20] was convened by UNEP in Tunis, 12-14 January 1977. The consultation reviewed the first draft technical principles and guidelines for the establishment and management of Mediterranean protected areas and recommended the creation of an Association of Protected Mediterranean Areas, the preparation of a

Directory of protected areas, the strengthening of the research on ecological problems and its co-ordination with the relevant MED POL pilot projects, and the further elaboration of principles and guidelines to be submitted to the Governments of the region for their consideration.

14.6 As the follow-up of the Tunis meeting, in May 1977 UNEP invited the Mediterranean governments to nominate members for the Association of Protected Mediterranean Areas, and in co-operation with IUCN and FAO took steps to prepare the Directory of Mediterranean protected areas and the principles and guidelines for the selection, establishment and management of Mediterranean protected areas.

15. RELATIONSHIP BETWEEN MED POL AND THE REGIONAL OIL COMBATING CENTRE (IMCO/UNEP)

Description

15.1 In connection with the problems of accidental spills of oil or other harmful substances in the Mediterranean, Governments at the Conference of Plenipotentiaries of the Coastal States of the Mediterranean Region for the Protection of the Mediterranean Sea (Barcelona, February 1976) [2] decided to establish a Regional Oil Combating Centre in Malta.

15.2 The primary objective of the Centre is to help coastal States of the region take co-operative and timely steps to prevent damage to their coastal resources from massive and accidental pollution by disseminating information, preparing contingency plans, maintaining efficient communication systems and encouraging technological co-operation and training programmes in the region.

15.3 In December 1976 the Regional Oil Combating Centre was inaugurated.

Objectives

15.4 Through the Regional Activity Centre for MED I (see 20) close collaboration will be established between the Regional Oil Combating Centre and the MED I pilot project (see 3). This collaboration will include, in particular:

- exchanging data and information relevant to the level and extent of pollution by oil and petroleum hydrocarbons in the Mediterranean;
- providing mutual assistance for the preparation of reports, surveys, contingency plans, etc;
- assisting in the development of training activities;
- establishing a common data bank;

- strengthening the capacity of the Regional Oil Combating Centre to act as an International Referral System (IRS) sectoral focal point in connection with oil pollution.

16. INTERCALIBRATION OF ANALYTICAL TECHNIQUES (IAEA/FAO/IOC/UNEP)

Description

16.1 In co-ordinated studies, when many laboratories are involved in measuring trace pollutants such as heavy metals, chlorinated and petroleum hydrocarbons by various methods, it is essential to ensure the comparability of the data obtained by different laboratories to deduce any sensible conclusion. This is exactly the case in the assessment of Mediterranean pollution.

16.2 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 quite considerably. Thus, a joint effort by the laboratories participating in the same projects towards improving the comparability of the data is essential to make the measurements meaningful.

16.3 The most effective way to improve and ensure the comparability of the measurements is to organize intercalibration exercises of the measurements of the trace pollutants in question - heavy metals, chlorinated hydrocarbons, oil and petroleum hydrocarbons - among the participating laboratories. By distributing homogeneous samples which have matrices as closely identical to those of the actual samples as possible, and comparing the results obtained by different laboratories, the participating laboratories are able to improve their analytical performances by themselves and eventually ensure the comparability of the data produced as a group.

Objectives

16.4 The primary objective of the intercalibration programme is to give specific assistance for analytical quality control to Mediterranean laboratories participating in the pilot projects MED I, MED II and MED III, within the framework of 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.

Progress in Implementation

16.5 The following homogeneous samples for the intercalibration exercises were made available for the participants in MED II and MED III by the IAEA International Laboratory of Marine Radioactivity in Monaco which acts as an intercalibration centre:

Oyster homogenate (MA-M-1)	for trace elements and chlorinated hydrocarbons
Sea plant homogenate (SP-M-1)	for trace elements and chlorinated hydrocarbons
Marine sediment (SD-M-1)	chlorinated hydrocarbons
XAD-2 resin	chlorinated hydrocarbons

16.6 In addition to these, the preparation and homogenization of copepod homogenate (MA-M-1) and fish flesh homogenate (MA-A-2) were carried out in 1976 and their homogeneity was tested.

16.7 The first step in the implementation of the intercalibration exercise for trace elements was taken by encouraging potential participating laboratories in MED II and MED III to take part in a world-wide intercalibration exercise on oyster sample (MA-M-1). After the official nomination of the research centres participating in the pilot projects their participation in the intercalibration programme became mandatory and additional oyster samples were distributed to those ready for the analysis. By early 1977, 23 laboratories had received oyster samples for intercalibration, 19 of which have reported the results.

16.8 These show that comparability of results among the Mediterranean research centres is not very different from the world-wide "consensus values" for Cu, Cd, Hg, although the scatter is greater. The comparability of the Pb results indicate that there is a serious analytical problem in Pb determination.

16.9 As the second step of the intercalibration exercise, copepod sample (MA-M-1) and sea plant sample (SP-M-1) were distributed with the US National Bureau of Standards (NBS) orchard leaves sample to the research centres that completed the analysis of the oyster sample. Several results have already been reported and compilation is now in progress.

16.10 Results of the intercalibration for chlorinated hydrocarbons are just beginning to arrive.

16.11 Participants in MED I will take part in the intercomparison exercise within the framework of the IGOSS Petroleum Monitoring Pilot Project which started in January 1977. This will enable them to compare analysis for dissolved/dispersed hydrocarbons, to calibrate their fluorimeters and check on concentration procedures (IOC Manuals and Guides No. 7). A suitable reference sample (chrysene) for intercomparison of dissolved/dispersed petroleum hydrocarbons will be distributed to all participants in MED I through the Regional Activity Centre for MED I in Malta.

17. COMMON MAINTENANCE SERVICES (IAEA/UNEP)

Description

17.1 The proper maintenance and rapid repair of the often very sophisticated analytical laboratory instruments or field equipment used in various pilot projects of the MED POL are of great importance for the day-to-day work of the laboratories using them. As laboratories in many Mediterranean countries cannot rely on the efficiency of maintenance services provided by local representatives of the producers of these instruments and equipment, the only way to ensure a smooth flow of data is by organizing help to the disadvantaged participants in MED POL.

17.2 The common maintenance services are provided by an electronics engineer operating from the IAEA International Laboratory of Marine Radioactivity in Monaco. For the most part they 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 I, MED II, MED III and MED VI.

17.3 Request for assistance should be addressed to UNEP's Co-ordinating Unit for MED POL (see 20.2) directly or indirectly through the specialized United Nations organization responsible for the technical operation of the pilot projects.

Objective

17.4 To ensure the 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 to provide advice and instruction on maintenance to local staff in the participating laboratories.

Progress in Implementation

17.5 An electronics engineer was recruited in October 1976 and has received specific additional training at the factories producing the equipment (atomic absorption spectrophotometers, gas chromatographs, recording current meters).

17.6 Up to end of October 1977, through the assistance of the common maintenance services, seven atomic absorption spectrophotometers and five gas chromatographs have been installed at research centres in various parts of the Mediterranean. Fighteen visits have been paid by the maintenance engineer to eleven institutions in Algeria, Cyprus, Israel, Turkey and Yugoslavia, and several additional calls for repair services will be answered soon.

18. ASSISTANCE TO PARTICIPANTS IN MED POL

18.1 The study of the capabilities of existing national research institutions, conducted by IOC on behalf of UNEP in 1974, indicated the need to assist institutions in many less developed Mediterranean countries in order to make possible their full participation in the MED POL pilot projects.

18.2 UNEP funds were therefore made available to selected participants in the MED POL pilot projects through the specialized United Nations bodies responsible for the technical implementation of the pilot projects.

18.3 Assistance was primarily given in equipment and training needed for the fulfilment of the mandatory parts of the pilot projects.

Training

18.4 Training is provided only on direct request from the participants in the pilot projects. It is carried out in the Mediterranean research centres or during joint cruises, thus strengthening the understanding and working relationship within the Mediterranean scientific community.

18.5 By the end of October 1977, 52 short-term (less than 2 months) and 40 long-term training programmes have been approved. Most of these 92 programmes are in progress or are going to start soon, while 28 programmes have already been successfully carried out. The estimated total cost of the training programmes approved by the end of October 1977 is over $156,300.

Equipment

18.6 Assistance in the provision of equipment is subject either to successfully completed training of the personnel who will use it or to the availability of local staff familiar with the type of equipment requested.

18.7 Largely based on the requests of the participants in MED POL and on their collective advice regarding the type of equipment considered the most suitable and reliable for Mediterranean conditions, 11 atomic absorption spectrophotometers, 6 gas chromatographs and 18 other instruments worth more than $5,000 each have been allocated by the end of October 1977, along with a large number of smaller pieces of equipment and expendable supplies. Fifteen out of the 35 larger instruments have already been installed bringing the total cost of the assistance in equipment close to $809,000.

19. INFORMATION STORAGE, HANDLING AND DISSEMINATION

19.1 The research centres participating in the baseline studies and monitoring pilot projects of MED POL (MED I, II, III and VII) agreed to carry out the "minimal" programmes described in the operational documents [5] and in the manuals and guidelines [7] relevant to these pilot projects. The basic elements of these minimal programmes are the same for all participants in a given pilot project. They specify the frequency of sampling, the sampling procedure, the size and nature of the samples, the treatment of the samples prior to their analysis, the pollutant to be analysed and the format of the data-reporting.

19.2 For each pollutant a reference analytical method was selected and its use is promoted by granting training and equipment, if necessary, to institutions from less developed countries. Institutions using a different analytical method from the one recommended as the reference method are encouraged to use their own method, and a permanent intercalibration exercise (see 16) takes care of the comparability of the data reported.

19.3 In addition to the "standard" data obtained through the minimal programmes of the baseline studies and monitoring pilot projects, data on the levels and effects of other pollutants in a variety of marine matrices and on the coastal transport processes contributing to the distribution and influencing the fate of many pollutants are also reported by the participants in the pilot projects. The methodology for the generation and reporting of these data is not standardized although initial steps have been taken to develop "reference" analytical or observation methodology.

Data storage and handling

19.4 Data obtained through each pilot project are reported periodically to the specialized United Nations body bearing the technical responsibility for the implementation of the project and through it to UNEP acting as the Secretariat of the Barcelona Convention (see 20). The rough estimate of the total number of primary data collected through MED POL is 1.5 million data items per year.

19.5 At the request of the participants in MED POL the original (primary) data reported are treated as confidential. These data are processed and evaluated by the relevant United Nations bodies with the assistance of the appropriate Regional Activity Centres (see 20) but are not otherwise distributed, published or reported in their original form without the approval of the research centre that has submitted them.

19.6 To date no facilities have been established for the centralized archiving and processing of data from all projects of the Mediterranean Action Plan. This has already proved to be a serious disadvantage when a composite evaluation of the degree of pollution in the Mediterranean was attempted. A solution to the problem could be found in a regional data repository

which would have full data-processing capability, making possible systematic archiving, statistical analyses and usage of data for modelling, and which would be required to respect the confidentiality of the original data (see 19.5). Such a regional data repository will be necessary and must be provided with adequate resources.

19.7 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 (see UNEP/IG.11/BD.30) recommended that:

- a United Nations-operated computer facility should be used for the handling of the data generated by the MED POL projects;

- only reduced and processed data should be sent to these computer facilities in a suitable format: primary (raw) data should be processed by the participating research centres themselves;

- participating research centres which lacked computer facilities or expertise in data-handling should be assisted through a technical training programme;

- a committee composed of computer experts and marine scientists familiar with the data requirements of MED POL projects should be established to develop a data management plan setting out the procedures to be followed during the course of the MED POL projects. This committee would serve in an advisory capacity to the computer centre throughout the course of the MED POL projects, and would co-operate actively with the IOC Working Committee for IODE, taking into account IODE recommendations wherever possible;

- an appropriate flow of information should be established between the computer centre and the research centres providing data for it.

News-letters

19.8 Information of interest to participants in certain pilot projects has been disseminated through news-letters issued by FAO(GFCM) and IOC.

19.9 Plans to initiate a news-letter giving news of all the activities of the Mediterranean Action Plan are under consideration. This news-letter could be issued as a joint publication with Co-operative Investigations in the Mediterranean (CIM). In addition to the news-letter there should be a medium for quick, informal dissemination of information serving both for exchange between participants and for provision of information from UNEP and other United Nations bodies.

Directories

19.10 To facilitate contacts between the Mediterranean scientists, a Directory of Mediterranean Marine Research Centres [9] was issued in 1976 bringing 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 October 1977. It is planned that the next edition of the Directory will be expanded to include additional institutions engaged in fisheries research and in research relevant to public health.

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

Bibliographies

19.12 As part of the MED POL activities two bibliographies have been prepared by FAO(GFCM) and IOC. These bibliographies, in spite of some overlapping, covered only part of the available scientific literature relevant to the protection of the Mediterranean. Therefore, the preparation of a consolidated and comprehensive Mediterranean bibliography is contemplated. FAO and IOC are prepared to issue, jointly, a bibliography based on the Aquatic Sciences and Fisheries Abstracts (ASFA) component of the Aquatic Sciences and Fisheries Information System (ASFIS). An annotated bibliography would be appropriate, but due to cost considerations this alternative is probably not realistic at this stage. Failing this, addresses of authors, or at least the address of one author, should, if possible, be included in the references.

20. INSTITUTIONAL ARRANGEMENTS

UNEP's Co-ordinating Unit

20.1 UNEP, as the organization responsible for carrying out the secretariat functions of the Convention for the Protection of the Mediterranean Sea against Pollution adopted at the Conference of Plenipotentiaries of the Coastal States of the Mediterranean Region for the Protection of the Mediterranean Sea (Barcelona, 2 - 16 February 1976), is responsible for the implementation of the Mediterranean Action Plan (see 1.3 and 1.4).

20.2 To ensure the harmonious development of the environmental assessment component of the Mediterranean Action Plan, a Unit, responsible for the over-all co-ordination of the work undertaken by national institutions in the framework agreed at the 1975 Barcelona Conference [2], was established at the Geneva Office of UNEP in September 1975.

20.3 This Environmental Assessment Unit works in close co-operation with selected specialized United Nations organizations which, on behalf of UNEP, are responsible for the technical operation of the individual projects and maintain the day-to-day direct contacts with the national institutions participating in the work.

20.4 The future location of this Unit is discussed in a separate document submitted to this meeting (UNEP/IG.11/3/Annex IV).

Regional Activity Centres for MED POL

20.5 In consultation with the Governments of the Mediterranean States and with the specialized United Nations bodies concerned, in August 1976, seven national marine research centres were nominated by UNEP as Regional Activity Centres (RAC) for the seven pilot projects of MED POL (see 2.12 and Annex III).

20.6 The selection of the RACs was based on their technical competence taking into account the need for equitable geographical distribution.

20.7 The role of the RACs is to assist UNEP and the relevant specialized United Nations bodies in the organization and execution of the pilot projects. Under general guidance from UNEP the technical operation of the RACs is entrusted to the relevant specialized United Nations organization (GFCM of FAO, IOC of UNESCO and WHO).

20.8 The ultimate aim is to create, through the RACs, potential nuclei for centres which may eventually play a regional role in co-ordinating the work in the post-pilot-project phase of the programme.

21. PLANS FOR FUTURE DEVELOPMENTS

21.1 Although all the various activities listed in the previous chapters of this document were initiated by the Intergovernmental Meeting on the Protection of the Mediterranean in Barcelona due to operational reasons they did not start simultaneously.

21.2 As some of these activities, in particular those reviewed in chapters 3-11 and 16-18, require a high degree of co-ordination and frequently need simultaneous measurements, observations and data-reporting, it is envisaged that the duration of these activities, operated now as pilot

programme should make possible analyses of the trends in levels and effects of pollutants in the Mediterranean, as well as the formulation of models on their biogeochemical cycles and on their expected environmental (and socio-economic) impact on

(h) A central data repository and processing facility, satisfying the requirements of the Mediterranean Action Plan, should be selected and operated on a trial basis. The recommended type of computer facility and the modalities of its operation are included in paragraph 19.7 of this report;

(i) The build-up of modelling capabilities of the Mediterranean scientists should be promoted. Initial targets for modelling may include biogeochemical cycles of heavy metals, oil, chlorinated hydrocarbons and ecosystems and they should be integrated with hydrodynamic models, because they constitute the common basis for such models;

(j) Activities related to the development of methods for the assessment and principles for the control of coastal water pollution should be intensified;

(k) Continuing activities aimed at the development of a technical guideline in the form of a model code of practice for the disposal of liquid wastes into the Mediterranean should be carried out.

21.5 It can be expected that the Barcelona Convention together with one or more of the related Protocols will enter into force in 1978. This will bring about the first meeting of the Parties to the Convention in 1979 and could well coincide with the completion of the pilot project phase of the environment assessment activities. The meeting should present an opportunity for intergovernmental consideration and decision on the establishment of an operational phase thereafter.

21.6 During 1978, and in particular during the operational phase, increasingly responsible roles will have been assumed by national institutions on whose co-operative endeavours the successful implementation of the programme depends. Although additional international financial and other support may be sought, the ultimate aim is to make the programme self-supporting within the regional context, that is to say, not only to develop institutional capabilities to perform the required tasks, but to support these activities with training, provision of equipment, and other forms of assistance from within the region.

21.7 As the Mediterranean regional activity becomes self-supporting, UNEP will continue to retain a strong interest, due both to its responsibility as the organization responsible for the secretariat functions of the Convention and to UNEP's global responsibilities to which the Mediterranean programme is a major contribution. On a continuing basis UNEP will ensure that data and information generated within this region are compatible with those from other regions of the world. Steps have already been taken to initiate comprehensive action plans in other regions: the Persian/Arabian Gulf, the Caribbean Sea, the Gulf of Guinea, the Red Sea and East Asian Waters. The comprehensive approach developed in the Mediterranean area

will be used as a model for programmes aimed at the protection and development of these regions; however, it is recognized that the approach used in the Mediterranean region cannot be copied mechanically in all areas and that each region must develop its own Action Plan based on variations in the state of knowledge, the information and human resources available, and other regional characteristics.

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11) Algeria, Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Malta, Morocco, Spain, Tunisia, Turkey and Yugoslavia

12) Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Malta, Morocco, Spain, Tunisia, Turkey and Yugoslavia

13) Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Malta, Morocco, Spain, Tunisia, Turkey and Yugoslavia

14) Algeria, Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Morocco, Spain, Tunisia, Turkey and Yugoslavia

15) Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Malta, Morocco, Spain, Tunisia, Turkey and Yugoslavia

16) Greece, Israel, Italy, Lebanon, Malta, Monaco, Morocco, Spain, Turkey and Yugoslavia

17) Five institutions from France, Greece, Israel, Malta, Spain

18) Workshop on Marine Ecosystem Modelling in the Eastern Mediterranean, Alexandria, December 1974.

Workshop on Marine Ecosystem Modelling in the Mediterranean, Dubrovnik, October 1976.

Expert Consultation Meeting on Marine Ecosystem Modelling in the Mediterranean, Paris, December 1976.

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19) "The Use of Modelling of Marine Systems in the Framework of UNEP Monitoring and Research Programmes."

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LIST OF ACRONYMS

ASFA	:	Aquatic Sciences and Fisheries Abstracts
ASFIS	:	Aquatic Sciences and Fisheries Information System
CIM	:	Co-operative Investigations in the Mediterranean
ECE	:	Economic Commission for Europe
FAO	:	Food and Agriculture Organization of the United Nations
GFCM	:	General Fisheries Council for the Mediterranean
IAEA	:	International Atomic Energy Agency
ICSEM	:	International Commission for the Scientific Exploration of the Mediterranean
IGOSS	:	Integrated Global Ocean Station System
IMCO	:	Intergovernmental Maritime Consultative Organization
IOC	:	Intergovernmental Oceanographic Commission
IODE	:	International Oceanographic Data Exchange
IRS	:	International Referral System
IUCN	:	International Union for the Conservation of Nature and Natural Resources
MED POL	:	Co-ordinated Mediterranean Pollution Monitoring and Research Programme (Part of the Mediterranean Action Plan)
NBS	:	US National Bureau of Standards
UNEP	:	United Nations Environment Programme
UNESCO	:	United Nations Educational, Scientific and Cultural Organization
UNIDO	:	United Nations Industrial Development Organization
WHO	:	World Health Organization
WMO	:	World Meteorological Organization

United Nations Environment Programme

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Monaco, 9 - 14 January 1978

ADMINISTRATIVE REPORT ON THE IMPLEMENTATION OF THE CO-ORDINATED MEDITERRANEAN POLLUTION MONITORING AND RESEARCH PROGRAMME (MED POL) AND RELATED PROJECTS OF THE MEDITERRANEAN ACTION PLAN

Note: This document is an updated and revised version of a draft (UNEP/WG.11/3 (Prov.)) which was presented to and reviewed by the Mid-Term Review Meeting on the Progress of the Co-ordinated (MED POL) and Related Projects of the Mediterranean Action Plan (Monaco, 18 - 22 July 1977)

ANNEX I : LETTERS TO THE GOVERNMENTS OF THE MEDITERRANEAN STATES INVITING NOMINATIONS OF PARTICIPANTS IN MED POL

LETTERS TO THE GOVERNMENTS OF THE MEDITERRANEAN STATES INVITING NOMINATIONS OF PARTICIPANTS IN MED POL

This Annex reproduces the letters sent on 1 September 1975, 18 December 1975 and 26 March 1976 to all UNEP focal points in Albania, Algeria, Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Libyan Arab Jamahiriya, Malta, Monaco, Morocco, Spain, Syrian Arab Republic, Tunisia, Turkey, Yugoslavia and to the national co-ordinators for MED POL in Cyprus, France, Greece, Israel, Italy, Lebanon, Malta and Yugoslavia, inviting the Governments of these States to nominate participants in the Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL).

UNITED NATIONS ENVIRONMENT PROGRAMME
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1 September 1975

Sir,

I have the honour to refer to our letter of 22 May 1975 advising you of the Expert Consultation Meeting which was convened in Rome from 23 June to 4 July 1975 jointly by the General Fisheries Council for the Mediterranean (GFCM) of the Food and Agriculture Organization and the United Nations Environment Programme to draw up operational documents for four of the research and pollution monitoring pilot projects of the Action Plan which was approved at the Inter-Governmental Meeting on the Protection of the Mediterranean held in Barcelona, Spain, from 28 January to 4 February 1975. The report of this consultation, which includes the operational documents for these pilot projects, is attached for your consideration.

The laboratories which expressed readiness to participate in each of the pilot projects are listed in Appendix I of the operational documents. This would, of course, be subject to the approval of the appropriate Government authorities to which they belong as indicated in paragraph 10 of the Report.

This letter has been sent to the MFA's of the following countries: CYPRUS/EGYPT/GREECE/ISRAEL/LIBYAN ARAB REP./ MALTA/SYRIAN ARAB REP./TURKEY and YUGOSLAVIA, plus copy to focal points where applicable and copy to Res. Rep.

I should be much obliged if you would be good enough to let us know, as soon as possible, but not later than 1 October 1975, which research centres in your country will take part in the project and which research and monitoring programmes they will undertake as part of these pilot projects, and inform us of any assistance they may need to enable them to participate in the programme.

As agreed at the Expert Consultation Meeting, the laboratories listed in Appendix I of the attached report were informed by FAO of the results of the Consultation.

In order to speed up action for the implementation of the project, please send a copy of your reply to the Secretary of the General Fisheries Council for the Mediterranean, FAO, Rome.

Accept, Sir, the assurances of my highest consideration.

M.K. Tolba
Deputy Executive Director

UNITED NATIONS ENVIRONMENT PROGRAMME
PROGRAMME DES NATIONS UNIES POUR L'ENVIRONNEMENT

Cable Address: UNITERRA, Nairobi
Telex No. 22068
Telephone: 33930

P. O. Box 30552,
Nairobi.

Ref. No.

Le 1er septembre 1975

Monsieur le Ministre,

J'ai l'honneur de me référer à la lettre du 22 mai 1975 vous informant de la réunion d'une Consultation d'experts qui s'est tenue à Rome du 23 juin au 4 juillet 1975, et à laquelle participaient le Conseil général des pêches pour la Méditerranée (CGPM) de l'Organisation pour l'alimentation et l'agriculture et le Programme des Nations Unies pour l'environnement, en vue d'établir les documents opérationnels pour quatre projets pilotes, de recherche et de contrôle de la pollution, du Plan d'action, approuvé lors de la réunion intergouvernementale sur la protection de la Méditerranée qui s'est tenue à Barcelone du 28 janvier au 4 février 1975. Les documents opérationnels pour ces projets pilotes sont inclus dans le rapport de cette consultation que vous trouverez ci-joint.

Une liste des laboratoires prêts à participer à chacun des projets pilotes est donnée à l'annexe I des documents opérationnels. Leur désignation officielle est, bien entendu, laissée à l'approbation des autorités gouvernementales auxquelles ils appartiennent, comme il est stipulé au paragraphe 10 du rapport.

This letter has been sent to the MFA's, of the following countries: ALBANIA/ALGERIA/FRANCE/ITALY/LEBANON/MONACO/ MOROCCO/and TUNISIA, plus copy to focal points where applicable and copy to Res. Rep.

Je vous serais extrêmement obligé de nous faire savoir le plus tôt possible, mais pas plus tard que le 1er octobre 1975 quels centres de recherche participeront au projet et quels programmes de recherche et de contrôle ils entreprendront dans le cadre de ces projets pilotes, ainsi que l'aide dont ils pourraient avoir besoin pour participer au programme.

Comme il a été convenu lors de la consultation d'experts, les laboratoires dont la liste est donnée à l'annexe I du rapport, ont été informés des résultats de la consultation par la FAO.

En vue d'accélérer les actions pour l'application du projet, veuillez envoyer une copie de votre réponse au Secrétaire du Conseil général des pêches pour la Méditerranée, FAO, Rome.

Veuillez agréer, Monsieur le Ministre, les assurances de ma très haute considération.

Le Directeur exécutif adjoint,

M.K. Tolba

UNITED NATIONS ENVIRONMENT PROGRAMME
PROGRAMME DES NATIONS UNIES POUR L'ENVIRONNEMENT

Cable Address: UNITERRA, Nairobi
Telex No. 22068
Telephone: 33930

P. O. Box 30552,
Nairobi.

Ref. No.

1º de septiembre de 1975

Excelentísimo Señor:

Tengo el honor de hacer referencia a la carta del 22 de mayo de 1975 en la que le informaba de la reunión de consulta de expertos que fue convocada en Roma entre el 23 de junio y el 4 de julio de 1975 por el Consejo General de Pesca del Mediterráneo (CGPM) de la Organización de las Naciones Unidas para la Agricultura y la Alimentación y el Programa de las Naciones Unidas para el Medio Ambiente en forma conjunta, con el fin de elaborar documentos operacionales para cuatro de los proyectos piloto de investigación y vigilancia de la contaminación del Plan de Acción aprobado en la Reunión Intergubernamental sobre la Protección del Mediterráneo celebrada en Barcelona (España) entre el 28 de enero y el 4 de febrero del año en curso. Se acompaña a la presente el informe de esa reunión de consulta, en el que figuran los documentos operacionales para esos proyectos piloto. (Dicho informe ha salido hasta ahora en inglés y francés únicamente.)

En el apéndice I de los documentos operacionales se enumeran los laboratorios que se manifestaron dispuestos a participar en cada uno de los proyectos piloto. Esa colaboración está, por supuesto, sujeta a la aprobación de las autoridades gubernamentales pertinentes de las que dependen, como se indica en el párrafo 10 del informe.

THIS LETTER HAS BEEN SENT TO THE GOV. OF SPAIN WITH COPIES TO FOCAL POINTS WHERE APPLICABLE.

Le agradecería muchísimo que tuviera la amabilidad de hacernos saber tan pronto le sea posible, pero a más tardar al 1º de octubre de 1975, cuáles son los centros de investigación de su país que han de participar en el proyecto y qué programas de investigación y fiscalización han de emprender como parte de esos proyectos piloto, y de indicarnos la asistencia que puedan necesitar para estar en condiciones de participar en el programa.

Según lo convenido en la reunión de consulta de expertos, la FAO informó a los laboratorios enumerados en el apéndice I del informe que se acompaña de los resultados de la consulta.

A fin de acelerar la adopción de medidas encaminadas a la ejecución del proyecto, sírvase enviar copia de su respuesta al Secretario del Consejo General de Pesca del Mediterráneo de la FAO, en Roma.

Aprovecho la oportunidad para reiterar a Vuestra Excelencia las expresiones de mi consideración más distinguida.

M. K. Tolba
Director Ejecutivo Adjunto

PROGRAMME DES NATIONS UNIES
POUR L'ENVIRONNEMENT

UNITED NATIONS ENVIRONMENT
PROGRAMME

Télégrammes: UNATIONS, GENÈVE
Télex: 22.212 ou 22.344
Téléphone: 34 60 11 33 40 00 33 20 00 33 10 00

Palais des Nations
CH-1211 GENÈVE 10

RÉF. No:
(à rappeler dans la réponse)

18 December 1975

Sir,

I have the honour to refer to our letter of 4 September 1975 advising you of the Expert Consultation which was convened in Malta from 8 to 12 September 1975 by the Intergovernmental Oceanographic Commission (IOC) of UNESCO, the World Meteorological Organization and the United Nations Environment Programme. The purpose of this meeting, as you know, was to draw up the operational documents for two of the pollution monitoring and research pilot projects of the Action Plan approved at the Intergovernmental Meeting on the Protection of the Mediterranean held in Barcelona, Spain, from 28 January to 4 February 1975. The report of this Consultation, which includes the operational documents for these pilot projects, is attached for your consideration.

I should be much obliged if you would be good enough to let us know, as soon as possible, but not later than 31 January 1976, which research centres in your country will take part in the pilot projects, which monitoring and research programmes they will undertake as part of these pilot projects and inform us of any assistance they may need to enable them to participate in the programme.

../.

This letter has been sent to the Mediterranean Focal Points of the following countries : CYPRUS/EGYPT/GREECE/ISRAEL/LIBYAN ARAB REP./MALTA/SYRIAN ARAB REP./TURKEY and YUGOSLAVIA, plus copy to focal points where applicable and copy to UNDP Res. Rep.

The Mediterranean research centres which may become participants in the pilot projects were informed of the results of the Consultation by IOC.

In order to speed up action for the implementation of the pilot projects, please copy your reply to the Secretary of the Intergovernmental Oceanographic Commission at UNESCO, Paris.

Accept, Sir, the assurances of my highest consideration.

P. S. Thacher
Director
UNEP Office, Geneva

PROGRAMME DES NATIONS UNIES
POUR L'ENVIRONNEMENT

UNITED NATIONS ENVIRONMENT
PROGRAMME

Télégrammes: UNATIONS, GENÈVE
Télex: 22.212 ou 22.344
Téléphone: 34 60 11 - 33 40 00 - 33 20 00 - 33 10 00

RÉF. No:
(à rappeler dans la réponse)

Palais des Nations
CH-1211 GENÈVE 10

le 18 décembre 1975

Monsieur le Ministre,

J'ai l'honneur de me référer à ma lettre du 4 septembre 1975, par laquelle je vous informais qu'allait se tenir à Malte, du 8 au 12 septembre 1975, la Consultation d'experts organisée par la Commission océanographique intergouvernementale (COI) de l'UNESCO, l'Organisation météorologique mondiale et le Programme des Nations Unies pour l'environnement. Cette réunion avait pour objet, comme vous le savez, d'élaborer les plans d'opération de deux projets pilotes concernant la surveillance continue des polluants et la recherche sur les polluants inscrits dans le Plan d'action approuvé à la Réunion intergouvernementale sur la protection de la Méditerranée (Barcelone, 26 janvier - 4 février 1975). Vous trouverez ci-joint, pour examen, le rapport sur la Consultation, qui comprend les plans d'opération des deux projets pilotes.

Je vous saurais gré de bien vouloir me faire savoir dès que possible, et au plus tard le 31 janvier 1976, quels centres de recherche de votre pays prendront part à l'exécution des projets, quels programmes de surveillance continue et de recherche ils entreprendront dans le cadre de ceux-ci, et de quelle assistance ils pourraient avoir besoin pour participer au programme.

Les centres de recherche méditerranéens qui participeront peut-être à l'exécution des projets pilotes ont été informés des résultats de la Consultation par la COI.

../.

... This letter has been sent to the Mediterranean Focal Points of the following countries : ALBANIA/ALGERIA/FRANCE/ITALY/LEBANON/MONACO/MOROCCO and TUNISIA, plus copy to focal points where applicable and copy to UNDP Res. Rep.

En vue d'accélérer l'exécution, je vous serais reconnaissant d'envoyer une copie de votre réponse au Secrétaire de la Commission océanographique intergouvernementale à l'UNESCO, à Paris.

Veuillez agréer, Monsieur le Ministre, les assurances de ma très haute considération.

Peter S. Thacher
Directeur, Bureau du PNUE, Genève

PROGRAMME DES NATIONS UNIES
POUR L'ENVIRONNEMENT

UNITED NATIONS ENVIRONMENT
PROGRAMME

Télégrammes: UNATIONS, GENÈVE
Télex: 22.212 ou 22.344
Téléphone: 34 60 11 33 40 00 33 20 00 33 10 00

RÉF. No:
(à rappeler dans la réponse)

Palais des Nations
CH-1211 GENÈVE 10

el 18 de diciembre de 1975

Excelentísimo Señor:

Tengo el honor de hacer referencia a nuestra carta de 4 de septiembre de 1975 en la que le informaba de la reunión de consulta de expertos que se celebró en Malta entre el 8 y el 12 de septiembre de 1975 y en le que participaron la Comisión Oceanográfica Intergubernamental (COI) de la UNESCO, la Organización Meteorológica Mundial y el Programa de las Naciones Unidas para el Medio Ambiente. Como V.E. sabe, esa reunión tenía por objeto elaborar los documentos operacionales para dos de los proyectos piloto de investigación y vigilancia del Plan de Acción aprobado en la Reunión Intergubernamental sobre la Protección del Mediterráneo celebrada en Barcelona entre el 28 de enero y el 4 de febrero de 1975. Se acompaña adjunto para su consideración el informe de esta reunión de consulta, en el que figuran los documentos operacionales para esos proyectos piloto.

Ruego a V.E. se sirva comunicarnos cuanto antes, y a más tardar el 31 de enero de 1976, qué centros de investigación de su país participarán en los proyectos piloto y qué programas de vigilancia e investigación emprenderán como parte de estos proyectos piloto, e informarnos de cualquier asistencia que esos centros puedan necesitar para estar en condiciones de participar en el programa.

../.

Excelentísimo Señor
Ministro de Asuntos Exteriores
Ministerio de Asuntos Exteriores
Plaza de la Provincia, 1
MADRID - 12.
España

This letter has been copied to focal points where applicable.

Los centros de investigación del Mediterráneo que pueden pasar a ser participantes en los proyectos piloto fueron informados por la COI de los resultados de la Consulta.

A fin de acelerar las medidas para la aplicación de los proyectos piloto, le agradeceré se sirva enviar una copia de su respuesta a la secretaría de la Comisión Oceanográfica Intergubernamental en la UNESCO, París.

Aprovecho la oportunidad para reiterar a Vuestra Excelencia el testimonio de mi alta consideración.

P. S. Thacher
Director
Oficina del PNUMA, Ginebra

PROGRAMME DES NATIONS UNIES POUR L'ENVIRONNEMENT
UNITED NATIONS ENVIRONMENT PROGRAMME

Telephone 34 22 00 98 58 50
Telex: 28 877
Cables: UNATIONS, GENEVA

UNEP Geneva Office
Palais des Nations
CH-1211 GENÈVE 10

Reference:

26 March 1976

Sir,

I have the honour to refer to our letter of 10 November 1975 advising you of the Expert Consultation which was convened in Geneva from 15 to 19 December 1975 by the World Health Organization and the United Nations Environment Programme. The purpose of this meeting, as you know, was to draw up the operational document for one of the pollution monitoring and research pilot projects of the Action Plan approved at the Intergovernmental Meeting on the Protection of the Mediterranean held in Barcelona, Spain, from 28 January to 4 February 1975. The report of the Consultation, which includes the operational document for this pilot project, is attached for your consideration.

I should be much obliged if you would be good enough to let us know, as soon as possible, but not later than 30 April 1976, which research centres in your country will take part in the pilot project, which monitoring and research programmes they will undertake as part of the pilot project and inform us of any assistance they might need to enable them to participate in the programme.

../.

This letter has been sent to the Mediterranean Focal Points of the following countries : CYPRUS/EGYPT/GREECE/ISRAEL/LIBYAN ARAB REP./MALTA/SYRIAN ARAB REP./TURKEY and YUGOSLAVIA, plus copy to focal points where applicable and and copy to UNDP Res. Rep.

The Mediterrancan research centres which may become participants in the pilot project were informed of the results of the Consultation by the World Health Organization.

In order to speed up action for the implementation of the pilot project, please copy your reply to the Division of Environmental Health, World Health Organization, Geneva.

Accept, Sir, the assurances of my highest consideration.

P. S. Thacher
Director
UNEP Office, Geneva

PROGRAMME DES NATIONS UNIES POUR L'ENVIRONNEMENT
UNITED NATIONS ENVIRONMENT PROGRAMME

Telephone 34 22 00 98 58 50
Telex: 28 877
Cables: UNATIONS, GENEVA

Reference:

UNEP Geneva Office
Palais des Nations
CH-1211 GENÈVE 10

le 26 mars 1976

Monsieur le Ministre,

J'ai l'honneur de me référer à ma lettre du 10 novembre 1975, par laquelle je vous informais qu'allait se tenir à Genève, du 15 au 19 décembre 1975, la Consultation d'experts organisée par l'Organisation mondiale de la santé et le Programme des Nations Unies pour l'environnement. Cette réunion avait pour objet, comme vous le savez, d'élaborer le plan d'opération d'un des projets pilotes concernant la surveillance continue des polluants et la recherche sur les polluants, inscrits dans le Plan d'action approuvé à la Réunion intergouvernementale sur la protection de la Méditerranée (Barcelone, 28 janvier - 4 février 1975). Vous trouverez ci-joint, pour examen, le rapport sur la Consultation, qui comprend le plan d'opération de ce projet pilote.

Je vous saurais gré de bien vouloir me faire savoir aussitôt que possible, et au plus tard le 30 avril 1976, quels centres de recherche de votre pays prendront part à l'exécution du projet pilote, quels programmes de surveillance continue et de recherche ils entreprendront dans le cadre de ce projet, et de quelle assistance ils pourraient avoir besoin pour participer au programme.

../.

This letter has been sent to the Mediterranean Focal Points of the following countries : ALBANIA/ALGERIA/FRANCE/ITALY/LEBANON/MONACO/MOROCCO and TUNISIA, plus copy to focal points where applicable and copy to UNDP Res. Rep.

Les Centres de recherche méditerranéens qui participeront peut-être à l'exécution du projet pilote ont été informés des résultats de la Consultation par l'Organisation mondiale de la santé.

En vue d'accélérer la préparation de l'exécution du projet, je vous serais reconnaissant d'envoyer une copie de votre réponse à la Division de l'hygiène du milieu, Organisation mondiale de la santé, à Genève.

Veuillez agréer, Monsieur le Ministre, les assurances de ma très haute considération.

Le Directeur du Bureau du PNUE à Genève,

Peter S. Thacher

PROGRAMME DES NATIONS UNIES
POUR L'ENVIRONNEMENT

UNITED NATIONS ENVIRONMENT
PROGRAMME

Télégrammes: UNATIONS, GENÈVE
Télex: 22.212 ou 22.344
Téléphone: 34 60 11 33 40 00 33 20 00 33 10 00

RÉF. No:
(à rappeler dans la réponse)

Palais des Nations
CH-1211 GENÈVE 10

26 de marzo de 1976

Excelentísimo Señor:

Tengo el honor de dirigirle la presente en relación con nuestra carta del 10 de noviembre de 1975 en la que le informaba de la reunión de consulta de expertos que convocaron en Ginebra, del 15 al 19 de diciembre de 1975, la Organización Mundial de la Salud y el Programa de las Naciones Unidas para el Medio Ambiente. Como Vuestra Excelencia sabe, esa reunión tenía por objeto elaborar el documento operacional para uno de los proyectos piloto de investigación y vigilancia del Plan de Acción aprobado en la Reunión Intergubernamental sobre la Protección del Mediterráneo celebrada en Barcelona (España), del 28 de enero al 4 de febrero de 1975. Se acompaña adjunto para su consideración el informe de esta reunión de consulta, en el que figura el documento operacional para ese proyecto piloto.

Ruego a Vuestra Excelencia se sirva comunicarnos cuanto antes, y a más tardar el 30 de abril de 1976, qué centros de investigación de su país participarán en el proyecto piloto y qué programas de vigilancia e investigación emprenderán como parte de ese proyecto piloto, e informarnos de cualquier asistencia que esos centros puedan necesitar para estar en condiciones de participar en el programa.

../.

This letter has been sent to the Government of Spain with copies to focal points where applicable.

Los centros de investigación del Mediterráneo que pueden pasar a ser participantes en el proyecto piloto fueron informados por la Organización Mundial de la Salud de los resultados de la Consulta.

A fin de acelerar las medidas para la aplicación del proyecto piloto, le agradeceré se sirva enviar una copia de su respuesta a la División de Fomento de la Higiene del Medio, Organización Mundial de la Salud, Ginebra.

Aprovecho la oportunidad para reiterar a Vuestra Excelencia el testimonio de mi más alta consideración.

Peter S. Thacher
Director
Oficina del PNUMA, Ginebra

United Nations Environment Programme

Distr.
RESTRICTED
UNEP/IG.11/INF.3
31 October 1977
Original : ENGLISH

Intergovernmental Review Meeting of Mdeiterranean Coastal States on the Mediterranean Action Plan

ADMINISTRATIVE REPORT ON THE IMPLEMENTATION OF THE CO-ORDINATED MEDITERRANEAN POLLUTION MONITORING AND RESEARCH PROGRAMME (MED POL) AND RELATED PROJECTS OF THE MEDITERRANEAN ACTION PLAN

Note: This document is an updated and revised version of a draft (UNEP/WG.11/3 (Prov.)) which was presented to and reviewed by 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)

PARTICIPANTS IN MED POL AND THE STATUS OF THEIR PARTICIPATION

This Annex is the reproduction of computerized information on the participants in the pilot projects of the Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL) which is kept permanently up to date and distributed once a month to the United Nations bodies participating in the implementation of MED POL.

The present reproduction contains information valid on 31 October 1977.

UNEP/IG.11/Inf.3
ANNEX II
31 October 1977

INFORMATION ON PARTICIPANTS IN MED POL

PARTICIPATING INSTITUTION	PROJECT	PRINCIPAL INVESTIGATOR	STATUS OF AGREEMENT	STARTING DATE OF WORK
ALGERIE				
Centre de Recherches océanographiques et des Peches Jetée Nord B.P. 90 ALGER tel: 62.73.11, 62.66.59 Directeur: Dr. Rachid Semroud	Med II	Mme D. Siblot	signed 18.10.76	Sept.1976
	Med V	Dr. R. Semroud	signed 18.10.76	Jan 1977
	RAC V	Dr. R. Semroud	signed 23.5.77	
CYPRUS				
Fisheries Department Ministry of Agriculture and Natural Resources Tagmatarchou Pouliou 5-7 NICOSIA tel: 021-403279 Mr. Andreas Demetropoulos Fisheries Officer	Med I	Mr. A. Demetropoulos	signed 23.4.77	May 1976
	Med II	Mr. A. Demetropoulos	signed 11.8.76	Sept. 1976
	Med III		negotiating	
	Med IV		negotiating	
	Med V	Mr A. Demetropoulos	signed 11.8.1976	March 1976
	Med VI	Mr. A. Demetropoulos	signed 29.6.77	Nov. 1976
EGYPT				
Institute of Oceanography and Fisheries Mediterranean Branch Kayet Bey ALEXANDRIA tel: 801-553, 801-449 Acting Director: Dr. Talaat Hashem	Med I	Dr. S.D. Wahby	signed 20.3.77	Jan. 1977
	Med II	Dr. H.I. Emara	signed 23.1.77	Dec. 1976
	Med III	Dr. M. M. Abbas Aly	signed 23.1.77	Dec. 1976
	Med IV	Dr. H.H. Saleh	signed 23.1.77	Dec. 1976
	Med V	Dr. M. L. El-Hehyawi	signed 23.1.77	Dec. 1976
	Med VI	Dr. M.A. Gerges	signed 20.3.77	May 1976
	RAC VI	n.d.	cleared 3.10.77	

FRANCE

Laboratoire de Chimie appliquée à l'expertise Faculté de Pharmacie, Université de Montpellier I Avenue Charles Flahaut B.P. 1103 34060 MONTPELLIER, CEDEX tel: (67) 635582 Directeur: Prof. Robert Mestres	Med I	Prof. R. Mestres	signed 15.5.77	Nov 1975
	Med III	Prof. R. Mestres	signed 22.12.76	Dec. 1976
Laboratoire central d'Hygiène alimentaire Direction des Services vétérinaires Ministère de l'Agriculture 43 Rue de Dantzig 75015 PARIS tel: 5318210 Directeur: Dr. Jean Pantaléon	Med II	M. G. Cumont	signed 14.4.77	March 1977
Laboratoire d'Océanographie physique Museum d'Histoire naturelle 43-45 Rue Cuvier 75231 PARIS, CEDEX tel: 707.85.44, 707.19.00 Directeur: Prof. Henri Lacombe	Med VI		negotiating	
Laboratoire de Biologie et d'Ecologie marines UER "Domaine Méditerranée" Université de Nice, Campus de Valrose, Avenue de Valrose 28 06034 NICE, CEDEX tel: 51.91.00 Directeur: Prof. Raymond Vaissière	Med IV		negotiating	
	Med V		negotiating	
	Med VI		negotiating	
Centre d'Etudes et de Recherches de Biologie et d'Océanographie médicale (CERBOM) Parc de la Cote Avenue Jean Lorrain 1 06300 NICE tel: 893292-897249 Directeur: Dr. Maurice Aubert	Med I	Dr. M. Aubert	cleared 31.1.77	Jan. 1977
	Med II		negotiating	
Station zoologique de Villefranche-sur-Mer	Med I		negotiating	
Station marine de Villefrance-sur-Mer La Darse 06230 VILLEFRANCHE-SUR-MER tel: (93) 807165,808112 Directeur: Prof. Paul Bougis	Med VI		negotiating	
Institut français du Pétrole 1 et 4 Avenue de Bois Préau 92502 RUEIL MALMAISON tel: 967.11.10, 794.02.14 Directeur: Dr. Jean-Claude Balaceanu	Med I	M. P. Renault	signed 29.3.77	Jan. 1977
Institut scientifique et technique des Peches maritimes (I.S.T.P.M.)	Med I		negotiating	
Centre de Sète 1 Rue Jean Vilar 34200 SETE tel: 74.99.81 Directeur: Dr. Yves Fauvel	Med II	Dr. Y. Thibaud	signed 7.9.76	Sept. 1976
	Med III	Dr. C. Alzieu	signed 7.9.76	Sept. 1976

FRANCE (Cont.)

Laboratoire Arago 66650 BANYULS-SUR-MER	Med IV		negotiating	
tel: 383009, 383119, 383040	Med V		negotiating	
Directeur: Dr. Jacques Soyer	Med VI	Dr. J. Soyer	signed 3.5.77	Jan. 1977
Laboratoire d'Hydrologie, Faculté de Pharmacie Université d'Aix-Marseille II 27 Boulevard Jean Moulin 13385 MARSEILLE, CEDEX 4	Med II		negotiating	
	Med III		negotiating	
tel: (91) 472840				
Directeur: Dr. André Arnoux				
Laboratoire Solaigue Compagnie nationale d'Aménagement de la Région du Bas-Rhone-Languedoc 685 Route d'Arles 30000 NIMES	Med I		negotiating	
	Med II		negotiating	
	Med IV		negotiating	
tel: (66) 846001				
Directeur: Dr. Jean Laporte				
Station marine d'Endoume et Centre d'Océanographie Rue de la Batterie-des-Lions 13007 MARSEILLE	Med I		negotiating	
	Med II		negotiating	
tel: 521294				
Directeur: Prof. Jean-Marie Pérès	Med III		negotiating	
	Med IV	Dr. G. Bellan	cleared 7.10.76	Oct. 1976
	Med V	(a)Dr. F. Blanc et Dr. M. Leveau (b)Dr.D.Bellan-Santini	(a) signed 13.12.76 (b)signed 13.12.76	(a)Jan.1977 (b)Jan. 1977
	Med VI		negotiating	
	RAC IV	Prof.J.-M. Pérès	signed	
Service de Chimie analytique Département de Chimie appliquée Centre d'Études nucléaires de Grenoble B.P. 85 X 38041 GRENOBLE, CEDEX	Med I	Dr. A. Cornu	negotiating	
tel: (76) 974111				
Chef du Service Dr. Aimé Cornu				
Service de Chimie appliquée Departement de Chimie appliquée Centre d'Études nucléaires de Cadarache B.P. 1 13115 SAINT-PAUL-LEZ-DURANCE	Med I	Melle M. Gauthier	negotiating	
tel: (91) 259000				
Chef du Service Dr. Ing. Jacques Corpel				
Centre de Pierrelatte Commissariat à l'Energie atomique B.P. 16 PIERRELATTE 26	Med II		negotiating	
	Med III		negotiating	
tel: 041600				
Directeur: Dr. Claude Siméon				

FRANCE (Cont.)

Centre de Marcoule Commissariat à l'Energie atomique B.P. 106 BAGNOLS-SUR-CEZE (Gard) tel: 895390 Directeur: M. Belot	Med II		negotiating	
	Med III		negotiating	
Centre des faibles Radioactivités Laboratoire mixte CNRS-CEA B.P. No. 1 91190 GIF-SUR-YVETTE tel: 907.78.28 Directeur: Dr. Jacques Labeyrie	Med VIII	Dr. R. Chesselet	cleared 29.4.77	

GREECE

Institute of Oceanographic and Fisheries Research Ministry of Culture and Science Agios Kosmas-Ellinikon ATHENS tel: 9820211 Director: Dr. Alexander Stephanidis	Med I	Dr. E. Verykokakis	signed 18.5.77	Jan 1977
	Med II	Dr. F. Voutsinou and Dr. J. Satsmadjis	signed 20.4.77	Dec. 1976
	Med III	Dr. J. Satsmadjis	cleared 24.8.77	Dec. 1976
	Med IV		negotiating	
	Med V	Dr. C. Bogdanos and Dr. A. Zarkanellas	signed 20.4.77	Dec. 1976
	Med VI	Dr. E. Papageorgiou	signed 18.5.77	Jan 1977
Zoological Laboratory and Museum University of Athens Panepistimiopolis-Kouponia ATHENS 621 tel: 743.217 Director: Prof.Dr.Vassili Kiortsis	Med IV	Dr.M.Moraitou Apostolopoulou	signed 27.4.77	April 1977
	Med V	Dr. C. E. Vamvakas	signed 27.4.77	Feb 1977
The Department of Zoology University of Thessaloniki THESSALONIKI tel: 2392.2449 Director: Prof. Dr. Marios E. Kattoulas	Med IV		negotiating	
	Med V	a)Prof.Dr.M.E. Kattoulas	signed 8.9.77	Dec. 1976
		b)Prof.Dr.M.E. Kattoulas	signed 8.9.77	Dec. 1976
Radioanalytical Laboratory Radiochemical and Nuclear Analysis group Department of Chemistry Nuclear Research Centre "Demokritos" Aghia Paraskevi Attikis, ATHENS tel: 6513111 ext. 336-335 Head of the Laboratory: Dr. Apostolos P. Grimanis	Med I	Dr. N. Mimicos	negotiating	
	Med II	Dr. A.P. Grimanis and Dr. C. Papadopoulou	signed 20.4.77	Oct. 1975
	Med VIII	Dr. C. Papadopoulou	signed 20.6.77	
General Chemical State Laboratory Division of Environmental Pollution Control Ministry of Economic Affairs 16 A. Tsocha Street 602 ATHENS tel: 6428211 Head of Division Dr. Demis G. Marketos	Med II	Dr. D. G. Marketos	signed 28.4.77	June 1976

GREECE (Cont.)

Department of Food Hygiene Faculty of Veterinary Medicine Aristotelian University of Thessaloniki THESSALONIKI tel: 31.2392.2305 Director: Prof. Dr. Achilles G. Panetsos	Med II	Prof.Dr. A.G. Panetsos	signed 9.8.77	March 1977
	Med III	Prof.Dr. A.G. Panetsos	signed 9.8.77	March 1977
	Med VII		cleared 27.9.77	February 1977
Laboratory of Hygiene Medical School Aristotelian University of Thessaloniki THESSALONIKI tel: 2392-2339 Director: Prof. Dr. Theodore Edipides	Med III		negotiating	
	Med VII	Prof.Dr. T. Edipides	signed 25.7.77	July 1977
Laboratory of Analytical Chemistry Faculty of Physics and Mathematics University of Thessaloniki THESSALONIKI tel: (031) 2392-2482 Director: Prof. Dr. George Vasilikiotis	Med II	Prof.Dr. G. Vasilikiotis	signed 4.7.77	Feb. 1977
	Med III	Prof.Dr. G. Vasilikiotis	signed 4.7.77	Feb. 1977
Benaki Institute of Phythopathology 8 Delta Street ATHENS tel: 8012376 Director: Dr. Dimitrios S. Vassilopoulos	Med III	Dr. N. Adam	signed 21.5.77	March 1977
	Med IV	Dr. R. Fytizas	signed 21.5.77	March 1977
Laboratory of Organic Chemistry Aristotelian University of Thessaloniki THESSALONIKI tel: 2392.2497 Director: Prof. Nicholas E. Alexandrou	Med I	Prof. N.E. Alexandrou	negotiating	
Environmental Pollution Control Project Ministry of Social Services 147, 28 October Street ATHENS 814 tel: 850111, 850476 Director: Dr. Gregory Markantonatos	Med VII	Dr. J. Papadakis Dr. S. Sotiracopoulou Dr. S. Thalassinou	negotiating	Nov. 1976
Department of Hydrology and Hydraulic Works National Technical University 42, 28th October Avenue ATHENS 147 tel: 3607.603/3691.265 Director: Prof. Dr. Themis S. Xanthopoulos	Med VI	Prof. Dr. Th. S.Xanthopoulos	negotiating	

ISRAEL

Israel Oceanographic and Limnological Research Ltd. Tel Shikmona P.O. Box 1793 HAIFA tel: (04)539.258 Director: Mr. Yohay Ben-Nun	Med I	Dr. O.H. Oren	signed 13.8.77	May 1976
	Med II	Dr. O.H. Oren	signed 14.9.76	Oct. 1975
	Med III	Dr.R. Ravid	signed 14.9.76	Oct. 1975
	Med IV	Dr. T. Shimoni	signed 21.9.76	Sept. 1976
	Med V		negotiating	
	Med VI	Dr. A. Hecht	signed 19.8.77	May 1976
	Med VIII	Dr. O. H. Oren	cleared 24.8.77	
Environmental Health Laboratory Hadassah Medical School Hebrew University P.O. Box 1172 JERUSALEM tel: 238-821 Director: Dr. Hillel I. Shuval	Med VII		cleared 11.7.77	after signature of agreement
Environmental Engineering Laboratories Technion - Israel Institute of Technology Technion City HAIFA 32000 tel: (04) 227.111 ext. 2359 Head: Prof. Menahem Rebhun Head of Microbiology Section: Prof. Yehuda Kott	Med VII		negotiating	
The Dr. A. Felix Public Health Laboratory Ministry of Health Abu Kebir, P.O. Box 8255 TEL-AVIV tel: (03)821.777 Director: Dr. Yonah Yoshpe-Purer (Mrs)	Med VII		negotiating	
Public Health Laboratory Public Health Department Ministry of Health P.O. Box 9526 HAIFA tel: (04)536201 Director: Dr. Rachel Seligmann (Mrs)	Med VII		negotiating	
Biological Research Laboratories Institute of Evolution University of Haifa Mount Carmel 31999 HAIFA tel: (04) 240448 Director: Prof. Eviatar Nevo	Med III		negotiating	

ITALY

Institute of Hydrobiology and Fish Culture University of Messina Via dei Verdi 75 98100 MESSINA tel: 710617 Director: Prof. Sebastiano Genovese	Med VII		negotiating	
Laboratory of Hydrobiology and Fish Culture Institute of Comparative Anatomy University of Siena Via delle Cerchia, 3 53100 SIENA tel: (0577) 288428 Director: Prof. Dr. Aristeo Renzoni	Med II	Prof.Dr. A. Renzoni	signed 1.9.76	sept. 1976
Observatory for Experimental Geophysics - Marine Laboratory P. O. Box 2011 34016 TRIESTE tel: (040) 730276 Director: Dr. Ezio Accerboni	Med VI	Dr. E. Accerboni	cleared 28.4.77	June 1977
Institute of Marine Biology-CNR Riva Sette Martiri 1364/A 30122 VENICE tel: (041)707622 Director: Prof. Dr. Bruno Battaglia	Med III	Dr. V.U. Fossato	signed 27.7.77	July 1976
Marine Contamination Laboratory-CNEN 19030 FIASCHERINO (La Spezia) tel: (0187) 966496/7 Director: Dr. Aldo Brondi	Med II Med IV	Dr. A. Brondi	signed 11.8.77 negotiating	Dec. 1975
Centre for Study and Research in Sanitary Engineering Institute of Water Supply and Wastes Disposal University of Naples Via Claudio 21 80125 NAPLES tel: 620344 Director: Prof. Luigi Mendia	Med VII		negotiating	
Centre for Radiochemistry and Activation Analysis - CNR Institute of General Chemistry University of Pavia 12 Viale Taramelli 27100 PAVIA tel: (0382) 31-200/24-605 Director: Dr. Mario A. Rollier	Med II	Prof. E. Orvini	signed 16.9.76	Sept. 1976

ITALY (Cont.)

Group for Oceanographic Research - Genova Institute of Hydrobiology and Fish Culture University of Genova Via Balbi 5 12126 GENOVA tel: (010) 280-955 Chairman: Prof. Norberto Della Croce	Med II	Prof. R. Capelli	signed 3.2.77	Dec. 1976
	Med IV	Prof. M. Orunesu	negotiating	
	Med VI	Prof. I. Dagnino	signed 12.8.77	March 1976
Institute of Hygiene University of Trieste Via dell'Istria 65/1 34137 TRIESTE tel: (040) 728.303 Director: Prof. Luigi Majori	Med VII		negotiating	
Istituto Superiore di Sanità Viale Regina Elena 299 00161 ROME tel: (06) 4990 Director: Prof. Francesco Pocchiari	Med VII		negotiating	
	RAC VII	Prof. F. Pocchiari	signed 15.6.77	
Institute for Water Research - CNR Via Reno 1 00198 ROME tel: (06) 84-48-741 Director: Prof. Roberto Passino	Med VI	Prof. R. Passino	negotiating	
	Med VII		negotiating	
Zoological Station of Naples Villa Comunale 80125 NAPLES tel: 406222/406347 Director: Prof. Alberto Monroy	Med V		negotiating	
	Med VII		negotiating	
Station for Marine Biology Institute of Zoology and Comparative Anatomy University of Messina Via dei Verdi 75 98100 MESSINA tel: 81-27-21 Director: Prof. Arturo Bolognari	Med II	Dr. L. Moio	signed 23.11.76	Dec. 1976
Institute of Zoology "Federico Raffaele" University of Rome Viale dell'Università 32 00185 ROME tel: (06) 4958259/4958254 Director: Prof. Eri Manelli	Med V	Prof. E.T. Rivosecchi	negotiating	
	Med VII		negotiating	
Institute of Hygiene University of Genova Via A. Pastore 1 16132 GENOVA tel: 515052, 515013 Director: Prof. Fernando L. Petrilli	Med VII		negotiating	

LIBAN

Centre de Recherche marine de Jounieh Conseil national de la Recherche scientifique B.P. 11-8281 BEYROUTH tel: 933162 Président du Conseil: Dr. Joseph Naggear	Med I	Dr. H.H. Kouyoumjian	signed 19.5.77	first half 1977
	Med II	Dr. H.H. Kouyoumjian	signed 19.5.77	
	Med III	Dr. H.H. Kouyoumjian	signed 19.5.77	
	Med IV		negotiating	
	Med V		negotiating	
	Med VI		negotiating	
	Med VII	Dr. H.H. Kouyoumjian Prof. F. Ghorra	cleared 27.9.77	August 1977

MALTA

The University of Malta MSIDA tel: 36.450 Rector Magnificus Prof. Edwin J. Borg-Costanzi	Med I	Prof. V. Ferrito	signed 23.3.77	July 1976
	Med II	Dr. A. Storace	signed 30.7.76	Sept. 1976
	Med III	Dr. J. V. Bannister	signed 30.7.76	Sept. 1976
	Med IV	Dr. L.J. Saliba	signed 30.7.76	July 1976
	Med VI	Dr. D.A. Havard	signed 22.3.77	Feb. 1976
	Med VII		negotiating	
	Med VIII	Dr. J. V. Bannister	signed 26.5.77	May 1977
	RAC I	Prof. V. Ferrito	cleared 24.10.77	
The Bactereological and Chemical Laboratories Public Works Department c/o Malta College of Arts, Science and Technology MSIDA tel: 22176 ext. 21 Executive Officer: Vincent Gauci	Med VII		negotiating	
Public Health Laboratory Health Department 15 Merchants Street VALLETTA tel: 24071 Chief Medical Officer: Dr. A. Grech	Med VII	Dr. L.J. Spiteri	signed 13.7.77	Aug. 1977

MONACO				
Centre scientifique de Monaco Administration:- 16 Boulevard de Suisse MONTE CARLO Laboratoires:- Avenue Saint-Martin MC-MONACO-VILLE tel: (93)302154/301514 Président du Conseil d'Administration: S.E.M. César C. Solamito	Med VI	Dr. A. Vatrican	cleared 28.4.77	April 1977
	Med VII		cleared 11.7.77	after signature of agreement
MAROC				
Institut scientifique des Peches maritimes Rue de Tiznit B.P. 21 CASABLANCA tel: 678.11 Directeur: Dr. Mohamed Azzou	Med II	Melle H. Idrissi	signed 17.5.77	March 1977
	Med III	Melle H. Idrissi	signed 17.5.77	March 1977
	Med IV	Mr. A. N'Hila	cleared 12.8.77	Sept. 1977
	Med VII		negotiating	
Faculté des Sciences Université Mohamed V Avenue Ibn Batouta B.P. 1040 RABAT tel: 718.34 Doyen: Prof. Dr. Drissi Khalil	Med II		negotiating	
	Med III		negotiating	
	Med IV		negotiating	
	Med V		negotiating	
SPAIN				
Instituto de Investigaciones Pesqueras Paseo Nacional, s/n BARCELONA 3 tel: 31 06 450 Director: Dr. Buenaventura Andreu	Med I	Dr. M. Calderon	signed 9.5.77	Jan. 1975
	Med II	Dr. A. Ballester	signed 22.7.76	Jan. 1976
	Med III	Dr. J.M. Franco	signed 28.7.76	Jan. 1976
	Med IV	Dr. R. Establier	signed 28.7.76	Jan. 1976
	Med V		negotiating	
	Med VI	Dr. A. Cruzado	signed 2.3.77	March 1976
	Med VII		negotiating	
	Med VIII	Dr. A. Ballester	signed 26.7.77	August 1977
Laboratorio del Mar Menor Instituto Espanol de Oceanografia P.O. Box 22 SAN PEDRO DEL PINATAR (Murcia) tel: (968) 57.05.29 Director: Dr. Argeo R. de Leon	Med I		negotiating	
	Med II		negotiating	
	Med III		negotiating	
	Med IV		negotiating	
	Med VI		negotiating	
	Med VII		negotiating	

SPAIN (Cont.)

Laboratorio Oceanografico de Baleares Instituto Espanol de Oceanografia P.O. Box 291 PALMA DE MALLORCA tel: 230737 Director: Dr. Miguel Duran	Med I		negotiating	
	Med V		negotiating	
Laboratorio Oceanografico de Malaga Instituto Espanol de Oceanografia Paseo de la Farola 27 MALAGA tel: 212810 Director: Mr. Natalio Cano	Med VI		negotiating	
Jefatura Provincial de Sanidad Avenida Maria Cristina, s/n TARRAGONA tel: (977) 202645, 201150, 201522 Director: Dr. Alfredo Bardaji Gimenez	Med VII	Dr. R. Mujeriego	signed 25.8.77	April 1977
Jefatura Provincial de Sanidad Puente del Carmen 30 MALAGA tel: (952) 216590, 227806 Director: Dr. Marcelo Arce Avino	Med VII	Dr. R. Mujeriego	signed 25.8.77	April 1977

TUNISIE

Institut national scientifique et technique d'Océanographie et de Peche SALAMMBO tel: 275.632 Directrice: Madame Founoun Ktari	Med I	Mr. M.H.A. Salem	cleared 2.4.77	June 1977
	Med II	Mr. M.H.A. Salem	signed 5.11.76	Jan. 1977
	Med III	Mr. M.H.A. Salem	signed 5.11.76	Jan. 1977
Laboratoire Central Ministère de l'Economie Nationale Rue Dr. Baquehaye, Montfleury TUNIS tel: Directeur: Dr. Ridha Bouhalila	Med IV		negotiating	
	Med V		negotiating	
	Med VI		negotiating	

TURKEY

Hydrobiological Research Institute Faculty of Science University of Istanbul Rumelihisari ISTANBUL tel: 65 15 11 Director: Prof. Dr. Lutfi Biran	Med II	Mr. I. Artuz	signed 15.4.77	Dec. 1976
	Med III	Mr. I. Artuz	signed 15.4.77	Dec. 1976
	Med IV	Mr. I. Artuz	signed 15.4.77	Jan. 1977

TURKEY (Cont.)

Marine Sciences Department Middle East Technical University ANKARA	Med I	Prof.Dr. T.I. Balkas	signed 28.2.77	June 1976
tel: 237100 Chairman: Prof. Dr. Turgut I. Balkas	Med II	Prof.Dr. T.I. Balkas	signed 3.9.76	Sept. 1976
	Med III	Dr. T. Soylemez	signed 3.9.76	Sept. 1976
	Med VI	Dr. U. Unluata	signed 10.5.77	July 1976
	RAC III	Prof.Dr. T.I. Balkas	signed 26.4.77	
Institute of Hydrobiology Faculty of Science. Ege University Mithatpasha Cad. No. 564 IZMIR	Med II	Dr. H. Uysal	signed 14.4.77	March 1977
tel: 180110 Director: Prof. Remzi Geldiay	Med IV	Dr. H. Uysal	signed 14.4.77	Feb. 1977
	Med V	Dr. A. Kocatas	signed 14.4.77	Jan. 1977
General Directorate of Aquatic Resources Ministry of Food, Agriculture and Livestock Saglik Sokak ANKARA tel: 254353 Director: Mr. Ethem Ozel	Med II	Mr. A. M. Atahan	cleared 4.3.77	March 1977
	Med III	Dr. S. Tunali	cleared 4.3.77	March 1977
	Med IV	Mr. G. Getin	cleared 4.3.77	after the completion of training
	Med V	Mr. M. Sarp	cleared 4.3.77	after the completion of training
Department of Environmental Engineering Faculty of Engineering Middle East Technical University ANKARA tel: 237100 Chairman Prof. Dr. S. Erol Ulug	Med VII	Prof. Dr. S.E. Ulug	cleared 11.7.77	July 1977

YUGOSLAVIA

Laboratory for Trace Element Analyses Department of Physics and Mathematics Faculty of Industrial Pedagogy University of Rijeka Omladinska 14 RIJEKA tel: (051) 23.296 Head: Prof. Dr. Vlado Valkovic	Med I	Prof.Dr. V. Valkovic	negotiating	
	Med II	Prof.Dr. V. Valkovic and Dr. A. Ljubicic	signed 14.9.76	March 1976

YUGOSLAVIA (Cont.)

Institute for Oceanography and Fisheries Rt Marjana P.O. Box 114 SPLIT Tel: 46.682 Acting Director: Dr. Mira Zore-Armanda	Med I	Dr. J. Dujmov	negotiating	
	Med II	Prof.Dr. M. Buljan	signed 10.2.77	March 1977
	Med III	Dr. I. Vucetic	signed 10.2.77	March 1977
	Med IV	Dr. R. Muzinic	signed 10.2.77	March 1977
	Med V	Dr.T.Pucher-Petkovic	signed 30.6.77	April 1977
	Med VI	Dr. M. Zore-Armanda	signed 3.3.77	Jan. 1977
	Med VII	Dr. S. Sobot	signed 7.10.77	Nov. 1976
The Biological Institute Ivrdava Sv. Ivana P. O. Box 39 DUBROVNIK tel: (050) 27-937 Director: Prof. Dr. Tomo Gamulin	Med III	Mr. V. Sipos	signed 13.10.76	Sept. 1976
	Med IV	Dr. F. Krsinic	signed 20.8.77	Nov. 1976
	Med V	Dr. A. Benovic	signed 27.1.77	Nov. 1976
Centre for Marine Research "Rudjer Boskovic" Institute P.O. Box 1016, Bijenicka 54 ZAGREB tel: (041) 38.541/424.355 Director General: Mr. Vojno Kundic Director of Rovinj Centre: Dr. Marko Branica	Med I	Dr. V. Pravdic	cleared 31.1.77	Jan. 1977
	Med II	Dr. M. Branica	signed 24.9.76	Sept. 1976
	Med III	Mr. N. Smodlaka	signed 24.9.76	June 1976
	Med IV	Dr. B. Kurelec	signed 24.9.76	June 1976
	Med V	Dr. D. Zavodnik	signed 24.9.76	July 1976
	Med VI	Dr. Lj. Jeftic	cleared 14.2.77	Jan. 1977
	Med VII	Ms. D. Fuks	signed 4.8.77	June 1976
	RAC II	Dr. M. Branica	signed 21.4.77	
Marine Biological Station Institute of Biology University of Ljubljana P.O. Box 16 PORTOROZ tel: (066) 73-073 Director: Prof. Dr. Miroslav Zei	Med II	Prof.Dr. S. Gomiscek	signed 23.8.76	June 1976
	Med III	Ms. N. Meith-Avcin and Dr. J. Cencelj	signed 23.8.76	June 1976
(Director General:- Prof. Matija Gogala Institute of Biology University of Ljubljana P.O. Box 141 LJUBLJANA tel: (061) 22121)	Med V	Dr. J. Stirn	signed 23.8.76	Sept. 1976
	Med VII	Ms. M. Lenarcic	signed 2.8.77	October 1977

REGIONAL ACTIVITY CENTRES (RAC) FOR MED POL PILOT PROJECTS

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1. For pilot project on Baseline Studies and Monitoring of Oil and Petroleum Hydrocarbons in Marine Waters:

University of Malta
Msida
Malta

Responsible for RAC I : Prof. V. Ferrito

2. For pilot project on Baseline Studies and Monitoring of Metals, particularly Mercury and Cadmium, in Marine Organisms:

Centre for Marine Research
"Rudjer Boskovic" Institute
Rovinj/Zagreb
Yugoslavia

Responsible for RAC II : Dr. M. Branica

3. For pilot project on Baseline Studies and Monitoring of DDT, PCBs and Other Chlorinated Hydrocarbons in Marine Organisms:

Marine Sciences Department
Middle East Technical University
Mersin/Ankara
Turkey

Responsible for RAC III : Prof. Dr. T. I. Balkas

4. For pilot project on Research on the Effects of Pollutants on Marine Organisms and their Populations:

Station Marine d'Endoume
Marseille
France

Responsible for RAC IV : Prof. J.-M. Pérès

5. For pilot project on Research on the Effects of Pollutants on Marine Communities and Ecosystems:

Centre de Recherches Océanographiques
et des Pêches
Alger
Algérie

Responsible for RAC V : Dr. R. Semroud

6. For pilot project on Problems of Coastal Transport of Pollutants:

Institute of Oceanography and Fisheries
Mediterranean Branch
Alexandria
Egypt

Responsible for RAC VI : not determined

7. For pilot project on Coastal Water Quality Control:

Istituto Superiore di Sanità
Roma
Italia

Responsible for RAC VII : Prof. F. Pocchiari

United Nations Environment Programme

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Intergovernmental Review Meeting of Mediterranean Coastal States on the Mediterranean Action Plan

Monaco, 9 - 14 January 1978

ADMINISTRATIVE REPORT ON THE IMPLEMENTATION OF THE CO-ORDINATED MEDITERRANEAN POLLUTION MONITORING AND RESEARCH PROGRAMME (MED POL) AND RELATED PROJECTS OF THE MEDITERRANEAN ACTION PLAN

Note: This document is an updated and revised version of a draft (UNEP/WG.11/3 (Prov.)) which was presented to and reviewed by 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)

ANNEX IV: SUMMARY REPORTS OF PARTICIPANTS IN CO-ORDINATED MEDITERRANEAN POLLUTION MONITORING AND RESEARCH PROGRAMME (MED POL)

SUMMARY REPORTS OF PARTICIPANTS IN CO-ORDINATED MEDITERRANEAN POLLUTION MONITORING AND RESEARCH PROGRAMME (MED POL)

Contents

1. INTRODUCTION

This Annex contains the summary reports of research centres nominated as participants in the Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL).

The reports were edited by the specialized United Nations bodies to which they were submitted.

For convenience, the reports are arranged in order of the MED POL pilot projects and within these projects by countries in alphabetical order.

The names of the principal investigators and the research centres are indicated at the beginning of each summary report. In cases where principal investigators have not been designated, the names of the executive officers of the participating institutions are indicated.

2. REPORTS

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

A. DEMETROPOULOS
Fisheries Department
Ministry of Agriculture and Natural Resources
NICOSIA
Cyprus

Work on this project started in September 1976. It has been limited to tar collection on beaches and visual observation of oil slicks. The other elements of the operational plan will be followed after completion of training and delivery of equipment.

Three stations were set up for tar collection (in Limassol Bay, Larnaca Bay and north of Paphos). Samples are taken every 9th and 10th day. Arrangements for reporting on oil slicks were made with Cyprus Airways, the British Royal Air Force Bases in Cyprus and a number of fishermen.

In addition to these observations we are also collecting complementary data covering basic oceanographic parameters in to Larnaca Bay.

It is intended to increase the number of stations for tar collection to six and to take a number of parallel samples to increase the statistical validity of sampling.

Results from surveys of tar on beaches are available, but not yet processed. The degree of pollution cannot yet be assessed quantitatively. In Limassol, and, to a lesser degree in Larnaca Bay, there is oil pollution from ships. At Paphos the pollution, which consists of tar and floating debris, is less than at the other two places.

* * * * *

S. D. WAHBY
Institute of Oceanography and Fisheries
Mediterranean Branch
ALEXANDRIA
Egypt

The sampling of tar on beaches was begun in February 1977 by four stations along the Alexandria coast. The monthly rate of tar accumulation varied between 4 and 225 g/m^2.

The collection of floating tar balls started in May 1977 from the area west of Alexandria and is being carried out as frequently as possible. The suspended tar balls collected varied between 0.06 mg/m^3 in areas at 100 m depth, increasing in near-shore areas (20 m depth) to 0.15 mg/m^3.

Observations of oil slicks are made on all oceanographic cruises.

Dissolved/dispersed hydrocarbons and particulate petroleum residues will be analysed as soon as the necessary training has been completed and the equipment received.

* * * * *

R. MESTRES
Laboratoire de Chimie appliquée à l'expertise
Faculté de Pharmacie
Université de Montpellier I
MONTPELLIER
France

The programme of analysis currently being followed by the laboratory deals with the investigation of the level of hydrocarbons in the waters sampled in the region of Banyuls-sur-Mer.

The samples arrive at the laboratory already prepared; they are kept refrigerated at 4°C until the time of analysis, which is done as soon as possible.

Extraction is done with carbon tetrachloride; the analysis itself is made by infra-red spectrophotometry (in the absence of a spectrofluorimeter).

The results obtained to date indicate a constant level of pollution between 0.1 and 0.7 mg/l of seawater, which is relatively low in comparison with other coastal areas.

* * * * *

E. M. VERYKOKAKIS
Institute of Oceanographic and Fisheries Research
Ministry of Culture and Science
Agios Kosmas-Ellinikon
ATHENS
Greece

Unfortunately, due to technical difficulties in connection with the equipment for fluorescence analysis, the determination of dissolved hydrocarbons in sea-water has not yet started. However, it is envisaged that the analysis will start early in June using an MPF-4 model PERKIN ELMER fluorescence spectrophotometer, which was acquired recently for the project. Sampling will take place at seven stations.

As regards observations of oil slicks, some data have already been collected by other Greek public services which will continue to gather more data. The laboratory is in contact with these services for a co-ordinated effort in this part of the project.

* * * * *

N. MIMICOS
Radioanalytical Laboratory
Radiochemical and Nuclear Analysis Group
Department of Chemistry
Nuclear Research Centre "Demokritos"
ATHENS
Greece

Work on analysis of dissolved/dispersed petroleum hydrocarbons has recently started. Samples have been taken from Patraikos and Messiniakos gulfs as well as from Crete, Rhodes and Lesbos islands.

Because of malfunctioning of the existing fluorometer the analysis of the collected samples was made by I.R. spectrophotometry (no clean-up procedure was followed).

The other operational aspects of MED I will be executed as soon as feasible.

In the gulf of Patraikos (seven stations) and off the east coast of Lesbos (six stations) values of dissolved/dispersed hydrocarbons were reported between 0.1 and 0.5 ppm. Along the western part of the northern coast of Crete the levels were slightly, but not significantly, higher.

N. E. ALEXANDROU
Laboratory of Organic Chemistry
University of Thessaloniki
THESSALONIKI
Greece

At the end of 1976 measurements were started to assess the extent of petroleum hydrocarbon contamination in Thessaloniki and Cavala Harbour and in Strymonicos Bay. Samples were taken from six stations in Thessaloniki Harbour and Strymonicos Bay respectively.

No significant differences in the oil concentrations between the three areas were observed. The average values were 1.5 mg/l, 2.6 mg/l and 1.1 mg/l for Thessaloniki and Cavala Harbour and Strymonicos Bay respectively. The sampling error obscured the expected variation in oil content due to sea currents and depths.

Since no fluorescence spectrophotometer was available, infra-red spectrophotometry was used. Samples were extracted with CCl_4 and the ν C - H absorption at 2930 cm^{-1} was measured without prior clean-up.

* * * * *

O. H. OREN
Israel Oceanographic and Limnological Research Ltd.
HAIFA
Israel

Several monitoring and research projects are already completed, being carried out or being planned, e.g.:

- quantity of tar on beaches of the Mediterranean Coast (from El Arish to Rosh Hanikka) was sampled every two weeks between spring 1975 and winter 1976. The study is completed, but will be repeated later for comparison. The mean amount of tar found was 3625 g/m of shore. There was on the average a decrease of tar from April 1975 to January 1976 and thereafter a tendency to increase;

- identification of source of tar balls on beaches (completed, but will be repeated); the centrally located beaches had larger quantities of tar, probably due to tanker operations in the vicinity;

- identification of source of tar balls in the open waters of the Levant Sea;

- changes in crude oil composition due to evaporation and other processes.

The preliminary results on experiments during 17 days for light crude oil and 40 days for heavy crude oil gave interesting indications on the changes that take place in crude oil dispersed on the surface of the sea. Several problems in interpretations of the results arose, and additional studies are being planned to solve these.

In the beginning of June the following studies will be initiated:

- distribution of petroleum hydrocarbons and tar balls on the surface and petroleum hydrocarbons in surface water, in the Levant Sea;

- petroleum hydrocarbons in the sediments of the Eastern Mediterranean.

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H. KOUYOUMDJIAN
Marine Research Centre of Jounieh
National Council for Scientific Research
BEIRUT
Lebanon

Sampling of tar balls on beaches and visual observations of oil in two zones (three stations per zone) started in July 1977 on a monthly basis: Fidar, to the north of Beirut, and Ramlet al-Baida, to the south of Beirut. Two more sampling zones will be added, one to the north and the second further south, thus covering the coast of Lebanon uniformly.

- Parameters also measured are: wind, water, temperature, salinity, pH and waves;

- Four sets of data have already been obtained from the two zones;

- Analysis of dissolved Hydrocarbons is awaiting delivery of spectrofluorimeter and solvents.

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V. FERRITO
The University of Malta
Department of Chemistry
MSIDA
MALTA

To date only sampling of tar on beaches on approximately a monthly basis is being carried out. The relevant water samples and nets have just been constructed and sampling of particulate petroleum and dissolved/dispersed petroleum hydrocarbons will commence in the immediate future. The spectrofluorimeter is now being installed and its performance checked.

The sampling sites are situated at Anchor Bay, Marsaxlokk and Qawra. Three zones at each site are being sampled. The results indicate an appreciable variation between zones at the same site although sampling was carried out on the same day. The tar balls are weighed without prior extraction such that the weight of water and other debris inside the tar balls is being included in the results. Preliminary tests show that the water content can be up to 19.5 % (w/w) and the debris 31 % (w/w) of the "Tar" content. However, these values can vary appreciably between each piece of tar.

The weight of tar is now also being calculated from its volume as suggested in the IGOSS Manual (density assumed 0.85). The tar varies from discrete tar balls (some of which can be up to 10 cm diameter) to a continuous film.

The wind direction during the sampling intervals is recorded and taken into account.

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M. CALDERON
Instituto de Investigaciones Pesqueras
Laboratorio de Cadiz
CADIZ
Spain

Since 1974 the level of petroleum hydrocarbons dissolved and dispersed in surface sea water have been monitored in Cadiz Bay and Cadiz Port.

Marine pollution (petroleum) at Grao Port (Castellon de la Plana) was monitored from April 1974 to April 1976. The studies consisted of analysis of aromatic petroleum fractions by UV-spectrofluorimetry. Gas-liquid chromatography was used to confirm the results.

The following areas are still being studied:

S. Sebastian, Bilbao, Vigo and the South Coast of Spain from Algeciras (Cadiz) to Ayamonte (Helva). A further extension is expected to other coastal areas.

In the harbour and bay of Cadiz contamination by petroleum residues is infrequent and occurs under special wind conditions only.

On the western side of the Gaditano peninsula appreciable quantities of tar have been frequently observed.

Oil films and slicks have been observed frequently in and outside the harbour, but the amount has not been estimated.

Concentrations of dissolved/dispersed petroleum hydrocarbons show a seasonal variation but remain within reasonable limits.

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T. BALKAS
Marine Science Department
Middle East Technical University
ANKARA
Turkey

The field station of the Centre in Mersin has recently become operational and research related to MED I was expected to start in June 1977.

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V. PRAVDIC
Centre for Marine Research
"Rudjer Boskovic" Institute
ROVINJ/ZAGREB
Yugoslavia

Sampling for dissolved/dispersed hydrocarbons has been done at 9 stations in the Rijeka Bay, on a seasonal basis, since June 1976. Determined concentrations ranged from less than 0.001 to 0.72 mg/l although only four samples showed concentrations higher than 0.1 mg/l.

No conclusion can be drawn at present with regard to seasonal variation. The distribution frequency indicates that no significant differences exist between composite and bottom samples. However, this "homogeneity" is a result of unsuitable sampling methods rather than a real state at homogeneous distribution.

Sampling will be continued on a seasonal basis.

Observations have been made of tar balls on beaches but only in a qualitative manner.

Observations of oil slicks are being made occasionally when they occur in the region.

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2.2 MED II : Baseline Studies and Monitoring of Metals, Particularly Mercury and Cadmium, in Marine Organisms: FAO(GFCM)/UNEP)

D. SIBLOT
Centre de Recherches océanographiques et des Pêches
ALGER
Algérie

Preliminary sampling in order to ascertain that the sites were properly chosen have been carried out. Mullus barbatus have been collected and frozen for later analysis. At one sampling site Mytilus galloprovincialis/edulis is not available and has been replaced by Perna perna. Most equipment has been received and the AAS will soon be installed.

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A. DEMETROPOULOS
Fisheries Department
Ministry of Agriculture and Natural Resources
NICOSIA
Cyprus

Sampling of Mullus barbatus, Xiphias gladius and Patella spp started in September 1976. Samples are stored deep-frozen awaiting the completion of training and delivery of equipment.

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H. I. EMARA
Institute of Oceanography and Fisheries
Mediterranean Branch
ALEXANDRIA
Egypt

The agreement has been signed and training arranged for the principal investigator in another participating research centre. The equipment will be delivered following the completion of the training. Some difficulties may be encountered in obtaining the required species and Sardinella spp has been suggested as a substitute.

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Y. THIBAUD
Institut Scientifique et Technique des Pêches Maritimes (I.S.T.P.M.)
Centre de Sète
SETE
France

Mercury residues reported for this project were based on June-December 1976 sampling. While there appears to be a direct relationship between size (weight) and mercury value in tuna, the relationship is not apparent with the mussel. In mussel there appears to be considerable variation in residue level between sampling areas.

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G. CUMONT
Laboratoire central d'hygiène alimentaire
Ministère de l'agriculture
PARIS
France

Samples of more than 700 specimens of Thunnus thynnus and Thunnus alalunga have been analysed for Hg. The structure of the bluefin tuna population in the Mediterranean has also been studied. The results show values for the Mediterranean that are often 3 to 4 times higher than those for Atlantic specimens.

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A. P. GRIMANIS/C. PAPADOPOULOU
Radioanalytical Laboratory
Radiochemical and Nuclear Analysis Group
Nuclear Research Centre "Demokritos"
ATHENS
Greece

Mercury, cadmium and zinc were determined in Mullus barbatus, Parapenaeus longirostris, Mytilus galloprovincialis and Xiphias gladius by neutron activation analysis. Specimens of M. barbatus were collected from three stations in the Saronikos Gulf during winter 1975-76, spring, summer and autumn 1976. Specimens of P. longirostris and M. galloprovincialis were collected from one station during winter 1975-76 and summer 1976. All cadmium values in M. barbatus were found to be less than 0.2 µg/g dry weight.

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F. VOUTSINOU and J. SATSMADJIS
Institute of Oceanographic and Fisheries Research
ATHENS
Greece

Cadmium was determined in Mullus barbatus, Parapenaeus longirostris and Mytilus galloprovincialis by atomic absorption spectrophotometry. Samples were collected seasonally in the Saronikos Gulf from autumn 1975 to winter 1976. Most cadmium values for M. barbatus and P. longirostris were found to be less than 0.2 µg/g dry weight while the values for M. galloprovincialis showed a greater variation.

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D. G. MARKETOS
General Chemical State Laboratory
ATHENS
Greece

Samples were collected from three sampling stations in the Saronikos Gulf in autumn 1976. Mercury was determined in Mullus barbatus. Preliminary results for total Hg were reported.

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A. G. PANETSOS
Department of Food Hygiene
University of Thessaloniki
THESSALONIKI
Greece

Mercury levels in autumn 1975 and throughout 1976 for Mytilus galloprovincialis indicated wide variability. Mullus barbatus analyses

were reported for 3 stations for spring and winter collections. They contained very low levels. Twenty eight Thunnus thynnus were analysed from 2 sampling stations - for March and September collections. These values were also relatively low.

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G. VASILIKIOTIS
Laboratory of Analytical Chemistry
University of Thessaloniki
THESSALONIKI
Greece

Samples of Mullus barbatus, Thunnus thynnus and Mytilus galloprovincialis collected at 7 stations from September 1975 until December 1976 were analysed in duplicate for mercury, cadmium and lead. Most mercury values in Mytilus were low (<0.1 mg/kg) with the highest below established standards. Levels of mercury in Mullus were comparable to those in Mytilus. Thunnus values were also low, with no values as high as 0.1 mg/kg. Cadmium values were similar to those for mercury.

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O. H. OREN
Israel Oceanographic and Limnological Research Ltd.
HAIFA
Israel

The agreement has been signed and the equipment is installed and operational. The analytical work has started and the institute has participated in the intercalibration exercise. As Mytilus galloprovincialis is not available, Donax sp. has been substituted.

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R. CAPELLI
Group for Oceanographic Research - Genova
Institute of General Chemistry
GENOVA
Italy

Data from two projects dealing with the accumulation of heavy metals were reported. An investigation of the distribution of heavy metals (Hg, Cd, Cu, Zn, Pb, Mn, Co, Cr, Ni) in different organs of Engraulis encrasicolus was completed. The variation of concentration of metals according to the collecting period (seasonal) and between areas within Mytilus galloprovincialis samples has also been established.

(i) Engraulis

Concentration of heavy metal residues within Engraulis seems to show a direct relationship between size and mercury and cadmium concentration.

This relationship is not seen with copper, cobalt, nickel or zinc. Zinc gut, gill and muscle levels are apparently higher in the smaller fish. Gill and gut levels are often high indicating perhaps contamination from exposure to the environment, rather than deposition and storage of residues. Liver levels are commonly high for those residues which are absorbed into the blood (mercury, cadmium and copper).

(ii) Mytilus

Seasonal sampling of Mytilus in the Gulf of La Spezia indicates that between January and June the highest levels of cadmium, copper and zinc were found in February and March. Manganese, cobalt, chromium and nickel had the same trends. There was no apparent relationship between water and tissue concentrations of these metals. Mytilus tissue levels did illustrate a pattern that might be related to the movement of contaminated sediment by the current along the north-east shore of the Gulf. These data from the eleven stations emphasize the difficulty of establishing the state of pollution of an area, even a restricted one, such as a port, by considering values from the analysis of samples from a monitoring effort restricted to too few stations.

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A. BRONDI
Marine Contamination Laboratory, CNEN-EURATOM
FIASCHERINO
Italy

Mercury values for marine organisms sampled by this laboratory between October 1975 and July 1976 were reported. Delay in the installation of the AAS has postponed the analysis of elements other than mercury. Most organisms were analysed individually rather than pooled in order to determine the variation between individuals from the same sample. Mercury determinations have been completed for edible tissue from 275 individuals of 17 species.

Instrument and pretreatment error (variation) were estimated from replicates of analytical determinations and of pretreatments. The coefficient of variance between instrument determinations ranged from 2.5 to 10%; 10 of 13 replicates showed less than 4% variation. Samples of Penaeus, Sepia and Mullus barbatus all show wide variation between individuals. Samples of Sepia, Octopus (arms), Mullus barbatus, Sardinia pilchardus and Crenilabrus tinca had relatively high values. Marked differences existed between areas for samples of Mytilus, Mullus and Crenilabrus.

High values were associated with both high trophic level predators and filter feeders (increased consumption of particulate matter with adsorbed metals). Cadmium, copper and lead in coastal waters of the Ligurian and Tyrrhenian Seas were investigated at 225 stations. Water values were

high in very clear water, while low in areas rich in algae or suspended particulates. It is suggested that studies should attempt to describe the fate of metals associated with algae, sediment and suspended particulates. Cadmium levels were similar to those reported for the Northwest Basin and the north Adriatic, while lead was of an order of magnitude lower than in the north Adriatic.

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E. ORVINI
Centre for Radiochemistry and Activation Analysis - CNR
Institute of General Chemistry
University of Pavia
PAVIA
Italy

Analyses of this research centre have been confined to the determination of mercury, zinc, arsenic and selenium residues in the flesh of tuna collected by the CNEN laboratory of Fiascherino. These few samples show no apparent relationship of the concentration of these elements with either size or area collected.

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A. RENZONI
Laboratory of Hydrobiology and Fish Culture
Institute of Comparative Anatomy
University of Siena
SIENA
Italy

Six elements were monitored in Mullus barbatus and Nephrops norvegicus from a single site in autumn 1976. There was no relationship between residue concentrations and size within the rather homogeneous groups sampled. Considerable variation existed between individuals, especially with mercury levels which vary by factors of 5 (Mullus) and 8 (Nephrops). Although both species concentrated mercury, levels in Mullus were considerably higher than in Nephrops. Nephrops concentrated zinc, copper and manganese at levels several times greater than those found in Mullus. Mullus from 3 sites in spring 1977 were also analysed.

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L. MOIO
Station for Marine Biology
Institute of Zoology and Comparative Anatomy
University of Messina
MESSINA
Italy

Collection of samples started in December 1976. Sampling areas are located on Sicily and on the Calabrian coast as far as possible away from

massive pollution sources. The number of sampling sites has been increased as some species were not readily available at all sites. Hg, Cd, Pb and Cu will be undertaken as soon as the analysis digestion unit is received and the graphite furnace is installed.

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H. H. KOUYOUMJIAN
Marine Research Centre of Jounieh
National Council for Scientific Research
BEIRUT
Lebanon

Monitoring could not be initiated during 1976. The agreement has been sent to the centre for signature. Preliminary surveys reveal that some difficulties may be encountered in obtaining certain species.

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A. STORACE
The University of Malta
MSIDA
Malta

Analysis has not begun; it is hoped that specimens collected in September 1976, December 1976 and March/April 1977 will be analysed by summer 1977. Frozen specimens being held are hake (Merluccius merluccius), striped mullet (Mullus barbatus) and horse mackerel (Trachurus mediterraneus). Mytilus have been unavailable and collection of Patella lusitanica and P. coerulea began in March. It was hoped that Xiphias gladius might also be available for collection in March/April.

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H. IDRISSI
Institut des pêches maritimes du Maroc
CASABLANCA
Maroc

The agreement has been signed with FAO(GFCM) and arrangements for training and delivery of equipment are under way. The sampling programme has recently been initiated and samples are stored deep-frozen. Some earlier results on content of Hg and As in seawater and Sardina pilchardus were submitted.

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A. BALLESTER
Instituto de Investigaciones Pesqueras
BARCELONA
Spain

Mercury values reported were from analyses of organisms samples from June 1975 until March 1976. Firm conclusions can only be made after a well designed and executed sampling programme (adequate sample number by size, class and area) and statistical analyses are completed. Mercury values appear to vary with species, habitat, trophic level and growth. High levels reported for Thunnus Thynnus and Scyliorhinus canicula could be explained by individual variation (S.c. sample size = 1), trophic level, distribution and/or season (only collected one period in one area), or by size (no small individuals sampled). Individual variation cannot be defined when composite or too few samples are used. An attempt to relate size to mercury residue has been made. Difference between collecting areas is generally one of the more apparent relationships. This variation between areas is one of the reasons why values from different areas cannot generally be pooled for analysis. As stated above interpretative use of results is most easily justified where the sampling and analysis have been well planned and executed.

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T. I. BALKAS
Department of Marine Sciences
Middle East Technical University
ANKARA
Turkey

Analytical results for 6 specimens of Mytilus sp. collected at Gemlik on the Sea of Marmara in August 1976 and composite samples of red mullet, shrimp and crab collected in the vicinity of Mersin were reported. All levels were relatively low with cadmium and copper showing an apparent direct relationship between concentration and specimen size.

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I. ARTUZ
Hydrobiological Research Institute
University of Istanbul
ISTANBUL
Turkey

The agreement was recently signed. Collection of samples has started. Analyses will start when equipment has been installed.

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H. UYSAL
Institute of Hydrobiology
Ege University
IZMIR
Turkey

The agreement was recently signed. Preliminary collection of Mytilus galloprovincialis, Mullus barbatus, Mugil cephalus and Carcinus mediterraneus at the sampling sites has been carried out. Analyses will start when the equipment has been installed.

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A. M. ATAHAN
General Directorate of Aquatic Resources
Ministry of Food, Agriculture and Livestock
ANKARA
Turkey

Collection of samples has started. The analytical work will be carried out at the Marine Science Department METU (Ankara), Mersin.

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S. GOMISCEK
Marine Biology Station
University of Ljubljana
PORTOROZ
Yugoslavia

Analyses of marine organisms had not begun (all equipment had not been installed), although preparations (including installation, purchase of chemicals, glassware, standards and literature review) have been performed. Local analysts have been trained and preparations have been made to receive trainees from laboratories of other participating countries.

Analysis was scheduled to begin in May 1977, the sampling programme has been under way since September 1976 with additional samples in November 1976 and February 1977 in both clean and polluted areas in the Gulf of Trieste. Samples were quick-frozen and are stored at -20°C. Mullus barbatus or M. surmuletus were difficult to collect in many sampling localities and it was suggested that M. barbatus be replaced with the common and readily obtained Pagellus erythrinus. It was also suggested that Sardina pilchardus, an important and common pelagic Mediterranean fish, be, together with the tuna, an obligatory monitoring species.

Multielement analysis (Hg, Se, As, Cu, Zn, Pb, Mn, Fe, Cd, Cr, Sb) has been performed on water, sediment, plankton and other selected organisms, using AAS, polarography and NAA in an attempt to understand the distrib-

ution of these compounds in the Gulf of Trieste. Mercury residues in mussel are most representative with normal concentrations 0.01 - 0.04 mg/kg (wet weight), however, those in areas under the influence of the Soca (Isonzo) and Tagliamento Rivers have higher concentrations. Similar trends were seen in sediments and preliminary analyses of fishes.

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V. VALKOVIC and A. LJUBICIC
Laboratory for Trace Element Analysis
Department of Physics and Mathematics
University of Rijeka
RIJEKA
Yugoslavia

Samples of Mytilus galloprovincialis from 4 sites were collected and analysed for Fe, Cu, Zn, As, Br, Sr and Pb in 1976.

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M. BRANICA
Centre for Marine Research
"Rudjer Boskovic" Institute
ROVINJ
Yugoslavia

Samples of Mytilus galloprovincialis taken in March 1977 from 6 different regions in the North Adriatic together with sea water, were analysed for Cd, Pb, Cu and Zn.

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M. BULJAN
Institute for Oceanography and Fisheries
SPLIT
Yugoslavia

Analysis of heavy metals in sea-water using polarography has started. Samples of Mytilus galloprovincialis and Mullus barbatus were collected in March 1977 and stored deep-frozen.

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2.3 MED III : Baseline Studies and Monitoring of DDT, PCBs and Other Chlorinated Hydrocarbons in Marine Organisms: (FAO(GFCM)/UNEP)

M. M. ABBAS ALY
Institute of Oceanography and Fisheries
Mediterranean Branch
ALEXANDRIA
Egypt

The agreement has been signed and the principal investigator has been scheduled for training in another participating research centre. Equipment will be delivered following the completion of the training. Some difficulties may be encountered in obtaining the required species and Sardinella spp and other species of Mytilus have been suggested as substitutes.

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C. ALZIEU
Institut scientifique et technique des pêches maritimes (I.S.T.P.M.)
Centre de Sète
SETE
France

Chlorinated hydrocarbon analyses were performed on portions of the Mytilus galloprovincialis and Mullus barbatus samples utilized for mercury analyses. Relatively high PCB levels were analysed. Chlorinated hydrocarbon levels in Leucate Lagoon were notably lower than at other sampling stations.

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A. G. PANETSOS
Department of Food Hygiene
University of Thessaloniki
THESSALONIKI
Greece

DDT, aldrin and PCBs were determined in Mytilus galloprovincialis, Mullus barbatus and Thunnus thynnus during autumn 1975 and winter 1976. Some preliminary results were reported.

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R. RAVID
Israel Oceanographic and Limnological Research Ltd.
HAIFA
Israel

The agreement has been signed and the analytical work will start soon. Some difficulties have been encountered with analytical techniques.

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V. U. FOSSATO
Institute of Marine Biology - CNR
VENICE
Italy

Mytilus sp., Carcinus mediterraneus and Mullus barbatus were monitored for chlorinated hydrocarbon residues in the Gulf of Venice and near Ancona in 1976. Results indicate that PCB residues are the most important at both stations. BHC, aldrin, dieldrin, DDT and its metabolites were also found in the samples. In this group DDT was the most abundant residue in the filter-feeding Mytilus and sediment-feeding Mullus, while its metabolite DDE was more abundant in Carcinus. The PCB Arochlor 1260 was not reported in Mytilus samples, although present in all other samples. Arochlor 1260 and 1254 were present in approximately equal amounts in Mullus, while in Carcinus the ratio was 1:3. In the Mullus sample collected near La Spezia in February 1976 Arochlor 1260 concentration was more than 7 times greater than the 1254 content. Levels in this sample and in the tuna from near Trapani are more than double those found in Gulf of Venice samples.

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H. H. KOUYOUMJIAN
Marine Research Centre of Jounieh
National Council for Scientific Research
BEIRUT
Lebanon

Monitoring was not initiated during 1976. The agreement has been sent to the centre for signature. Preliminary surveys reveal that there might be some difficulties in obtaining certain species.

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J. V. BANNISTER
The University of Malta
MSIDA
Malta

Samples collected in September 1976 were analysed while visiting the Istituto di Biologia del Mare CNR (Venezia). Levels in all samples were relatively low, especially those from Merluccius.

H. IDRISSI
Institut des pêches maritimes du Maroc
CASABLANCA
Maroc

The agreement has been signed with FAO(GFCM) and arrangements for training and delivery of equipment are under way. The sampling programme has recently been initiated and samples are stored deep-frozen.

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J. M. FRANCO
Instituto de Investigaciones Pesqueras
BARCELONA
Spain

Intensive sampling of four species (Mytilus edulis, Carcinus mediterraneus, Mullus barbatus and Sardina pilchardus) in the Castellon and Barcelona areas was conducted in 1976.

Seasonal evaluation was facilitated by five Castellon sampling periods. In Mullus barbatus there appears to be a clear seasonal pattern of chlorinated hydrocarbons accumulation. In Castellon Mullus all chlorinated hydrocarbons reached an annual peak in December/January which decreased to a low in September before high levels again appeared in December fish. In the Castellon region the high levels in December/January can be related to the higher fat content of Mullus during that period. Barcelona Mullus have much higher residues, with the highest values at Montgat. DDE values for Sardina in the Castellon area followed the same seasonal pattern shown by Mullus, however this was not seen for the other chlorinated hydrocarbon residues because of their elevated levels in the June sample. Here again fat analyses do nothing to clarify the data interpretation. Sardina, as with Mullus, had higher concentrations of chlorinated hydrocarbon in the Barcelona area, especially PCBs at Montgat.

Mytilus and Carcinus results are more complex. Although DDT and its metabolites are present in lower levels than the fishes, PCB levels are uniformly high for all areas in Carcinus. In Mytilus while DDT values decreased to their lowest values in June, the PCB values increased at Castellon over this period. Seasonal differences in the accumulation and metabolism of these compounds may become clear after further sampling and analyses.

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T. SOYLEMEZ
Marine Science Department
Middle East Technical University
ANKARA
Turkey

The results for December 1976 samples of shrimp, crab legs and red mullet collected in the vicinity of Mersin were reported. Concentrations of chlorinated hydrocarbons, particularly Arochlor 1260 and the variation between shrimp samples were notable.

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I. ARTUZ
Hydrobiological Research Institute
University of Istanbul
ISTANBUL
Turkey

The agreement has recently been signed. Collection of samples has started. Analyses will be completed after equipment has been installed and training of principal investigator is completed.

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S. TUNALI
General Directorate of Aquatic Products
Ministry of Food Agriculture and Livestock
ANKARA
Turkey

Collection of samples has started. The analytical work will be carried out at the Marine Science Department METU (Ankara), Mersin.

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V. SIPOS
The Biological Institute
DUBROVNIK
Yugoslavia

Results of monitoring activities at three stations were reported. PCB levels in net zooplankton and Mullus surmuletus were the most notable results. Other chlorinated hydrocarbon values were relatively low.

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J. CENCELJ
Marine Biological Station
University of Ljubljana
PORTOROZ
Yugoslavia

Results obtained from 1974-76 were reported. Concentrations of DDT and lindane in sediments and zooplankton from the open waters of the Adriatic as well as in fish and molluscs from the north Adriatic were presented. A limited number of PCB analyses had also been performed. No PCBs and only trace amounts of DDT were found in sediments of the open Adriatic. Close to sewage discharges relatively high levels of DDT were found. The GC provided has been installed and is operational. Preliminary analysis with this instrument of DDT, dieldrin and PCBs in Mytilus galloprovincialis has been performed.

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T. VUCETIC
Institute of Oceanography and Fisheries
SPLIT
Yugoslavia

Sampling started in March 1977 at three sampling stations. Mullus barbatus, Mytilus galloprovincialis, Portunus depurator, Pachygrapsus marmoratus, Xanto hydrophilus, zooplankton and sediments were sampled. Some analyses were performed at the "Rudjer Boskovic" Institute.

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N. SMODLAKA
Centre for Marine Research
"Rudjer Boskovic" Institute
ROVINJ
Yugoslavia

Samples have been collected and the GC is operational. The analyses will soon be performed.

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

H. H. SALEH
Institute of Oceanography and Fisheries
Mediterranean Branch
ALEXANDRIA
Egypt

The agreement has been signed and steps have been taken to provide for training and equipment.

The development and maturation of gonads in Mullus barbatus, Sparus auratus, Solea spp. and Mugil spp. will be investigated from collections at sampling areas utilized in the pilot projects for monitoring of pollutants and ecosystem studies.

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G. BELLAN
Station marine d'Endoume et centre d'océanographie
MARSEILLE
France

(i) Toxicity

In the Endoume laboratory the emphasis has been on a definition of methodology. Assays examining differential effects on development in echinoids began in early 1976; results will soon be available. The in vitro methodology for the study of the interaction of pollutants (especially heavy metals and detergents) with ambient parameters (i.e. salinity) using urchin (Parancentrotus lividus) larvae is under way; the flow-through system for this programme has only recently become operational. These studies are being completed in close collaboration with other investigations studying recolonization of portable substrates in natural habitat. Static bioassays are being performed to determine the sensitivity of Scolelepis fuliginosa and Capitella capitata to salinity and detergents as well as investigation of their potential synergistic action. These results are being evaluated using the statistical methods of Bliss and Life-Markins. Preliminary tests have shown a well defined tolerance limit with little variability in the level initiating mortality.

Several species of polychaetes, molluscs and amphipods will be exposed to various pollutants in the flow-through system, which is capable of varied and controlled salinity of the sea water, providing a changing environment similar to estuarine conditions. This system will improve the ability to evaluate toxicity results based on in vitro and in situ tests. The goal is to improve the relationship between laboratory data and field observations.

(ii) Development, Reproduction and Population Genetics

The study of the developmental process may reveal sublethal effects of pollution that could seriously reduce community productivity and/or eliminate populations. The time sequence for development of eggs, fertilization, cleavage, gastrulation and larval stages has been determined for Paracentrotus lividus. Percent success and frequency of anomalies at each stage have also been determined. Statistical analysis has proven difficult with the method of Prentici (1976) currently being attempted. The results of this effort should be available in spring 1977.

(iii) Morphology and histopathology

Sublethal levels of pollutants are also being investigated for potential morphogenic, histopathological and teratogenic effects.

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R. FYTIZAS
"Benaki" Institute of Phytopathology
ATHENS
Greece

The toxicity of Paraquat to three marine organisms, a fish (Mugil cephalus), a gasterpod (Murex brandaris) and a decapod (genus Pagurus) has been investigated. The study has two aspects. In the first part survival times were determined at levels of 10, 5, 2.5 and 1 mg/l and pathological changes described. The second part determined the accumulation capacity of organisms and the herbicide distribution in different tissues and organs of M. cephalus. It has been shown that marine organisms are more sensitive to Paraquat than fresh water fish. At a concentration of 10 mg/l, M. cephalus survival did not exceed one hour; at 1 mg/l, maximum survival was 17 days. Decapods were more sensitive to Paraquat than gastropods. Although less vulnerable than M. cephalus to acute poisoning, Pagurus was more sensitive to repeated exposure. Exposure concentrations were too high to provide information on potential long term (chronic) effects.

Histopathological analysis revealed the existence of serious lesions in various organs of M. cephalus. In the branchiae, besides changes frequently noticed with other toxic agents, a typical lesion has been observed, i.e. sclerosis of external extremeties of branchial cilia. This lesion is similar to that provoked by the same herbicide in the lungs of mammals. When survival time was long enough, large round wounds were observed on the abdominal skin of fish.

As regards accumulation and distribution of Paraquat, much larger amounts were found in Pagurus; this appears to be related to the high sensitivity of this small crustacean to repeated exposure.

In M. cephalus, the largest amounts of Paraquat were found in the digestive tract and skin; the lowest values in muscles.

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Amongst the proposed pollutants, Cu^{2+} in the form of $CuSO_4 . 5H_2O$ was initially investigated. The effects of various concentrations of Cu^{+} on planktonic copepods Acartia clausi and Oncaea mediterranea have been studied. These organisms were first exposed to low concentrations of Cu^{+} (0.00025 ppm to 0.009 mg/l) in order to detect the possible effects of such sublethal doses.

Except for the lowest dose (0.00025 mg/l) a decrease in the survival time has been observed under laboratory conditions with a decline of motility and a lowering of the production rate of genital products.

Copepods are currently being tested with higher doses (0.027 ppm to 0.054 mg/l) of Cu^{2+}.

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Israel

Heterozygosity and genetic variation may increase fitness and provide genetic flexibility to deal with environmental uncertainty. A reduction in heterozygosity, which might result from a less diverse environment (as with increased pollution), may result in a population more susceptible to reduction or elimination by subsequent environmental alteration. Population genetics studies of Balanus amphitrite at three stations in the Bay of Haifa have demonstrated reduced heterozygosity accompanying survival in a more polluted environment. Evidence does not allow a conclusion on the effect of a specific pollutant on these organisms, but rather the effect of a composite of water quality parameters on gene frequencies in their populations.

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L. J. SALIBA
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(i) Toxicity

Acute toxicity of mercury, cadmium and copper to Arbacia lixula, Paracentrotus lividus and Palaemon elegans (newly hatched larvae, product of laboratory breeding) was determined. Twenty-four hour and forty-eight hour LC50 values for mercury on Phaeodactylon tricornutum has also been determined. "Whenever possible" specimens were collected 24-48 hours prior to the experiments. Static assays were performed in 1.0 - 1.5 l beakers. Food was withheld during the test period and 3-4 replicae were run on each assay. The mortality data were plotted on log probability paper and analysed by students' T-test or ANOVA. Twenty-four, 48 and 72 h LC50s for mercury (mercuric sulphate) were respectively 1.5, 0.5 and 0.35 mg/l for Arbacia lixula. Preliminary data for Paracentrotus lividus seem similar. The 24 h LC50s for copper (cupric sodium citrate) were 86 mg/l (23°C) for Palaemon elegans larvae. The 48 h LC50 was 25 mg/l at 20 and 23°C. Bioassays are continuing.

(ii) Physiological and Behavioural Effects

Field collected Arbacia lixula and Monodonta articulata were exposed to sublethal levels of mercury (mercuric sulfate) in an attempt to define some physiological indications of reduced fitness. Tests were conducted at 0.1 - 0.5 mg/l Hg^{++} for Arbacia (72 h LC50 0.35 mg/l). These concentrations produced cytolysis and concentration-dependent release of pigment. Monitoring of this pigment (echinochrome, spinochrome, or melanin) in the media may provide an evaluation of sublethal exposure. An "adhesion distress syndrome" was observed during other tests at a lower concentration (0.002 mg/l). These experiments are continuing with animals exposed to 0.002 to 0.05 mg/l Hg^{++} and tested with varied "pulls" to measure the effect on adhesion of the tube-feet to the substrate.

Activity of Monodonta exposed to 0.2 - 1.0 mg/l Hg^{++} in 250 ml beakers and monitored for 24 h periods was measured using a specially developed "aktograph". Effect on activity was concentration dependent and expressed by an increase in emersion time and reduced waterline activity. Exposure to 0.2 mg/l reduced oxygen consumption to nearly 1/3 of the control value with further decrease with increase in exposure concentration. These experiments are also continuing.

(iii) Development, Reproduction and Population Genetics

Mercury studies on the reproduction and development of the algae Phaeodactylon tricornutum have recently begun. This algae is being successfully cultured and seawater controls have been evaluated with regard to total number of cells (Coulter counter), total volume, as well as chlorophyll and protein content.

Work has been completed on effects of some heavy metal salts (Cu, Pb, Zn) on egg hatching, growth rate and acclimation in Artemia salina. Similar studies are under way using mercury and cadmium salts.

Preliminary results indicate that both are more toxic than copper and that lower levels must be tested. Inhibiting of hatching and inability to acclimate were noted at 0.001 mg/l Hg^{++} and Cd^{++}.

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R. ESTABLIER
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(i) Toxicity

Acute toxicity (24 h LC50) of Penaeus kerathurus larvae to mercury, cadmium and copper was determined. Values were characterized by great variation which pointed to the need for increased precision and extension of these studies. The larvae originated from 7 different hatches and although variation was great between larval stages, it also existed between identical stages of different hatches, For mercury (methyl mercuric chloride and mercuric chloride), the LC50s ranged from 3.5 to 12.4 for the former and 4.5 to 12.7 ug/l for the latter. The values for cadmium (cadmium chloride) were 0.72 to 1.33 mg/l, while the copper (cupric sulphate) values were 63 to 132 ug/l. The 24 and 48 h LC50 for Penaeus kerathurus and Palaemonetes varians larvae, juvenile and adults, as well as adult Sparusauratus will be determined for mercury, cadmium and copper.

(ii) Pollutant Dynamics

Heavy metal accumulation and both short and long-term effects in the fishes Sparus auratus, Mugil auratus and Halobatrachus didactylus were studied. Exposure to mercury, cadmium and copper did not exceed 0.1, 1.0 and 3.0 ug/l respectively. Water levels of these contaminants were monitored by AAS analysis. The fish were acclimated to the 36% filtered seawater for ten days before exposure. Two-thirds of the water was exchanged every 48 hours; on long-term studies fish were fed two hours before this water change. Fish used for short-term studies were not fed.

Cadmium concentration in Halobatrachus didactylus exposed for 96 hours to 50 mg/l was greatest in the intestine (39 ug/kg), kidney (13) and liver (5); lower levels were found in the blood (1.2) and muscle (0.2).

Mercury concentrations in Halobatrachus didactylus exposed for 49 days to 0.1 mg/l were 50.3 ug/kg in liver and 9.6 in muscle; 25 and 10 times respectively the control values.

Mugil auratus were sampled after 10, 24, 35, 46 and 57 days exposure to 0.1 mg/l mercury. The tissue from 3 fish was pooled for each analysis. Mercury levels in the gill did not increase after the first week's exposure (9 mg/kg, 100 x control values). Other tissues continued to increase in concentration over the 57 day exposure. Muscle levels increased by a factor of 20, to 2.2 mg/kg; by contrast, gut levels increased 70 times, to 20 mg/kg, while liver levels increased by a factor of 500, to over 100 mg/kg.

Sparus auratus exposed to 0.2 mg/kg copper (cupric sulphate) for 77 days had little increase in gill or muscle copper, but intestine values doubled (2.4 mg/kg), as did milt (8.9). Liver values were greater than five times the control value at 20.1 mg/kg.

(iii) Morphology and Histopathology

Histological studies of tissues from fishes - Sparus auratus, Mugil auratus and Halobatrachus didactylus - exposed to mercury, cadmium and copper were made for possible pathological effects of media contaminated with sublethal levels. Tissues being evaluated were blood, liver, kidney and intestine.

Halobatrachus didactylus exposed to 0.1 mg/l mercury for 49 days (n = 6) were characterized by intestine with hyperchromatism of nuclei and apical cytoplasm and increased thickness of the villi. Mugil auratus exposed for 57 days to 0.1 mg/l Hg^{++} ($HgCl_2$) had livers with vacuolization and modification of parchymal cords and intestines with thickened epithelium, disorientation of nuclei, vacuolization and increase in cells in the villi.

Halobatrachus were exposed to 50 mg/l cadmium for 96 hours in April, June and September. Although sample size was only 3, the following effects were observed: (1) erythrocytes with varied shape, vacuolization, pycnosis and haemoglobin content; (2) intestinal epithelium with altered nuclear orientation, vacuolization, hypochromatism and necrosis; (3) liver with increased reticular trabeculi and nuclei, and (4) kidney tubules with nuclear disorientation, hypochromatism, reduced lumen or dilated and full of amorphic mass (with eosinophils and signs of degeneration).

Sparus auratus exposed to 0.2 mg/l Cu^{++} for 77 days produced disorganization of the epithelium and basal membrane of the intestine, as well as increased epithelium thickness.

Photomicroscopy was utilized with selected tissue sections to record the effects discussed above.

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The agreement was signed recently and the experimental work has started. Bioassays for mercury, cadmium, copper and zinc will be done with Mytilus galloprovincialis, Paracentrotus lividus, Carcinus mediterraneus and Mugil cephalus. Analytical studies accompanying these experiments will start as soon as the AAS to be provided is operational.

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I. ARTUZ
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The agreement has recently been signed and the Institute has started to investigate different marine organisms for toxicity testing. Water samples have been collected from different sources (i.e. papermill and pesticides industry waste water) and short-term static tests have been performed with Trachurus mediterraneus, Carcinus mediterraneus and Mytilus galloprovincialis. Other tests could not be performed until equipment was received. A difficulty with these experiments was the reaction of the organisms to the different pH levels and salinities in the waste water.

Samples used in the toxicity tests for heavy metals and pesticides have been stored deep-frozen until the AAS and GC equipment is operational.

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B. KURELEC
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"Rudjer Boskovic" Institute
ROVINJ
Yugoslavia

The philosophy of this laboratory in the study of biological effects of pollutants commences from the rationale that any change in the environment results in a number of measurable alterations of a physiological and biochemical steady state, i.e. that an environmental stressor causes a number of symptoms which constitute the stress syndrome. A measurable change in the PS (programmed biosynthesis of DNA, RNA, proteins) may indicate such a syndrome of stress; therefore, the processes of the PS may offer a biochemical index of stress.

Fishes metabolize the aryl hydrocarbon benzo(a)pyrene by a microsomal mixed-function oxidase. This aryl hydrocarbon hydroxylase has been induced in the liver and gills of Salmo trutta and Mallotus villosus by exposure to petroleum (Payne and Penrose, 1975). Measurements of the activity of this enzyme appears to be a good monitor for marine petroleum pollution, as a sublethal effect that can be quantified. Induction of benzo(a)pyrene hydroxylase (BPH) may be related to (1) potential carcinogenic threat to fish of petroleum pollution, (2) the "taint" problem as a means of quantifying exposure to petroleum products, (3) chronic effects on growth, reproduction, behaviour, and their ecological implications.

In an effort to substantiate the utility of this assay for sublethal effects of petroleum pollution, studies were initiated at "Rudjer Boskovic" Institute. Blennius pavo, a stationary tide-pool fish common in the Mediterranean, Sardina pilchardus, a pelagic fish, and Microcosmos sulcatus, a benthic protochordate, have been monitored in these investigations.

Laboratory induction of BPH in Blennius pavo, collected from unpolluted areas, resulted in maximum elevation of enzyme activity after 14 days. These induced levels were still present 30 days after termination of exposure to petroleum products. Three days exposure produced increase in BPH activity. Induction appears to be an all-or-none response; a dose response was not demonstrated. BPH activity was not detected in exposed Microcosmos.

Field monitoring of BPH activity in Blennius from the Rovinj area was correlated with known pollution levels. In these field tests it was felt that enzyme activity might be a reflection of pollution level (concentration dependent). Aromatic pesticides and PCBs may also induce elevation of BPH activity. In addition, changes in nutrition and hormonal balance have been shown to alter levels of activity of microsomal mixed-function oxidases, such as BPH. On the basis of this knowledge the effect of an oil pollution incident in the Northern Adriatic was investigated by monitoring BPH activity in the liver of Blenniidae. New Year 1977 an oil spill caused an increase in the BPH activity which reached a peak on the 23rd day (representing a 20-fold increase of the background level), followed by a decrease in activity until a new background level (4 to 5 times the original background) was reached on the 45th day. This new background level has been constant with subsequent sampling (throughout April - 4 months after the accident). This is the first case history of an oil spill followed up by this biochemical monitoring technique - induction of BPH activity.

The investigation of Y-glutamyl cycle enzymes in natural phytoplankton populations and their role in amino-acid transport was also completed in the frame of this pilot project. This enzyme system is thought to have an important role in utilization of dissolved free amino-acids (DFAA). DFAA in Northern Adriatic waters are also being monitored

by this laboratory. The correlation of pollution with changes in the Y-glutamyl cycle enzymes of DFAA in sea waters could provide early notice of decreases in primary production cycles of the sea. This enzyme system has been demonstrated in natural populations of nereids and the sponge, Geodia cydonium. DFAA represent an especially nutritious source for protein synthesis and constitutes about 5 per cent of the sea's dissolved organic matter (DOM). To place this in perspective, it should be noted that the sea's total organized matter is estimated to be 0.33% of the mass represented by DOM. Experimental work based on these observations is underway.

The study of detergent effect on programmed biosynthesis in the regenerating sponge (Geodia cydonium) produced an in vitro effect at the lowest treatment level for which effects have been demonstrated. The lowest treatment level, previously demonstrated to produce an in vitro biological effect, was 10 mg/l on enzyme systems (alkaline phosphatase being the most sensitive), 1 mg/l on isolated cells or organs, and 0.1 mg/l on physicochemical systems. This study, utilizing the uptake of labelled radio precursors by the sponge, demonstrated a decreased uptake in the acid-soluble fraction at 0.1 mg/l, while incorporation into the acid-insoluble fraction was altered at 0.01 mg/l. Alteration in nucleic acid (DNA and RNA), as well as protein content, was observed in the detergent-exposed sponge cultures. Sodium dodecylsulphate (SDS), an anionic detergent, and a 1:1 mixture of two commercial laundry detergents were used at concentrations from 10^{-9} g/ml to 10^{-5} g/ml. The detergents were taken up but not metabolized by the sponge. Commercial detergents were only 10 percent as active as SDS, but demonstrated similar effects.

The effect of lead on the 5 aminolevulinate dehydrogenase activity in Mugil capito was studied on 6 specimens exposed to a concentration of 500 ug/l. Results demonstrate a 37% decrease in the ALA-D activity after one week of exposure, 65% decrease after two weeks and stabilisation of the activity during the third and fourth week. Preincubation of blood samples with 10^{-3} M zinc acetate resulted in expected restoring effect on the ALA-D activity.

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Some preliminary observations have been made on the influence of captivity in the sea bream (Sparus auratus) and its behaviour under aquarium conditions. Anaesthesia experiments with benzocaine and quinaldine were started to determine the concentrations appropriate for handling the fish. Some observations on the mortality of juvenile grey mullets (Mugil spp.) in aquaria have also been carried out.

Studies on the sublethal effects of lead on the activity of the 5-aminolevulinate dehydrogenase in adult Scyliorhinus canicula were started. For the in vitro experiments blood of several fish was pooled. A relationship between the enzyme activity and the concentration of the lead acetate was found. In the in vivo experiments the lead acetate was given by intraperitoneal injections. Each concentration was tested in individual fish. The data show some relation between the lead acetate concentration and the enzyme activity.

Development of continuous-flow equipment for long-term toxicity tests with heavy metals has been undertaken.

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F. KRSINIC
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Research is under way on the distribution and bioaccumulation of DDT and the PCB Arochlor 1254 on laboratory cultures of zooplankton. Introduction of these pollutants is through cultured marine phytoplankton. It is hoped that this work will increase the understanding of some of the problems associated with the investigation of accumulation, metabolism and effects of chlorinated hydrocarbons on marine diatoms. These problems include the very low solubility of these compounds in water and their high adsorption affinity with solid phases.

The results of the investigation of the distribution of DDT and Arochlor 1254 in the experimental system following exposure of phytoplankton have been reported. The distribution of these low solubility compounds seems to be complex and unpredictable in this system. This may indicate the importance of carefully controlling the conditions of introduction of the contaminants into the system. Problems with low yields include volatility and adsorption.

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2.5 MED V : Research on the Effects of Pollutants on Marine Communities and Ecosystems: (FAO(GFCM)/UNEP)

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The effects of the untreated sewage (domestic and industrial) of a city of two million inhabitants on the structure and dynamics of biological communities of the Bay of Algiers are being studied. The relatively unpolluted Bay of Bou Ismail, which is more open and only polluted by a few tourist complexes and agriculture, provides reference values. Emphasis is on the macrobenthos of soft substrate. Species composition, diversity, density, biomass, production potential and dynamics of populations and communities are being determined. Environmental parameters surveyed in conjunction with benthos analysis include sediment granulometry, salinity, temperature, dissolved oxygen and organic content of sediments. Pollutants are being monitored in an attempt to correlate their levels with community changes (responses). Benthos surveys and mapping began in April 1976 using a small dredge; with the acquisition of an orangepeel bucket sampler, quantitative sampling, essential to begin population dynamics studies, began in January 1977. Since that time, 4 samples have been collected from each of the 7 stations monthly. The bucket sampler has not been effective for sandy substrate and at these stations comparative studies on the relative effectiveness of an aspirator are now under way.

The water of the Bay is often turbid and its odour can be detected up to 2 km from the coast, especially in the SE portion of the Bay. Audouinia tentaculata and the molluscs Cardium and Venus serve as good indicators of pollution level. Comparative growth studies are being performed with populations of these molluscs from various project stations.

Statistical treatment of the data includes calculation of abundance, dominance, density and biomass, as well as some indices and coefficients of diversity and affinity. Descriptions of growth, mortality and production utilize the equation of Van Bertalanffy, Ford-Walford method and the diagram of Allen. Samples relevant to population dynamics have not been completely processed.

Cartography of the Bay of Algiers, based on 80 stations between 5 and 100 m, provides the first opportunity for the evaluation of pollution effects. In mid-bay, at depths from 0-20 m, the substrate is fine sand the dominant species are Owenia fusiformis, Cardium tuberculatum, Spisula

subtruncata and Mactra mactra. At the same depth, closer to the city, a muddy-sand substrate contains Owenia fusiformis, Audouinia tentaculata, Diopatra neapolitana and Aonides oxycephala. In the SE portion of the Bay (across the city) in the sandy mud between the rocks on the bottom at 10-15 m Owenia fusiformis, Amphiura chiajei, Nephthys hystricis and Sternaspis scutata predominate. More mud is found as the distant Cape Matifou, on the far side of the Bay, is approached. Detritus is common in the depths around the Cape. Northwest of the Port, at depths of 0-20 m, the substrate is coarse sand. From 20-50 m, it is progressively more muddy. At some stations at 50 m, where the mud is reduced, Audouinia tentaculata becomes more abundant. Most of the deeper areas are pure mud and characterized by rather homogeneous communities of Sternaspis scutata, Alpheus glaber, Gonoplax rhomboides and Nephthys hystricis.

The influence of pollution in the littoral zone, where hydrodynamics reduce the pollutants, was not clearly apparent. Influence at depth and in protected coastal areas was more clear; sedimentation could be correlated with Audouinia tentaculata abundance. In the deeper areas of the Bay communities were represented by a relatively small number of species (Sternaspis scutata being dominant in the mud).

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An effort is being made to define the effects of pollution on the ecology of Limassol Bay, especially the benthic communities. Limassol Bay contains two commercial ports, a town of 65,000 and light industry - a slaughterhouse and 7 beverage factories (soft drink, wine, spirit and brewery). All wastes are discharged untreated into the bay. Unpolluted Episkopi Bay will be studied for reference values.

Seasonal samples for oceanographic, pollutant, effluent, fishes and sediment and benthos will be collected. Oceanographic values being collected are temperature, dissolved oxygen, salinity, transparency, suspended solids, BOD, nitrites, nitrates, phosphates, and sediment organic content and granulometry. The data for February/March has been processed, but not analysed. Effluent monitoring has also been carried out and values vary greatly with time. Measurements include BOD, pH, conductivity, suspended solids, Cd, Cu, Pb, Zn, Hg, Fe, cyanides and chlorides. Results of the November/December 1976 benthic samples are not available in processed form. Problems have been encountered with diversity and low density of benthos. Biomass calculations are being made.

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Egypt

The agreement has been signed. The collection of samples covers five stations north of Alexandria and in Abu-Gir bay. The selected localities represent different pollution conditions. The analyses of salinity, nutrients, COD, BOD and other parameters was performed. The determination of abundance of 10 zooplankton components including Euterpina, copepods, gastropods, echinoderm larvae and eggs and larvae of fish in the surface water layer show that some species were abundant in localities significant distances from sources of pollution. Waters adjacent to these sources had low numbers or absence of certain species. In early spring 1977 the abundance of copepods in the localities influenced by petroleum hydrocarbons were one third of that in the localities influenced by the paper mill, while the fish eggs were about five times higher. In both cases the abundance was much lower than in the unpolluted localities.

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France

Benthic studies

Studies of benthic communities and ecosystems are not only time-consuming in the collection and processing of samples and data, but are also dependent on the passage of time for both temporal and spatial interpretations of the data. Although the studies of this laboratory span a 17-year period, data from areas under investigation in pilot project MED V were begun in late 1975 and early 1976, and interpretable results are not anticipated before 1978.

(i) Hard substrate

Hard substrate analysis is under way in the polluted (domestic, thermal and industrial) Gulf of Fos with comparison of different types of contamination at two depths - less than 3 m and 3-10 m. Analysis of hard substrate benthos from 0-3 m has resulted in a thesis the conclusions of which follow.

This habitat type in the Gulf of Fos can be divided into communities associated with degrees of pollution and different dominant organisms. Cystoseira stricta is dominant in relatively pure water; Mytilus galloprovincialis and Corallina mediterranea are common in moderately polluted areas, and Ulva rigida in heavily polluted waters.

In the Cystoseira stricta community a gradation exists in species composition between the Cape Couronne station and Point Daunelle inside the Gulf. The absence of pure water species (Hyale schmidti, Stenothoe spinimana, Caprella liparotensis and Ischironome lacazei) contributes to a decrease in species diversity at Point Daunelle, where the most pollution-tolerant Jassa falcata and Dynamene edwardsi are found. There is also a decrease in concretion of the substrate. The disappearance of some species (such as Hyale camptonyx and Miniacina miniacea, which contribute to the character of the substrate) at Cape Couronne accompanies increasing pollution at this station. Hyale schmidti, Caprella liparotensis and Jassa falcata are crustaceans that appear to increase with initial stages of pollution. It would be of interest to verify this with pilot project MED II and MED III results.

The Mytilus galloprovincialis and Corallina mediterranea communities, while quantitatively similar with regard to number of species collected, differ in relative importance of molluscs, polychaetes and crustaceans. In the Corallina mediterranea community crustaceans (Leptochelia dubia) are increasing while molluscs and polychaetes have decreased in comparison to the Mytilus galloprovincialis community. Pollution appears less important in that portion of the habitat occupied by the Corallina mediterranea community. In the moderately polluted environment species equilibrium appears to be easily shifted to better adapted species by the presence of a new source of pollution. This phenomenon is verified by the following example. The Corallina mediterranea community exposed to the thermal effluent of the central E.D.F. of Martigues Ponteau has experienced a decrease in number of species present, while the population of Leptochelia dubia and Platynereis dumerilii have increased. Under the influence of this thermal effluent the normal annual population cycles (characterized by increase in June) of Mytilus galloprovincialis and Corallina mediterranea are lost. The more heavily polluted waters, containing the Ulva rigida community, are characterized by both qualitative and quantitative impoverishment of the photophilic algal components. Composition is limited to those most tolerant of pollution and may show pronounced seasonal fluctuations (i.e. Platynereis dumerilii increase in May).

Generally, species distribution in the Gulf of Fos seems correlated with the degree of pollution, with a marked decrease in the number of species with the progression from uncontaminated to polluted waters. Crustaceans are most numerous in unpolluted waters (71% of the community at Cape Couronne and 56% at Point Daunelle) and are the first species to decrease with pollution. Molluscs become more common in moderately polluted areas (37% and 54%). As pollution increases molluscs also decrease and the polychaetes become most numerous (85%). The calculation of Margalef diversity indices demonstrates an inverse relationship between species diversity and pollution. The Sander's degree of affinity supports the relationship between polluted stations which result from increases in the more pollution-tolerant Leptochelia dubia, Mytilus galloprovincialis and Platynereis dumerilii.

The analysis of hard substrate benthos at depths greater than 3 m was begun in 1977. Early results seem to show the increased importance of algal populations in polluted areas with decreases in animal populations.

(ii) Semi-hard substrate

Sessile and motile benthos in Posidonia communities of semi-hard substrate are being compared in unpolluted and polluted areas. These investigations began in autumn 1976; however, the first results have not yet been evaluated.

(iii) Soft substrate

Soft substrates are under study in areas influenced by:

(a) the introduction of fresh water and desalinization (commercial and natural), together with domestic and industrial pollution in the Berre Lagoon;

(b) urban sewage (primarily domestic) - spatial and temporal study in the anchorage of Marseille and a part of Cortiou Bay (Cassis), which includes three lines of investigation:

(i) the impact of the waste water of one million people,
(ii) the impact of developed beaches, and
(iii) the influence of sedimentation.

(c) the colonization of mixed substrate deposits resulting from dredge activities.

Monthly samples from Berre Lagoon where soft substrate benthos is influenced by the introduction of fresh water are being classified and an evaluation of the results will not be available before 1978. Pre-project results in this area have been published by Bellan and Stora (1976 and 1976a).

Sludge and sediment deposits are filling the southern portion of the Bay of Marseille. The effects of this deposition on community structure is under study in two areas of increasing pollution - the Archipelago of Riou and the Bay of Cassis. Classification and evaluation are well under way. Classification of samples in areas receiving dredge spoils is also under way.

(iv) Conclusions

Final conclusions will be based on the entire structure of this project, as well as drawing on the accumulated background of 17 years of benthic study in the area. It is hoped that this background, together with

parallel studies in relatively unpolluted environments will allow differentiation of natural variation with time from the effects of pollution. Simultaneous to the field collections, laboratory toxicological experiments and in situ field observations of experimental organisms will be carried out in an effort to increase the knowledge available for the formulation of conclusions on the effects of municipal and industrial pollution on benthic communities.

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Neritic zone studies

The neritic zone SE of Marseille receives from this urban area untreated domestic and industrial waste waters which form an extensive sheet of polluted water moving to the east or west (back towards the Bay of Marseille), depending on prevailing current and winds. Both of these areas are used extensively by summer bathers and their condition is important to the condition of local fisheries as well. During the first phase of the study surface water samples will be taken at 40 stations. A large number of measurements will be done in situ, including chemical analyses, determination and enumeration of plankton composition and bacterial counts. Cartography of these measurements will graphically present the relationships of pollutants (as well as some of their physical, chemical and biological effects), and the evolution of the pollutant dilution in space. In addition, the levels of nutrient salts will be useful in the evaluation of the trophic resources of the area. The structure of planktonic communities, their diversity and relationships with pollutants will contribute to an understanding of the local effects of pollution and eutrophication.

The first samples and measurements will be completed in April/May 1977. A follow-up study will be conducted during 10 days in September/October 1977, the first 5-6 days of which will be devoted to obtaining a better understanding of an ecosystem structure. Initial phases of the investigation will provide data on physical and chemical parameters (salinity, temperature, turbidity, seston, dissolved oxygen, nutritive elements -- $P\text{-}PO_4$, $N\text{-}NO_3$, $N\text{-}No_2$, $N\text{-}NH_4$ and $Si\text{-}SiO_2$ --), biological parameters (bacterial counts, phytoplankton diversity indices, chlorophyll a and phaeophytin, adenylates -- ATP, ADP, AMP --, organic carbon and zooplankton) and pollutants (aromatic and total hydrocarbons, phenols, detergents, heavy metals -- cadmium, zinc, copper and lead --).

Statistical methods will be used to define the specific structure (spatial and temporal associations and interactions with pollutants) of the planktonic community.

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Greece

Sampling of macrozoobenthos at two areas of the north Saronikos Gulf was completed in March 1977. One area is the site of the sewage outfall of a large metropolitan area; the other is the probable site of a future outfall. Parameters measured were diversity, biomass, density, abundance, as well as grain size, organic carbon content and hydrogen sulfide concentration of the sediment. Temperature, salinity, nutrients, and dissolved oxygen were also taken into account.

Capitella capitata were the most abundant organisms in the area of the outfall sludge field. Few or no other species were present. The clean zone was characteristic of an Eastern Mediterranean oligotrophic habitat. The survey of this clean site provides background data for studies of succession after the outfall operation begins.

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C. E. VAMVAKAS
Zoological Laboratory and Museum
University of Athens
ATHENS
Greece

Six sites have been selected for the study of fouling communities. One in the Pireus harbour and five in the area near Lavrion harbour, southeast of the Attica peninsula, in depth from 1 to 10 m. Heated water from an energy plant, mining dust and phosphorus from a match factory are influencing the sites near Lavrion harbour.

The biofouling panels are made of polyvinyl chloride or of asbestos and wood. They will normally be changed by scuba divers every month, and during summertime every fortnight. There is another series of panels for longer periods. A parallel study of plankton and soft bottom benthic communities will be undertaken in the same area (Lavrion).

Environmental parameters measured each month are: temperature, salinity, dissolved oxygen, transparency, phosphates, nitrites, nitrates, ammonia, silicates, pH, suspended matter.

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A. KOCATAS
Institute of Hydrobiology
Ege University
IZMIR
Turkey

The agreement was recently signed. A map of benthic communities in Izmir Gulf was established in 1972. There has been continuing industrialization with resulting environmental pressure being added to already existing pollution. Industrial and urban wastes are discharged in the gulf without prior treatment.

Main research activities are: (i) physico-chemical factors will be considered, as well as nutrients; (ii) an annual study programme will be undertaken in order to investigate the dynamics of benthic communities on soft and hard substrates. Qualitative and quantitative sampling was completed in early May 1977. Collected material is now being sorted.

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A. BENOVIC
The Biological Institute
DUBROVNIK
Yugoslavia

The agreement has been signed recently and the work has started. Results on zooplankton studies as a baseline for the pilot project are completed. Between 1973 and 1976 several cruises covering the whole Adriatic Sea were performed. The last four years a great number of samples of micro-zooplankton has been collected. The main group studied is the tintinnides group.

The biomass of the zooplankton show the highest values in the Northern Adriatic and along the Italian coast, while a decrease along the Yugoslav coast from north to south is obvious. The qualitative composition of zooplankton show that copepods are the most important group in winter while cladocerans show larger amounts in summer. Larvae and other groups are of importance only locally.

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J. STIRN
Marine Biological Station
University of Ljubljana
PORTOROZ
Yugoslavia

The disruptive effects of municipal sewage on a sea grass (Cymodocea nodosa and Zosterella nottii) community are being studied in a controlled environmental experiment. In the Lagoon of Strunjan (Gulf of Trieste) two experimental lagoons have been constructed (each 7 x 7 m) containing an undisturbed sea grass community. The city of Piran transports sewage to a $5m^3$ settling tank in the vicinity; this tank allows primary treatment of the sewage and a pipeline can deliver controlled amounts of its effluent to the experimental lagoon. This lagoon receives 400 l of this primary-treated sewage once a day during the incoming tide; an amount based on hydraulic and tracer observations and calculated to correspond to the load the Gulf of Koper, a shallow bay, would receive under average conditions, from a city of 50,000 inhabitants. The second lagoon serves as a control and receives no effluent. The experiment will run through two annual cycles, September 1976 until September 1978.

In both experimental and control lagoons, as well as a reference station in the open coastal sea, a large number of environmental measurements will be regularly performed. On a continuous or daily basis, meteorological, pluviometric, tidal and salinity values will be recorded. Bi-monthly, 24-hour cycle observations and measurements of the following will occur: (1) hydraulic measurements of exchange rates; (2) spectral and quantum recording of solar activity; (3) thermics and evaporation; (4) salinity-density tidal cycling; (5) pH and Eh of water and sediment; (6) alkalinity, total CO_2, Ca, Mg; (7) oxygen, BOD, H_2S; (8) particulate C, P, N, total seston; (9) organic dissolved C, P, N; (10) inorganic NH_3, NO_2, NO_3, PO_4, SiO_2; (11) density of phytoplankton by groups; (12) chlorophyll a, b, c and metabolites; (13) density and biomass of zooplankton by groups; (14) total bacterial counts with fractionation into physiological groups and identification of Escherichia coli, Streptococcus faecalis, Clostridium spp., Salmonella spp.; (15) sampling of water, sediments and dominant biota for further analyses of pesticides, PCB, heavy metals, detergents and phenols.

The following ecological phenomena are under continuous study by the pilot project research team:

(a) Succession, standing crop and productivity at the following community levels (analysis on the species level for dominant or characteristic community members): benthic algae and sea grasses, phytoplankton and tychopelagic diatoms, zooplankton, macrobenthic infauna, meiofauna.

(b) Recruitment of benthic macrofauna

(c) Modifications of granulometric, mineralogical and chemical composition of sediments

(d) Basic microbiological processes, particularly nitrogen cycling

(e) Modifications of fouling processes

(f) Modifications of community structure and diversity.

Environmental measurements show a number of important modifications of the ecosystem within the experimental lagoon. Effects resemble the "classical symptoms" of accelerated eutrophication, especially near the bottom, and include increased CO_2, decreased dissolved oxygen, negative Eh, presence of H_2S, increased turbidity and seston. Some parameters normally associated with eutrophication were surprisingly of much less significance than expected; these included nutrient levels, DOC, POC, BOD, total bacterial counts, faecal coliforms and phytoplankton standing crop. The most remarkable observation has been the absence of any significant phytoplankton or tychopelagic bloom in spite of obvious over-fertilization by the discharged sewage. Macronutrients have been readily utilized by the massive development of benthic green algae (Ulva rigida, Enteromorpha compressa and others). The explosive growth of these algae took place during the second month of the experiment effectively extirpating all sea grass vegetation, with its related epiflora and fauna, from the experimentally polluted lagoon. The remaining community, of a quite different type, has been described from similar cases of pollution of natural (non-experimental) communities.

Although observations have been made within infaunal assemblages, fouling community and other ecosystem components, it is too early to provide further interpretative data. A more detailed progress report will be available by the end of 1977.

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D. ZAVODNIK
Centre for Marine Research
"Rudjer Boskovic" Institute
ROVINJ
Yugoslavia

Phytoplankton/Offshore Waters

Offshore waters west of the Istrian peninsula are influenced by the inflow of the Po river into the Northwest Adriatic Sea, as well as effluents from the west Istrian coast and the Rijeka Bay. This area is the most shallow part of the Adriatic with a sandy detritic or detritus ooze bottom. The inflow of fresh water from the Italian rivers produce a semiestuarine flowing basin environment with inflowing

polluted waters transported to the South Adriatic Sea. Four sampling stations have been established along a transect between Rovinj and the estuary of the Po river. Some hydrological values from past work suggest that the Istrian coast may contribute most of the pollution by metals while the heaviest organic pollution may be contributed by the Italian rivers of the Northwest Adriatic. Investigation of offshire phytoplankton may help to define the relative effects of these sources of pollution.

Hydrographic data, taxonomic analyses of phytoplankton, as well as Chlorophyll a and photosynthetic activity of phytoplankton from May and July 1976 offshore cruises were presented. Chlorophyll and photosynthetic values indicate greatest biomass nearest the Po estuary which also correlates with relative nutrient contribution.

Benthic/coastal communities

Baseline studies of benthic coastal marine communities in the Northern Adriatic with regard to population dynamics and productivity have been under way since 1960. The present project compares communities at Rijeka exposed to industrial effluents from the city and near an oil terminal with stations near Rovinj exposed to mixed municipal (domestic and industrial) effluent in the Bay of Valdibora and the relatively clean Faborsa Bay. This coastal area of West Istria consists of limestone rocks, with sand at 2-10 m and mud at greater depths. Pilot project field work began in late spring and early summer 1976 and benthic sampling has been reported in Rijeka Bay (November 1976). Biomass and photosynthetic activity values have been determined for the eel grass (Cymodocea nodosa) communities at Rijeka and Rovinj. The communities of rocky littoral and coastal terrigenous ooze are also being evaluated.

The composition of the rocky littoral communities near Rovinj (West Istrian coast) and in Rijeka Bay was presented. The dynamics of these communities will be monitored twice a year (summer and winter) at Rijeka and monthly at one of the Rovinj stations. This decision is based on the "identical" composition of the communities, even though both qualitative (i.e. Chthamalus depressus, Littorina neritoides, Rivularia atra, R. mesentherica, Patella lusitanica, Hildenbrandtia prototypus, Cladophora spp. and Ceramium spp.) and quantitative (i.e. Catenella opuntia, Patella coerulea, Lithothamnion Lenormandi and Fucus virsoides) differences appear to exist. Analysis of the sand community was not made; however, in situ measurements of eel grass (Cymodocea nodosa) photosynthetic activity were compared in the investigation of possible pollution effects on the community. The biomass of eel grass at Rijeka is 80-100 g/m^2. Photosynthetic activity in terms of net production in July and November was respectively 0.25 and 0.10 $m/O_2/g/h$ (respectively, temperatures were 22° and 14.5°C and illumination 64 000 and 20 500 luxes). The comparative values at station RO-1 (Rovinj unpolluted) in the winter were 0.02 ml $O_2 g/h$, 11.2°C, and 10 000

luxes. The eel grass was unavailable for comparison at the polluted RO-2 station (Rovinj), as it had completely disappeared. Observations of photosynthetic activity will be continued at monthly intervals during 1977 at Rovinj and hopefully seasonally at Rijeka.

Preliminary review of the composition of terrigenous ooze community samples from the Rijeka Bay - both inshore and offshore - was presented. All polychaetes have not yet been identified. The high biomass value (51,47 g wet weight/0.2m^2) at station 7 is attributed to the presence of large specimens of the echinoid Brissopsis lyrifera.

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T. PUCHER-PETKOVIC
Institute of Oceanography and Fisheries
SPLIT
Yugoslavia

A cross section of the central Adriatic is under study. Sea dynamics, hydrological factors, primary production, phytoplankton, zooplankton, ichthyoplankton and planktonic bacteria are being recorded. This work has been under way for twenty years. It has therefore been possible to understand the relationship between coastal and offshore ecosystems. The existence in coastal waters of some changes in primary production, community patterns, biomass as well as seasonal fluctuations has been demonstrated.

The following preliminary data pertaining to this programme were collected in March 1977:

(1) Environmental factors: (i) background hydrographic parameters, temperature, salinity, density, transparency, alkalinity, dissolved oxygen, oxygen saturation; (ii) eutrophication indicators: CO_2, phosphates, nitrates, nitrites, ammonia, silicates; (iii) heavy metals: Zn, Cd, Pb, Cu.

(2) Plankton: (i) phytoplankton: primary production (C^{14}), numerical abundance, biomass (pigments), structure; (ii) zooplankton: biomass, qualitative and quantitative structure (main groups), especially copepods; (iii) bacteria: biomass of heterotrophic bacteria.

(3) Benthos: (i) phyotobenthos: structure, abundance, biomass; (ii) zoobenthos: structure, abundance, biomass; (iii) ichthyobenthos, structure, abundance, biomass.

(4) Nekton: (i) plankton stages of small pelagic fish: abundance, distribution; (ii) adult pelagic fish: abundance, population dynamics, distribution.

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2.6 MED VI : Problems of Coastal Transport of Pollutants (IOC/UNEP)

A. DEMETROPOULOS
Fisheries Department
Ministry of Agriculture and Natural Resources
NICOSIA
Cyprus

Work on this project so far has been limited to two series of stations in the Limassol Bay extending from the shore-line to the 200-metre line. Each series consist of 10 stations. Measurements are made at standard depths and cover basic oceanographic parameters such as salinity, temperature, O_2, nutrients transparency, suspended solids, sediments and meteorological data. Current measurements so far have been restricted to some drogue observations.

Samples have been taken quarterly starting in November 1976. The monitoring of effluents also started at the same time.

Future work is aimed at increasing the number of stations to 5 and also covering a nearby area polluted by the effluents from the processing of copper ore.

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M. A. GERGES
Institute of Oceanography and Fisheries
Mediterranean Branch
ALEXANDRIA
Egypt

Seasonal hydrographic cruises and subsurface current measurements have been carried out along the Mediterraneaa coast of Egypt from Alexandria to Rosetta where several sources of pollution exist.

Studies included seasonal observations of temperature, salinity and dissolved oxygen. Other complementary data have been collected and the meteorological conditions have been observed.

The study of surface currents using drifters released along the coast and at selected hydrographic stations started in May 1976 and is continuing on a monthly basis, revealing a clear picture of the near-coast transport.

Most of the equipment has been received but training is still behind schedule.

R. VAISSIERE (Director)
Laboratoire de Biologie et Biologie Marines
Université de Nice
NICE
France

During the month of July 1977 an oceanographic cruise in the Tyrrhenian Sea will comprise hydrographical measurements at 12 stations. The relevant parameters to be studies are: Salinity, temperature, oxygen, nitrates, nitrites, phosphates, silicons, pH and transparency. A bathytermograph will be used and the samples will be taken at depths of 10, 100, 400, 800 and 1500 m.

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P. BOUGIS (Director)
Station Zoologique de Villefranche-sur-Mer
VILLEFRANCHE-SUR-MER
France

Studies pertinent to the hydrography of the region were conducted at a network of stations from June 1974 to June 1975; additional information was obtained in a second year ending in June 1976. Because of manpower shortages the data from these studies have not been fully processed, but have been inspected visually to identify permanent features, geographic variability and cycles. The following tentative conclusions seem to be indicated:

(1) The annual cycle of temperature is clear. In winter the same values were found at all points.

The parameters Si, nutrients, detergents, bacteria and chlorophyll have apparent annual cycles which are less regular than the temperature cycle.

(2) Geographic variations are most pronounced in the cases of nutrient salts, C.O.D., detergents, bacteria and chlorophyll.

(3) There are significant vertical gradients in the case of temperature, salinity, nitrates, phosphates and silicons material.

(4) Normal to the coast there are significant gradients in C.O.D. nutrient salts, detergents, bacteria and chlorophyll.

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E. PAPAGEORGIOU
The Institute of Oceanographic and Fisheries Research
ATHENS
Greece

Current measurements in Saronikos Gulf started in 1975. Aanderaa current meters were used, with extra sensors to record temperature, conductivity and depth.

Hourly mean values, graphs, histograms and progressive vector diagrams have been prepared. The flow pattern of surface and bottom currents are similar, but different from the wind pattern. The currents flow towards the northwest. Progressive vector diagrams of the winds indicate a northward direction in the beginning, changing later to an eastward direction.

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A. HECHT
Israel Oceanographic and Limnological Research Ltd.
HAIFA
Israel

Continuous current, temperature and conductivity measurements have been carried out at two stations since the beginning of August 1976. A total of approximately 100.000 measurements have been taken. A preliminary analysis of the data has been carried out, consisting of testing the validity of the data, in so far as possible editing the data and storing them for further analysis. Computer programmes are being prepared for the evaluation of the tidal component of the currents with a view both to estimating their magnitude and to preparing a predictive model. Lack of sufficient tidal and meteorological data preclude a detailed analysis of the residuals, although a spectral analysis of these residuals is envisaged.

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R. PASSINO
Institute of Water Research - CNR
ROME
Italy

In order to understand the hydrodynamic phenomena of coastal-zone pollution due to the discharge of a river into the sea, a study of the discharge of the Tiber was started in September 1976.

An intensive programme of measurements has been carried out:

(a) In the river: in the two branches of the Tiber to determine their relative discharge and to estimate the intrusion of salt water and the factors that govern it (measurements of salinity, temperature, velocity, dissolved oxygen).

(b) At sea: in the zone where the two plumes of fresh water occur, currents have been measured along the coast with recording current meters and with drogues. In addition, observations of surface salinity, temperature, chlorophyll and dissolved oxygen have been taken, together with information on the tide, wind and sea state.

A study has been made in the same zone of the possibility of measuring turbidity by means of satellite surveys using radiation in the visible part of the spectrum.

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I. DAGNINO
Group for Oceanographic Research - Genova
Institute of Hydrobiology and Fish Culture
University of Genova
GENOVA
Italy

The oceanographic research of relevance to the pilot project carried out in the coastal waters of the Ligurian Sea has been dealing mainly with:

- the thermohaline properties of surface waters in relation to atmospheric pressure and wind;
- temperature and salinity profiles to study advection and fluctuations superimposed on trends resulting from advection;
- correlation among surface currents, and atmospheric pressure and baric gradient;
- the characteristics of coastal surface currents by optical tracking of drifters, and by release of drift cards;
- the study of surface waves and the testing of a new method of recording wave motion;
- transparency of coastal waters, by means of a new turbidity meter employing solid-state components;

- impact of effluents from large urban concentrations and industrial centres by the study of physical, chemical and biological parameters.

Within the framework of the pilot project the Group will carry out current measurements of hydrological work along transects normal to the Ligurian coast, and is participating in the DRIFTEX operation in the Ligurian Sea.

During November 1973 two series of profiles, all together 110 profiles from 0-750m were taken at a station in the Ligurian Sea. The results showed the importance of wind direction and velocity for sub-surface transport. Internal waves were studied and periods of 3.8 and 13 h were found.

Drift card experiments were made in May and September 1973. They confirmed the cyclonic patter of the littoral current. Results indicated that floating pollutants at a distance of 4NM from the shore at the time of the study could be scattered along 75 NM of the coast. Certain stretches of the coast are more likely to receive such pollutants than others.

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E. ACCERBONI
Observatory for Experimental Geophysics
TRIESTE
Italy

From December 1971 to May 1977 OGS has been developing special programmes on the dynamics of pollution under the sponsorship of the Italian CNR. The last programme started in April 1977 and will probably be included in MED VI.

The following work is undertaken within the frame of MED VI:

(1) Measurements of currents by means of self-recording currentmeters along the section Ancona - Zadar and in the Gulf of Trieste to collect time-series observations of flux at this open boundary.

(2) Vertical profiling of temperature, salinity, dissolved oxygen, nutrients, ammonia, alkalinity, boratesand some heavy metals along the section Ancona - Zadar and on a network of stations located in the Northern Adriatic.

This data collection was planned in order to have information on fundamental parameters such as circulation, water mass characteristics and chemical properties to assess inputs to the system, and to identify functions to be used in the calibration of a hydrodynamical model.

The main circulation found in the Northern Adriatic Sea is cyclonic because of the prevailing thermohaline conditions . Tidal currents and wind-driven currents are also important. The tidal currents are well known after development of a numerical hydrodynamical model; important components are longitudinal (24 h) and are transversal (12 h), rotating around the amphidromic point 40 NM Southeast of Ancona.

Among the more important wind effects are complete mixing in the Northern Adriatic and large-scale transport in SW direction caused by the Bora Wind.

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D. A. HAVARD
The University of Malta
MSIDA
Malta

The regions of primary interest for study are the East and Southeast coast of Malta from St. Georges Shoal to Benghisa point (including Marsaxlokk bay) and the Comino channels including the south coast of Gozo.

Data on the bathymetry of the area are very detailed; also good continuous meteorological data are available. The seasonal variation of the thermocline is well documented.

As the Maltese Islands are well separated from other land masses, the coastal current system is influenced by the flow of surface water from the Western to the Eastern Basin. This permanent flow which has a value of about 0.2 ms-1 and sets to the S.E. along the Maltese coast, has been confirmed by driftcards results and flowmeter readings in calm weather conditions. It is expected that the presence of islands in this current flow will generate eddies to the South East of the islands. The coastal current system will be more strongly influenced by the changing meteorological conditions than other coastal areas of the Mediterraeean, and there is evidence that changes of the order of 0.5 ms^{-1} do occur at times.

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A. VATRICAN
Centre Scientifique de Monaco
MONTE CARLO
Principauté de Monaco

The problem of the coastal transport of pollutants has been studied as part of various other investigations, and has involved specifically the use of coloured tracers (rhodamine) and surface tracers (polyurethane).

In 1972 a study was made of the hydrologic conditions in a zone some 800 m from the coast on the 90 m isobath, in a project concerning emissions into the sea along the coast of Monaco. This study, using a Plessey 21 recording current meter yielded more than 26,000 data points in a period of 14 months. These data were coded and transmitted to a receiver ashore as they were recorded.

Since 1975 a national programme of surveillance has been developed, including the collection of physical oceanographic data. These now have to be selected, processed and interpreted.

In connection with the DRIFTEX projects, the Centre, together with the Groups at Villefranche and Genoa, released driftcards in April during the preliminary exercise in the Ligurian Sea. The returns are now being analysed with the assistance of IOC.

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A. CRUZADO
Instituto de Investigaciones Pesqueras
BARCELONA
Spain

Basic studies performed within the framework of the pilot project are:

- time series at three hydrographic stations located on a section to the SE of the port of Barcelona from May 1975 to November 1976;
- studies on the fresh water plume formed by the Rio Besos. These studies, initiated recently, have mainly been dealing with sampling of sediments in the neighbourhood of the river outlet;
- theoretical studies on the hydrodynamical processes driving coastal circulation:

  (a) Wind-driven coastal circulation
  (b) Estimation of currents from the density field.

Complementary studies: These studies, although of direct relevance to the project, have been carried on independently:

- two cruises, covering the whole Catalonian Sea, in October 1976 and March 1977;
- theoretical studies of the diffusion processes as applied to two characteristic phenomena:

  (a) evolution of the thermocline
  (b) structure of a polluted plume.

Preliminary results

- the area of the present studies, being rather open to the general circulation pattern in the Catalonian Sea, is flushed by the N to S general current system;

- a stable surface layer is formed by the combined effect of fresh water discharge, especially the northern coast, and the development of a thermocline;

- the predominant wind tends to spread the surface layer towards the E; the pollutants enter a small scale eddy system and recirculate in this direction;

- the frequency of wind variation, both in speed and direction, make the small scale coastal circulation unpredictable. Therefore, small scale current measurements have to be compared with local winds, while the large scale general transport should be associated with the density structure of the whole Catalonian Sea.

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N. CANO (Director)
Laboratorio Oceanografico de Malaga
Instituto Espanol de Oceanografia
MALAGA
Spain

In the field of work related to MED VI, studies are being made of the geostrophic currents in the whole of Alboran Sea from the Strait of Gibraltar to the meridian through Oran - Capo de Palos.

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U. UNLUATA
Marine Science Department
Middle East Technical University
ANKARA/Mersin
Turkey

The Mersin field station is presently operational, and the research related to MED VI is planned to start towards the end of June 1977.

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L. JEFTIC
Centre for Marine Research
"Rudjer Boskovic" Institute
ROVINJ/ZAGREB
Yugoslavia

During cruises in Rijeka Bay in June, August, September and December 1976 and March 1977, samples and observations were taken at 22 stations.

The following basic parameters were measured: temperature, salinity, dissolved oxygen, surface currents (driftcards and drifters), subsurface currents (recording current-meters) and meteorological variables.

Temperature and salinity were measured at all stations at standard oceanographic depths. Currents were measured at either two or three depths with self-recording current-meters for a period of at least 24 hours and at most 72 hours (recording every five minutes).

The following complementary parameters were also measured: pH, alkalinity, nitrates, nitrites, ammonia, phosphates, solicates, zinc, cadmium, lead, copper, surface-active substances, dissolved hydrocarbons, phenols, detergents, phytoplankton, zooplankton, benthic communities, total coliforms, faecal coliforms, heterotrophs, etc.

The Centre plans to continue with the above programme on a seasonal basis.

The following conclusions were drawn:

(1) Exchange of water masses from the Rijeka Bay is mainly through Vela Vrata and Srednja Vrata; the exchange through Tihi Kanal is relatively unimportant.

(2) Absolute values of currents in Tihi Kanal, Vela Vrata and Srednja Vrata are greater by a factor of 5 than in the rest of the Rijeka Bay. Maximum average current is about 1 knot, and maximum recorded current velocity was 1.6 knots.

(3) There is no direct correlation between currents in Tihi Kanal and in other channels.

(4) In the northwestern part of the Bay there is a rather complex movement of water masses, primarily due to the influence of fresh water springs.

(5) The intensity of currents decreases from the surface to the bottom by a factor of 5.

(6) There is a transport of water between Vela Vrata and Srednja Vrata. This is proved by driftcards and by surface and subsurface current measurements.

(7) The bottom layer is rather stagnant; water masses of higher salinity accumulate in this layer.

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M. ZORE-ARMANDA
Institute for Oceanography and Fisheries
SPLIT
Yugoslavia

This research centre is engaged in studies in the following region of the Eastern Adriatic coast: Zadar, Sibenik, Split and Dubrovnik. Earlier investigations have been made in all these areas, and particularly for the Zadar region there is a large quantity of data. A long time-series exists for the Split region.

At present, there are four stations in each region where data have been collected seasonally, including current measurements, turbidity measurements and dye diffusion experiments.

All the stations are placed in areas not deeper than 60 m and less than 2 miles offshore. In the warm period, starting from the middle of April, vertical stratification is well developed. A thermocline occurs at depths between 10 and 20 metres, but often it cannot be clearly determined since there is a temperature gradient from surface to bottom. In the cold period, from October onwards, vertical mixing is strong, and most often no layers can be detected. Summer surface temperatures vary from 22 to 26°C and salinity from 33 to 37.8°/oo. Winter surface temperatures range between 11 and 14°C. Salinity is highest in October, and lowest in May. Annual fluctuations are rather high.

Current observations indicate the presence of essentially two layers. In the warm period the thermocline separates the surface layer from the bottom layer. This layer shows some specific dynamic properties. In some places, such as Dubrovnik, the bottom layer begins at a considerable depth, and in others (Kastela Bay near Split) it begins at no more than 10 metres depth.

The surface layer is, in the first place, characterised by the predominance of a current in the NW direction. This is the direction of the current entering the Adriatic and circulating along its eastern coast. Western and northern directions also occur frequently. The W direction seems to represent the offshore current connected with the bora (NE wind).

The compensatory currents of the bottom layer flow mostly towards the SE, E and NE; the last two are the shoreward directions. Therefore, two types of circulation occur in the coastal area: one correspondent to the open sea circulation (surface NW and bottom SE direction), and the other occurring between the coastal area and the open sea with offshore flow in the surface layer and shoreward flow in the bottom layer.

The NW direction is predominant in all the seasons. The W direction has the highest frequency in winter, which may indicate its connection with the bora.

Periods of several days are important in the current field. For the time being the character of these oscillations is not clear.

Tidal currents have small velocities. On an average they are 4-5 cm/sec. This is due to the small range of the tides.

Tidal currents are predominantly of a rotating type (current vector perform ellipses). Sometimes they are reversing (e.g. in Zadar channel).

Current velocities in the coastal areas are somewhat lower than those in the open sea. The average speed in the open middle Adriatic is 20 cm/sec.

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2.7 MED VII : Coastal Water Quality Control: (WHO/UNEP)

T. EDIPIDES
Laboratory of Hygiene
Medical School
University of Thessaloniki
THESSALONIKI
Greece

For the last ten years, the laboratory has done work on coastal water and shellfish pollution measuring the following parameters:

Coliforms; E. Coli; enterococci; salinity; temperature; turbidity; dissolved oxygen; BOD_5; nitrates; nitrites; heavy metals (Hg, Cd); hydrocarbons; vibrio; salmonella.

The above work is continuing and, in addition, at three stations in the recreational area, the laboratory is carrying out activities following the suggestions made in the operational document of the project.

It is planned to extend the work and to include an epidemiological study and studies on viruses in seawater and shellfish.

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J. PAPADAKIS, S. SOTIRACOPOULOU and S. THALASSINOU
Environmental Pollution Control Project
Ministry of Social Services
ATHENS
Greece

A sampling programme around the Attica Peninsula (area of Greater Athens) and the Saronikos Islands has been established. Data for 1975 and 1976 were analysed for faecal coliforms (multiple tube method used).

The following programme is being initiated:

1) Monitoring programme covering beach zone and recreational waters. Frequency of sampling and analysis: as set out in the operational document for MED VII project.

   Parameters measured:

   - Coastal seawater: temperature, salinity, dissolved solids, turbidity, total coliforms, faecal coliforms (E.coli), faecal streptococci (enterococci);

   - Sediments: organic carbon, chlorophylls, particle size analysis, fungi C. albicans.

2) Monitoring programme concerning shellfish covering: water in culture area, sediments and shellfish.

   The parameters which will be measured are:

   Total coliforms; faecal coliforms; faecal streptococci; and in addition other parameters will be monitored related to epidemiological conditions such as Salmonella and Vibrio (cholerae, NAG, parahaemolyticus).

3) Epidemiological-microbiological study of the health risks related to beach and coastal pollution.

   A preliminary survey at selected sites to determine water quality indicators with the view of evaluating the feasibility of conducting an epidemiological study in coastal areas of Metropolitan Athens is being implemented.

4) A laboratory study of bacterial die-off or disappearance rate in the Saronikos Gulf is being carried out.

5) A study of microfauna and periphyton of coastal areas is aimed at assessing the existing situation and the identification of pollution and their possible evaluation.

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H. SHUVAL (Director)
Environmental Health Laboratory
Hadassah Medical School - Hebrew University
JERUSALEM
Israel

The laboratory analysed statistically 14 years data (1963 - 1976) of bacteriological monitoring of the Tel-Aviv bathing waters which handles approximately 10,000 bacteriological test results and the environmental data collected at 17 sampling stations. Coliforms and E. Coli tests are carried out in parallel. The coefficient of correlation between total coliforms and E. Coli is .91. The results of parallel total coliform and E. Coli tests at various beaches also indicate that the guideline currently used in Israel of 2400 coliforms/100 ml is about equivalent to an E. Coli guideline of 1000/100 ml with agreement in 86% of the cases.

Following studies on die-away of coliforms and enteric viruses, new studies to determine the in situ die-away rate of enteric viruses in the sea in the vicinity of the sewage outfall in Tel Aviv are being planned utilizing new sensitive methods for detecting a few viruses in sea water samples of 100-500 litres. Also a study to compare the three standard bacterial tests with enteric virus concentrations at beaches is being planned using these same methods.

An epidemiological study of desease rates among bathers and non-bathers at beaches of varying levels of bacterial pollution in the Tel Aviv area is being planned along the lines recommended by the WHO Expert Consultation on Health Criteria and Epidemiology of Health Risks related to Beach and Coastal Pollution, Athens, 1-4 March 1977.

The laboratory is planning to offer a specialized training course in new techniques for concentrating and detecting viruses in sea water for scientists participating in the MED VII programme. The programme could also include training in methods for detecting microbial aerosols created by sea spray from polluted coastal areas. Training possibilities on an individual basis can also be arranged.

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M. REBHUN (Director)
Environmental Engineering Laboratories
Technion, Israel Institute of Technology
HAIFA
Israel

In the field of marine pollution, the research activities in the Environmental Engineering Laboratories were directed mainly to monitoring sewage outfalls and studying presence, activity and survival of various indicators and pathogenic bacteria (salmonella, Vibrio cholerae) in the marine environment as compared to E. coli bacteriophages and human enteric viruses.

In the MED VII research programme it is proposed to study the fate of bacteria (indicator and pathogenic), E. coli bacteriophages and human enteric viruses in the sea, in the vicinity of two waste water outfalls. One is at the mouth of the Kishon river and the second opposite the Tirat Hacarmel community.

The study will be carried out in five sampling points, two in the Kishon river area, two in the Tiral Hacarmel area and one, the control point, north of the T.H. outfall.

Frequency of sampling will be once a month.

The fate of the following organisms will be studied:

E. coli and bacteriophages; coliform bacteria; faecal streptococci; salmonella; and human enteric viruses.

Since fish living and growing in polluted water may harbour and concentrate bacteria as well as viruses, and therefore constitute a public health hazard, it is proposed to study the recovery of the above-mentioned organisms from various organs of fish living in the vicinity of the outfalls.

It is proposed also to study the recovery of the above-mentioned organisms in the sediments as compared to the water samples taken from the same sampling points.

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Y. YOSHPE-PURER (Director)
The Dr. Felix Public Health Laboratory
Ministry of Health
TEL AVIV
Israel

The Ministry of Health initiated coastal water monitoring in 1950 and established internal guidelines for coastal water quality at 2400 total coliform organisms/100 ml.

The length of the Mediterranean coastline is about 180 km. In 1976 the Ministry of the Interior, on the recommendation of the Ministry of Health, approved 65 public bathing beaches along the Mediterranean; four were closed during the season because of visible signs of pollution and bacterial counts higher than that recommended by the Ministry of Health.

The total number of sea water samples collected during 1976 was 1213 from 47 monitoring stations - 251 during the winter and 462 during the summer (April to September). In addition to total coliform tests on all samples, 900 samples were also tested for faecal coli.

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R. PASSINO
Institute for Water Research - CNR
ROME
Italy

As regards coastal pollution problems the CNR Water Research Institution has initiated an in-depth research programme in the estuarine zone of the river Tiber. The present programme includes physical and chemical as well as micro-biological and biological measurements. Also, eutrophication problems and their effects of coastal water quality are being studied.

For the purpose of project MED VII a pilot zone in front of the mouth of the river Tiber was designated in the course of the first year. About 20 monitoring and sampling sites were established. During the first phase of the problem, surface samples only were taken once or twice a month, but during the coming year, vertical distribution will also be taken into account.

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L. VILLA
Istituto Superiore di Sanit:
Viale Regina Elena 299
ROME
Italy

The zone chosen for the study concerning MED VII Project is the sandy municipal beach of Castel Porziano (about 2 km long). This is located on the Tyrrhenian Sea between the Rome and Torvaianica beaches. The beach is limited by two canals.

Sampling points are situated at a distance of about 400 m from each other along the beach. Two other sampling stations are located in the two canals in order to evaluate their pollution load.

In the above-mentioned area the mandatory part of the programme is carried out. The detection of Salmonella and of anti-coli and anti-Salmonella bacteriophages will be effected as facultative analyses.

The work began in the first days of May 1977, following the methodology for the MED VII Project.

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F. L. PETRILLI (Director)
Institute of Hygiene
University of Genova
GENOVA
Italy

The Institute of Hygiene of the University of Genova has a lengthy tradition in the study of coastal water quality. More recently, detailed studies on the hygienic conditions of coastal waters, with particular regard to the situation in the Ligurian Sea, were extensively reviewed in 1965 and 1972.

The hygienic conditions of the water off the coast of Leghorn, Tuscany, were also investigated two years ago. A survey was also carried out in coastal waters around the Elba Islands by performing bacteriological analysis in situ.

In the field of microbiological monitoring of sea water, an apparatus has been designed for the cumulative sampling of water over a pre-established period.

In particular the problem of the virological monitoring of sea water, as related to the bacteriological parameters of pollution, has been examined. By using the selected polyelectrolyte method, the virological monitoring was carried out on samples of coastal water with various levels of bacteriological pollution.

Additional investigations were carried out to study the problem of virus accumulation and release in clastic sediments of coastal waters.

A series of studies was concerned with detection of microelements in shellfish (Mytilus galloprovincialis) and in crustaceans (Meganyctiphone norvegica) collected in the Ligurian Sea.

Epidemiological surveys have been initiated to try to determine a possible association between sea bathing and a number of diseases. Two groups of school children (10 - 12 years old) were investigated with the help of questionnaires. One of the groups spent its summer holidays at the seaside and the other in the mountains. A statistical study of the two groups based on the completed questionnaires is now in progress.

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S. GENOVESE (Director)
Institute of Hydrobiology and Fisheries
University of Messina
MESSINA
Italy

The coastal areas studied during the last years are as follows:

1974: Saline-Augusta open waters, four cruises (in press with Rev. Intern. Oceanogra. Med.)

1975: Augusta coastal zone, three cruises; Stretto coastal zone, three cruises.

1976: Stretto, two cruises; Milazzo, two cruises.

1977: Stretto, one cruise; Milazzo, one cruise; Augusta coastal zone, two cruises.

The following cruises are planned for 1977: Milazzo, two cruises; Patti, one cruise; Vibo Valentia, one cruise; Augusta coastal zone, two cruises; Augusta open waters, two cruises; Capo Passero, three cruises.

Measured parameters are: temperature; salinity; oxygen; oxygen saturation; pH; total alkalinity; specific alkalinity; Seston 80°C and 800°C gravimetric; ammonia; nitrites; nitrates; phosphates; sulphates; BOD_5; oils/greases; total charge of heterotrophic water; total coliforms; faecal coliforms; petroleum bacteria (qualitative for crude oil and quantitative for diesel); total charge of heterotrophic sediments.

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L. MENDIA (Director)
Centre for Study and Research in Sanitary Engineering
Irstitute of Water Supply and Wastes Disposal
University of Naples
NAPLES
Italy

Specific MED VII analytical activities have not yet started because of organizational difficulties. However, numerous activities have taken place with a view toward the development of the future analytical programme and in the more general field of coastal water quality control.

Analytical methods have been reviewed and discussed with specialist microbiologists and analytical chemists. A critical review of the Draft Guidelines for Monitoring Public Health Aspects of Coastal Water Quality will follow.

Criteria, guidelines and standards for coastal recreational waters and beaches have been discussed at several meetings as well as at the national level. A review of the criteria adopted by EEC has been developed mainly with reference to the present criteria adopted by the Italian authorities.

The possibility of collaborating on the research programme with the Zoological Station of Naples has been discussed with the director, Prof. A. Monroy, and it is expected that an agreement will be reached soon. A joint activity is planned for August to monitor the Bay of Naples. A specialist of the University of Newcastle-upon-Tyne (Mrs. Evison) has been invited to the Zoological Station of Naples to carry on (for the second year) bacteriological monitoring of the Bay. The methodological lines of MED VII will be followed.

Concerning the general problem of the coastal water quality control, a "Strategy for Coastal Management" has been developed which, it is hoped, will bring the problems within reach of solution.

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L. MAJORI (Director)
Institute of Hygiene
University of Trieste
TRIESTE
Italy

The Institute of Hygiene has been working on problems of marine pollution for about 10 years, co-ordinated within the framework of the National Research Council.

The first part of the study was aimed at obtaining a pollution map of the North Adriatic from Trieste to Ravenna.

Further research on a sampling zone including the Marano lagoon, which is highly polluted, and its sea front was directed toward the study and comparison of microbiological parameters (E. coli, total bacterial load at 34°), physical parameters, biochemical, temperature, OD, BOD, detergents, chlorides, orthophosphates, polyphosphates, ammonia, etc.) to try to define the validity of their utilization in marine pollution research and in the study of the diffusion of pollutants.

Methodological research is under way for the detection of enteric pathogens such as salmonella and viruses.

The Institute of Hygiene of Trieste is prepared to collaborate in the MED VII project in the following research:

1) Methodological evaluation of micribiological, chemical and biochemical tests;

2) Determination of polluted areas by microbiological tests (E. coli, streptococci faecalis, enteropathogens (bacteria and viruses).

Collaboration between the various groups working in the North Adriatic is to be hoped for. For example, some agreements have already been reached with the Marine Biological Station in Portoroz, Yugoslavia.

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H. KOUYOUMJIAN/F. GHORRA
Marine Research Centre of Jounieh
National Council for Scientific Research
P.O. Box 11-8281
BEIRUT
Lebanon

It was not possible to accomplish much actual research throughout last year (1975-76) for obvious political reasons. However, presently action is under way for upgrading the Centre's capability and reassessing the intention for full participation.

In Lebanon, there are a number of institutions undertaking studies along the lines of MED VII project. One of these institutions is the newly established Marine Research Centre of Jounieh. Currently, different institutes use different methodologies, and not all collected data is readily available or published. Parameters routinely measured include counts for E. coli, streptococcus faecalis, BOD, O_2, S:/::

The participation of the Centre aims at adopting common and accepted methodology within the Mediterranean, and advising relevant authorities on bacteriological standards.

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L. J. SPITERI
Public Health Laboratory
Health Department
Ministry of Health and Environment
VALLETTA
Malta

Samples of sea water are anlysed bacteriologically by the multiple tube dilution method and the results are expressed as MPN per 100 ml samples. These samples are submitted routinely by the health inspectors for examination. When the level of E. coli exceeds 1000 per 100 ml or coliforms are in excess of 1800 per 100 ml bathing is prohibited.

Three main areas will be monitored within the framework of project MED VII, Mellena Bay, San Luciano and Renella. The monitoring will be carried out according to the mandatory part of the operational document using the membrane filtrations method.

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C. C. SOLAMITO (President)
Centre Scientifique de Monaco
MONTE CARLO
Principauté de Monaco

The Laboratory of Microbiology and Studies of Marine Pollution, department of the "Centre Scientifique de Monaco" has been working since November 1966 on coastal water quality control.

Samples of sea water are collected along the coast (3 km long) at 10 stations, once a week, at the surface and at three meters depth, for examination for coliform, E. coli, streptococcus faecalis, and Salmonella by the method of membrane filtration.

During the "swimming season" from May to October, water is collected in the beach area at 20 supplementary points.

Studies on currents and winds, factors of dispersion and diffusion of pollution have also been carried out.

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S. E. ULUG
Environmental Engineering Department
Middle East Technical University
ANKARA
Turkey

The selected Pilot Project area on Coastal Water Quality Control "Antalya Konya Alti Beach" is one of the places where the highest tourism potential is expected. The project is supported by the Turkish Scientific and Technical Research Council, the Ministry of Tourism, the Ministry of Health and Social Welfare, the Ministry of Agriculture and the General Directorate of Water-derived Resources.

The checklist of Pilot Project Activity (ICP/CEP 209) is signed by the collaborating centre (METU, Environmental Engineering Department) as the co-ordinating institute for the above interested public services.

Monitoring will include the water phase, sediments, plankton and shellfish.

Meteorological and hydrographic conditions of the area will be available from other studies carried out in the selected Pilot Project areas.

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M. LENARCIC
Marine Biological Station
University of Ljubljana
PORTOROZ
Yugoslavia

Regular monitoring was carried out along the 17 km length of coastal area at the densely populated and touristically developed Slovenian littoral of the Gulf of Trieste. The effects of pollution and its extent were assessed by monitoring complex parameters (Physico-chemical), bioproductivity, biocoemotic, bioassay, sedimentological etc) including bacterial parameters. During 1971-75 sampling took place at thirty-four (34) stations covering the above coastal area for bacteriolocial examinations, mostly at monthly intervals. Obligatory total heterotrophs grown on nutrient agar at 37°C and faecal coliforms on "Teagitol 7" medium at 44.5°C, obtained by membrane filtration, were counted. Indicatively, at selected stations and seasons, faecal streptococci and clostridium perfringens examined. The data obtained during the period of five years were evaluated statistically and the following sanitary standards were recommended to the responsible authorities for application in an up-dating of the legislation.

- shellfish culture waters: max 10 faecal coliforms/100 ml

- highly satisfactory bathing waters: max 50 faecal coliforms/100 ml

- tolerable bathing waters: max 800 faecal coliforms/100 ml

Beginning in 1975, regular bacteriological examinations have been made of the mussels (Mytilus galloprovincialis) from the polluted Port of Piran, of natural populations in clean waters of Savudrija, and in cultivation plants in Strurijan for comparison purposes. The parameters are faecal coliforms (by the multitube method) and pathogens, (Salmonella, Vibrio, Proteus, Shigella etc.) (by relevant methods).

For the purpose of the Pilot Project MED VII, it is planned to undertake the following studies:

1) Monitoring of the whole coastal sea as described above, including the obligatory part of the MED VII programme. The above study is to be co-ordinated with the investigations proposed by the Institute of Hygiene, Trieste, in order to include the whole area of the Gulf of Trieste.

2) Advanced and enlarged examinations of mussels as described above.

3) Research on the fate, behaviour, accumulation and disappearance of symbiotic and pathogenic enteric micro-organisms in experimental lagoons which will be artificially polluted by a typical domestic sewage.

In addition, in-job training facilities will be provided.

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D. FUKS
Centre for Marine Research
"Rudjer Boskovic" Institute
ROVINJ
Yugoslavia

The Bay of Rijeka in the Northern Adriatic was selected as the area in which the quality of the recreational waters was to be systematically investigated since June 1976.

Eight representative coastal stations (10-15 m from the shoreline) were selected in front of Rijeka, Volosko and Opatija. Two additional open sea stations, 500 m from the shoreline, are used as reference stations.

The monitored parameters in all stations are: total coliforms, faecal coliforms, faecal streptococci, dissolved oxygen, BOD (5 days), pH, salinity, temperature, atmospheric conditions. In addition, at the two open sea stations, nutrients, primary productivity and currents are also determined.

No attempt has been made to generalize the findings or to correlate the obtained data with the hydrographic conditions and existing land-based sources of pollution because of the high variability of the results obtained so far. This will be done when more data are collected.

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S. SOBOT
Institute for Oceanography and Fisheries
SPLIT
Yugoslavia

A sanitary survey of recreational beaches in four areas (Zadar, Split, Ston and Dubrovnik) along the Adriatic Coast was initiated and has been systematically carried out since November 1976. On 25 coastal stations (10-15 m from the shore), standard microbiological parameters (faecal and total coliforms, faecal streptococcus and heterotrophs) and accompanying physical and chemical parameters are collected in sediments and sea-water. Until May 1977 three baseline measurements were made on all stations and the frequency of sampling will be increased during the bathing season.

In one area (Ston) additional sampling of Mytilus galloprovincialis and Ostreo edulis is performed using systematic standard microbiological test procedures.

The results obtained so far indicate that all the analysed recreational waters are within the limits of sanitary tolerance, but the sites near the harbour (which are not used for recreational activities) are heavily influenced by faecal pollution.

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ADMINISTRATIVE REPORT ON THE IMPLEMENTATION OF THE CO-ORDINATED MEDITERRANEAN POLLUTION MONITORING AND RESEARCH PROGRAMME (MED POL) AND RELATED PROJECTS OF THE MEDITERRANEAN ACTION PLAN

Note: This document is an updated and revised version of a draft (UNEP/WG.11/3 (Prov.)) which was presented to and reviewed by 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)

ANNEX V: MAPS

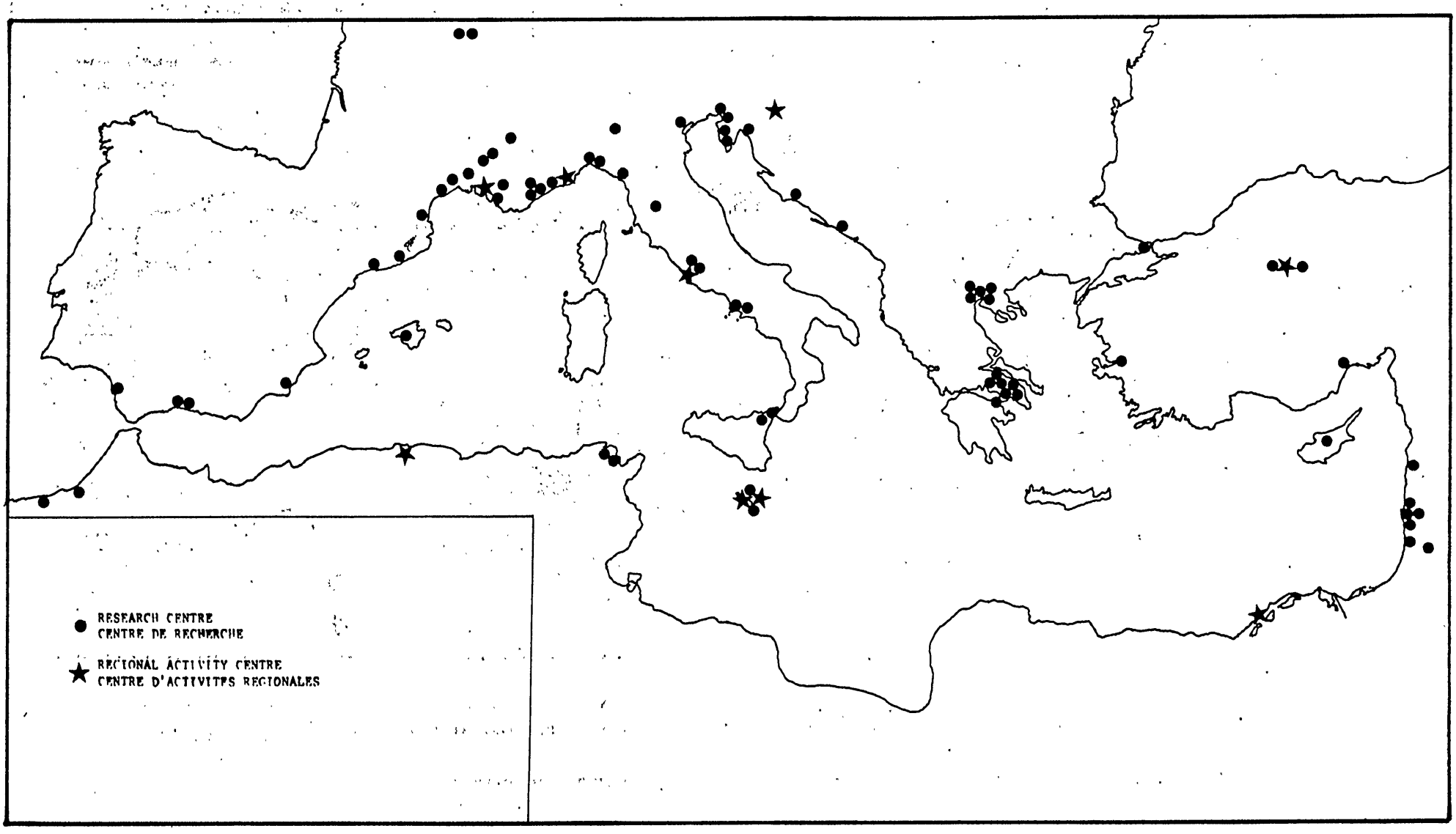
UNEP/IG.11/INF.3, ANNEX V
31 October, 1977

MAPS

This set of maps illustrates the geographical distribution of the research centres participating in various pilot projects of the Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL), of the Regional Activity Centres relevant to MED POL projects and the areas where monitoring or research activities are carried out in the framework of MED POL pilot projects.

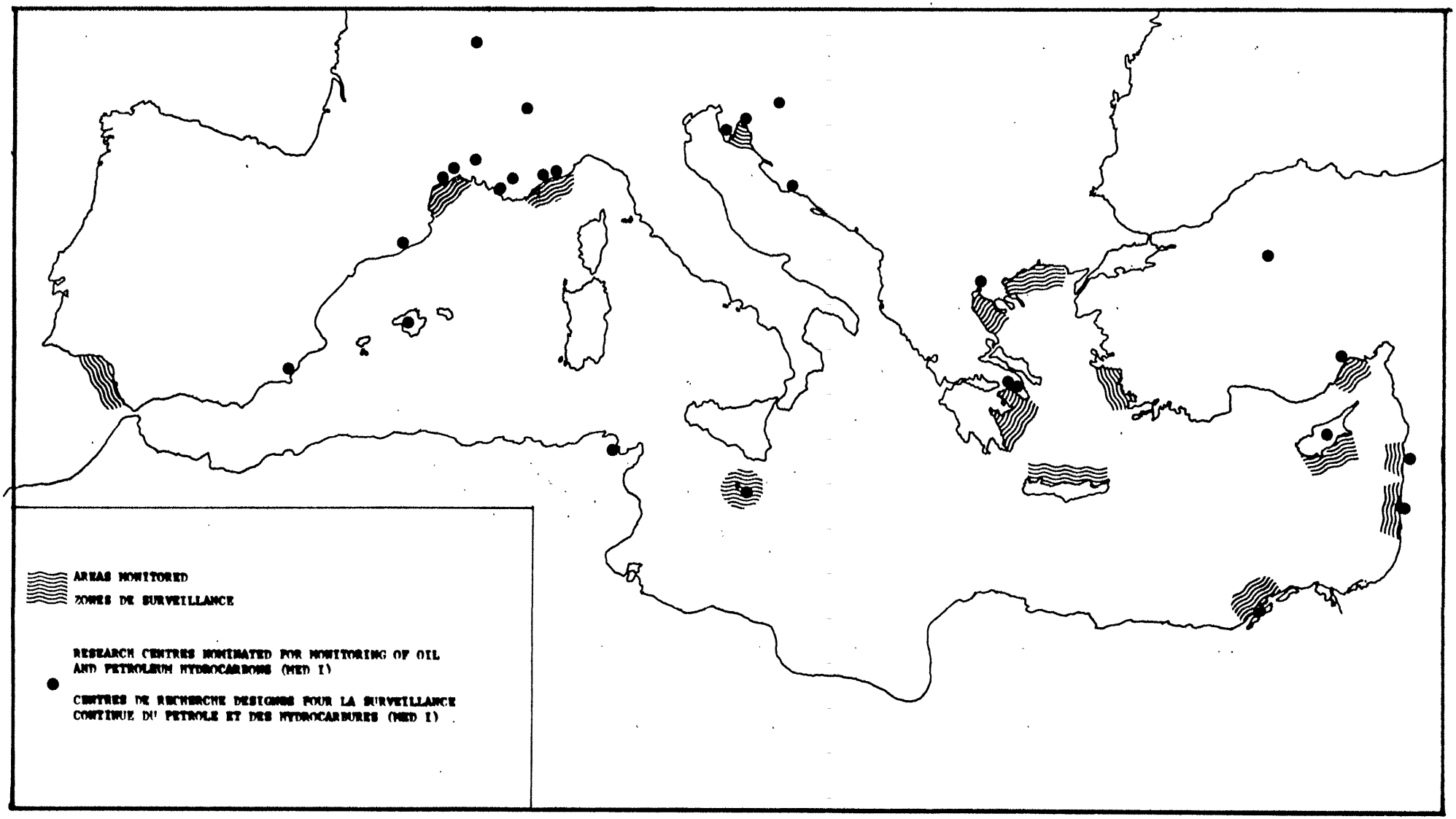
RESEARCH CENTRES NOMINATED AS PARTICIPANTS IN MED POL AND REGIONAL ACTIVITY CENTRES RELEVANT TO MED POL

CENTRES DE RECHERCHE DESIGNES COMME PARTICIPANT AU MED POL ET CENTRES D'ACTIVITES REGIONALES SE RAPPORTANT AU MED POL



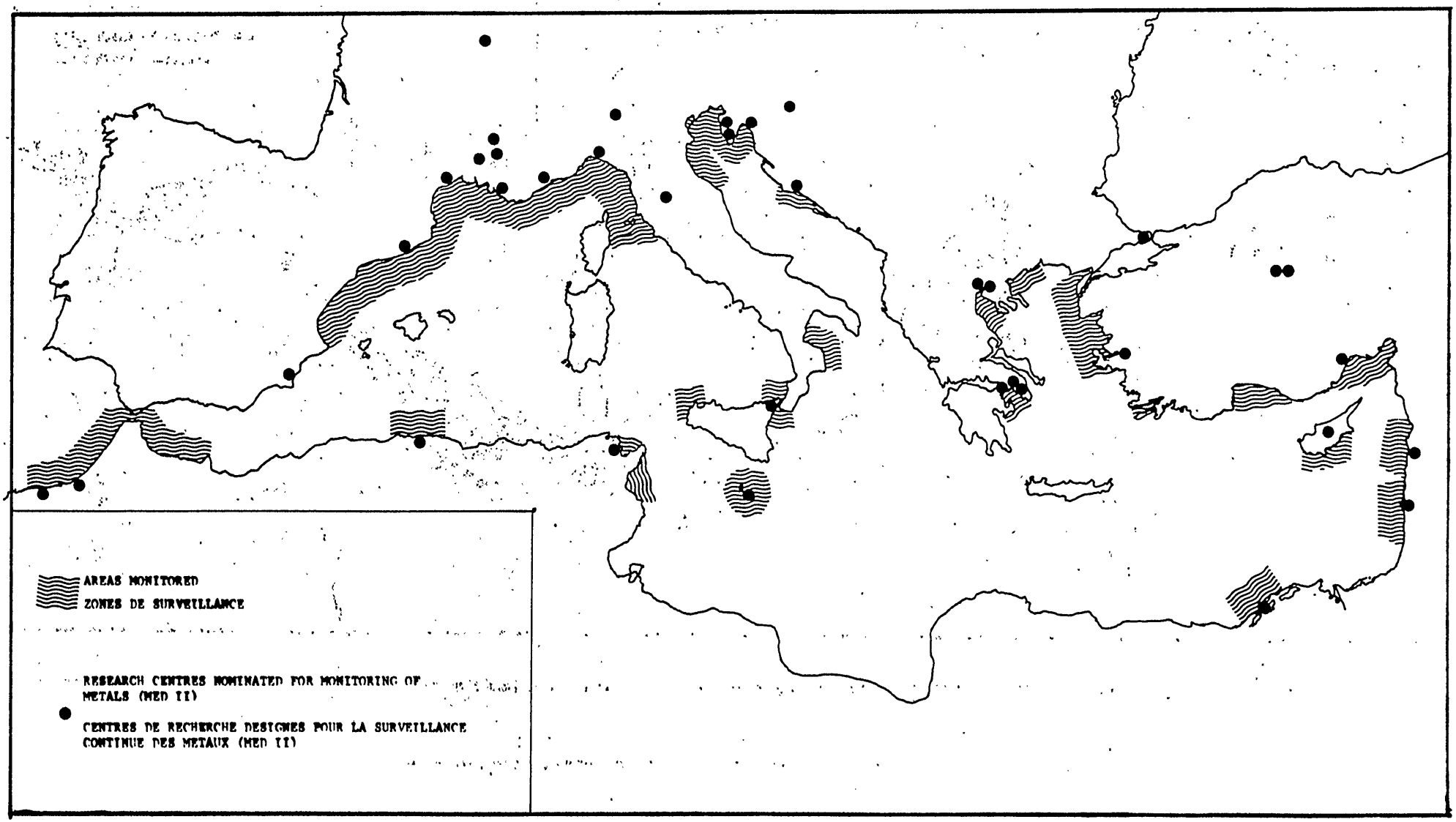
AREAS MONITORED FOR OIL AND PETROLEUM HYDROCARBONS AS PART OF MED POL

ZONES DE SURVEILLANCE CONTINUE DU PETROLE ET DES HYDROCARBURES COMME FAISANT PARTIE DU MED POL



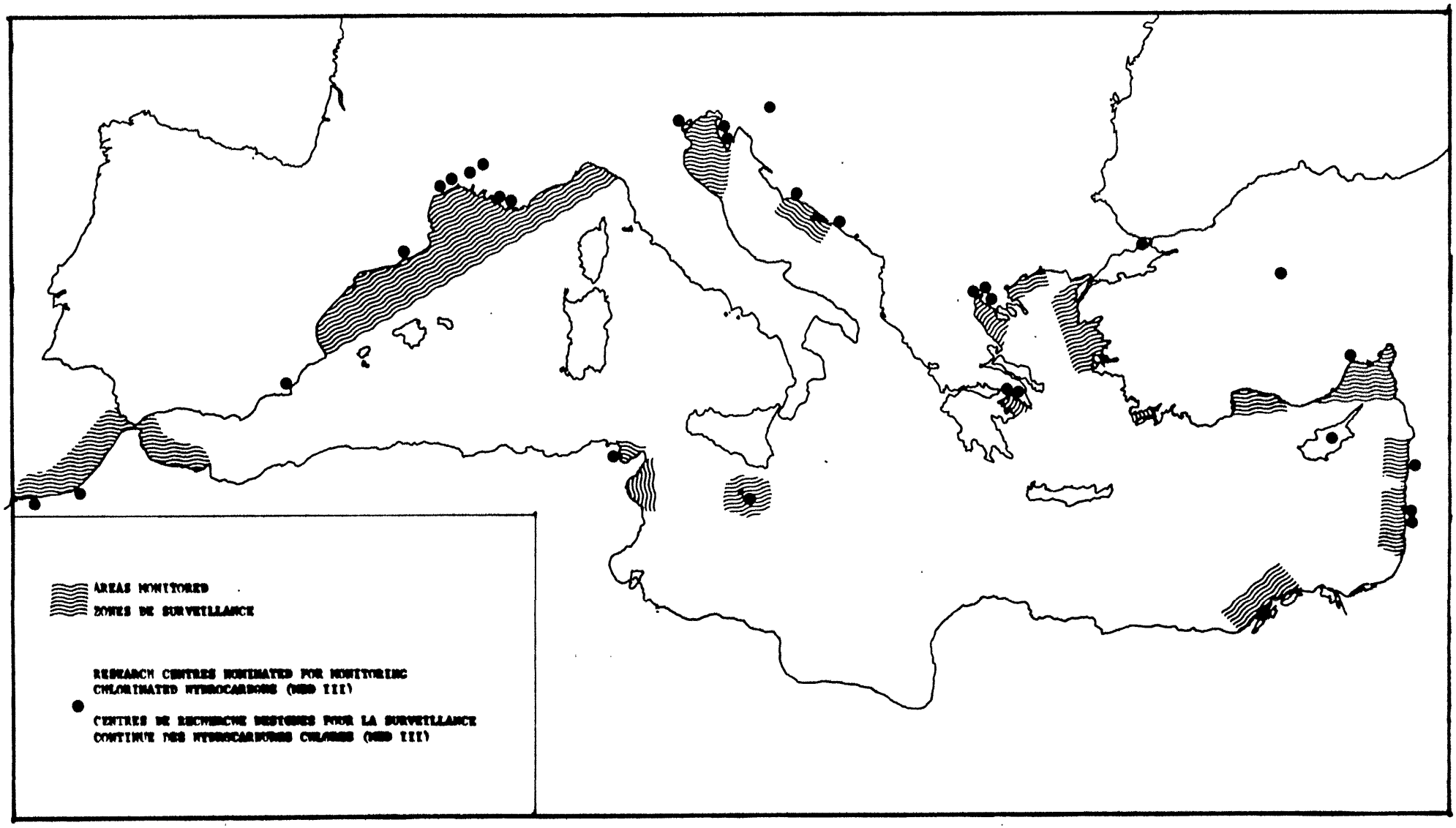
AREAS MONITORED FOR METALS AS PART OF MED POL

ZONES DE SURVEILLANCE CONTINUE DES METAUX COMME FAISANT PARTIE DU MED POL



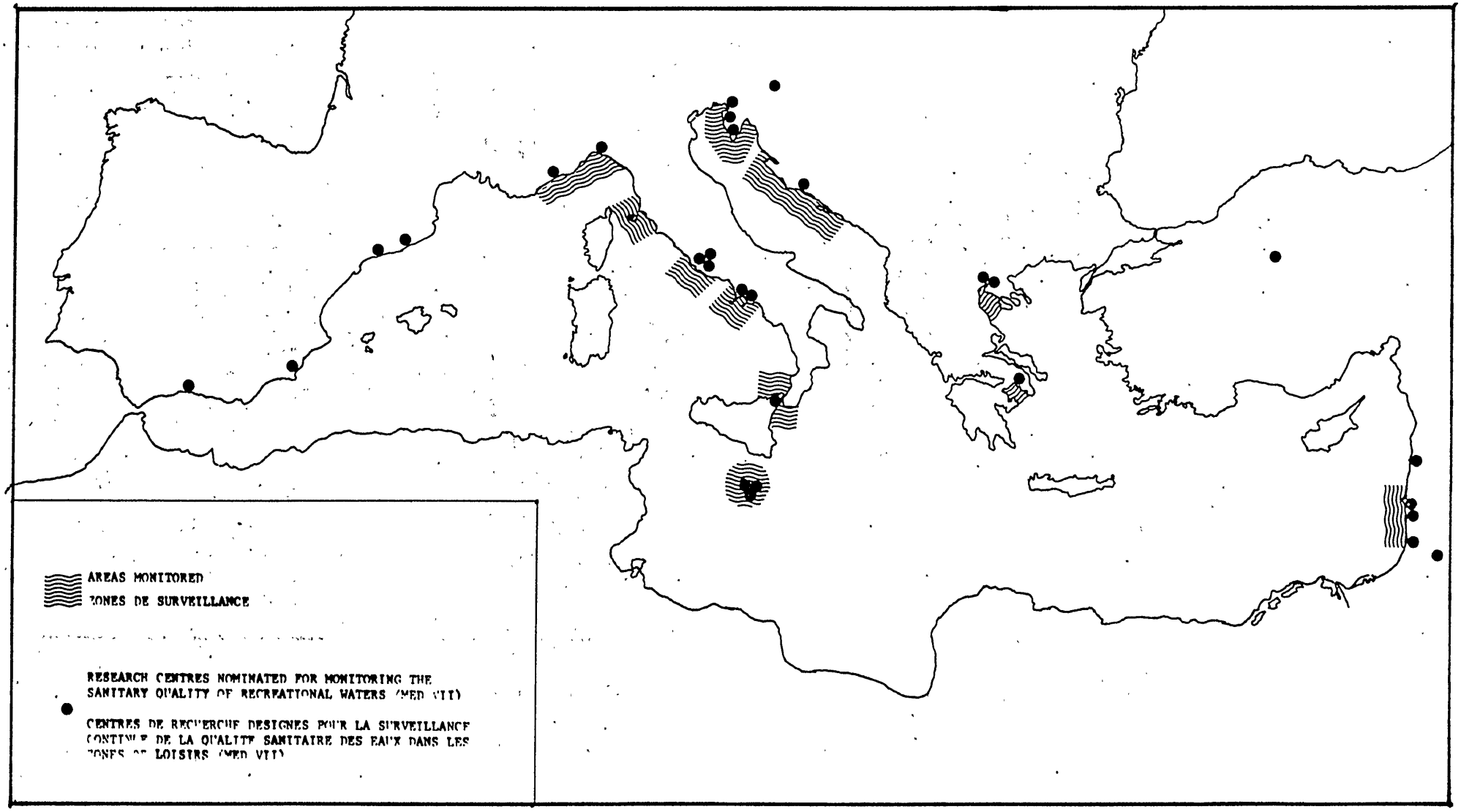
AREAS MONITORED FOR CHLORINATED HYDROCARBONS AS PART OF MED POL

ZONES DE SURVEILLANCE CONTINUE POUR LES HYDROCARBURES CHLORES COMME FAISANT PARTIE DU MED POL



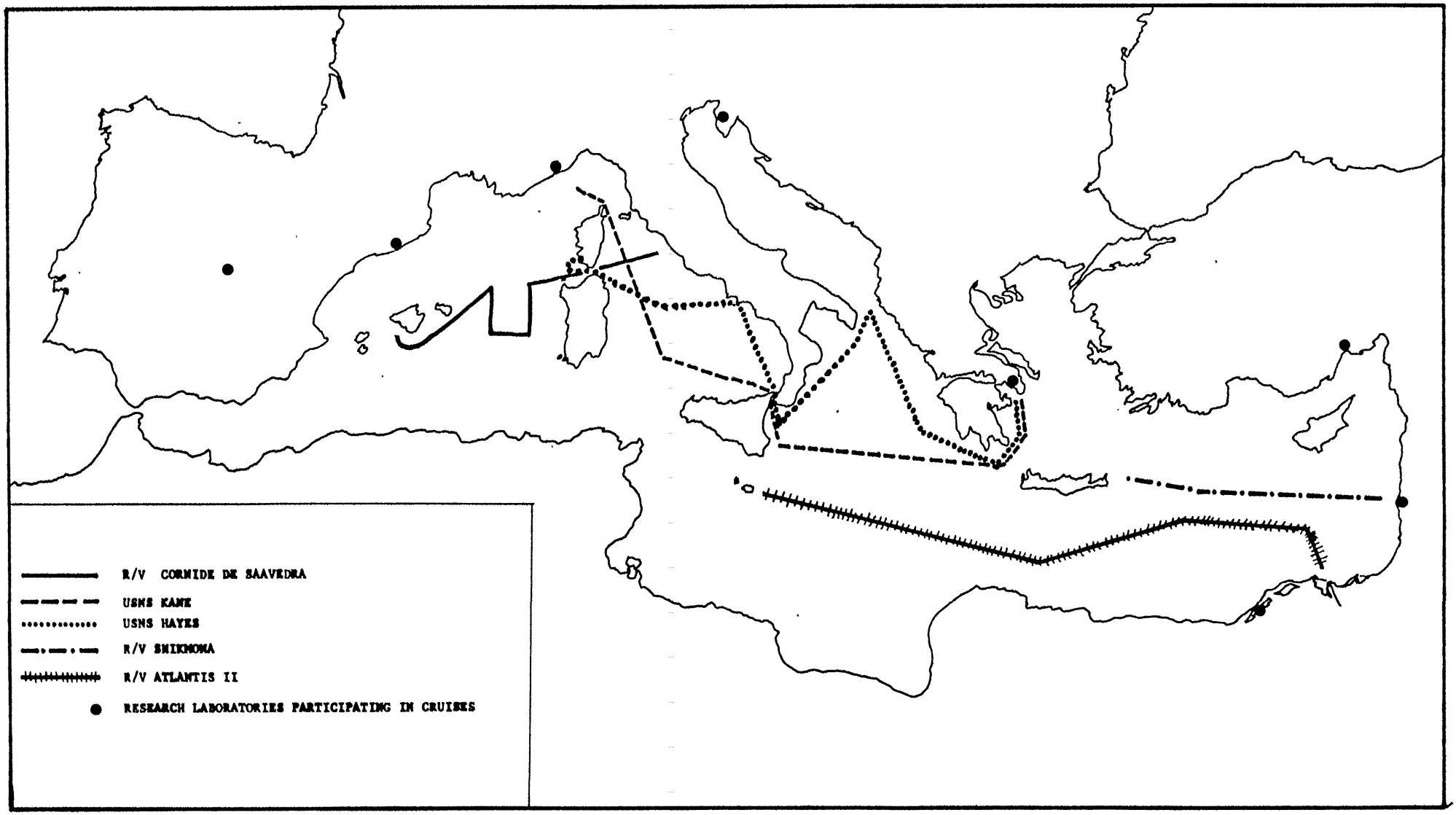
AREAS MONITORED FOR THE SANITARY QUALITY OF COASTAL WATERS AS PART OF MED POL

ZONES DE SURVEILLANCE CONTINUE POUR LA QUALITE SANITAIRE DES EAUX COTIERES COMME FAISANT PARTIE DU MED POL



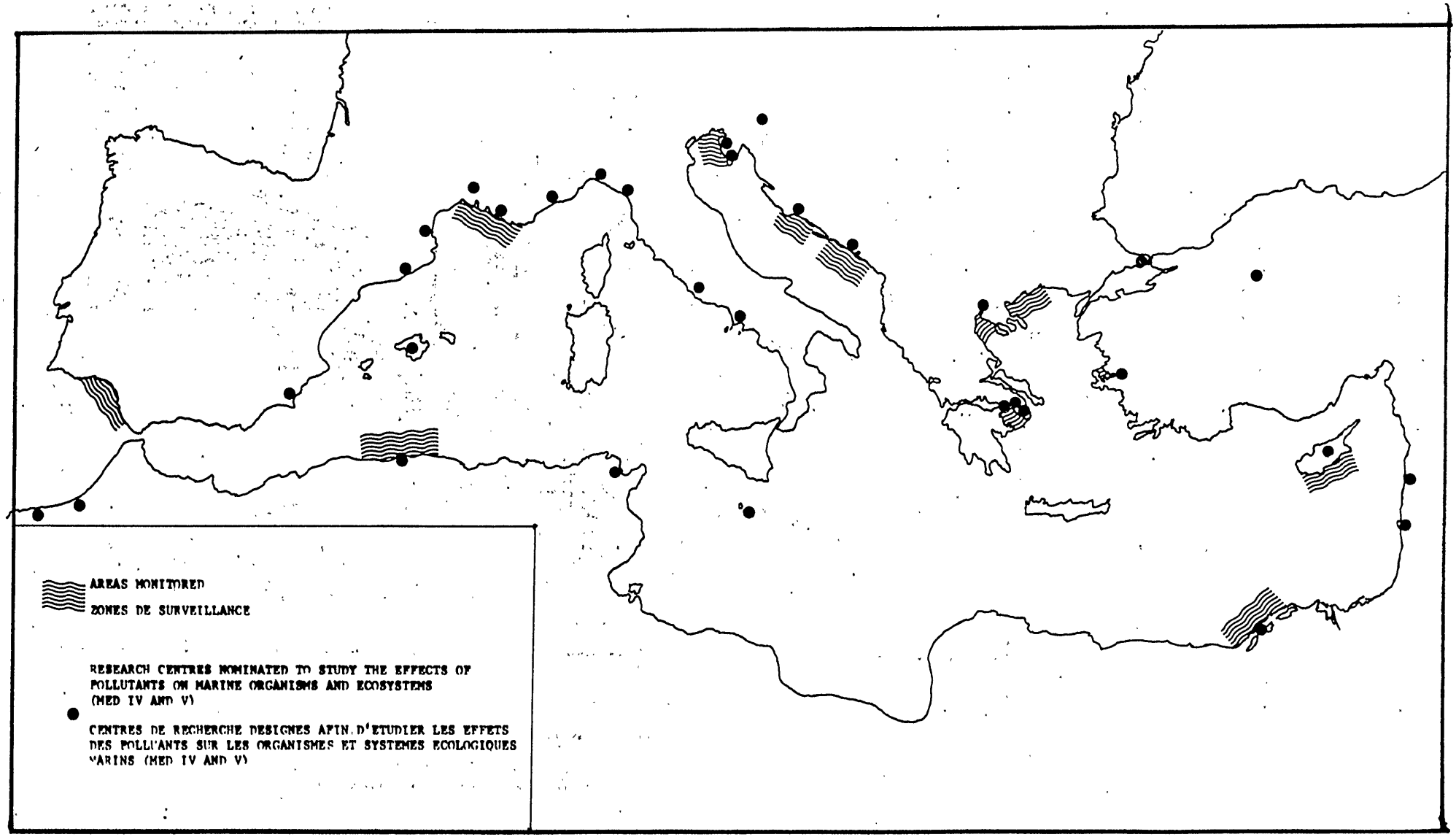
TRACKS OF JOINT CRUISES UNDERTAKEN AS PART OF MED POL.

ROUTES DES CROISIERES CONJOINTES ENTREPRISES DANS LE CADRE DU MED POL.



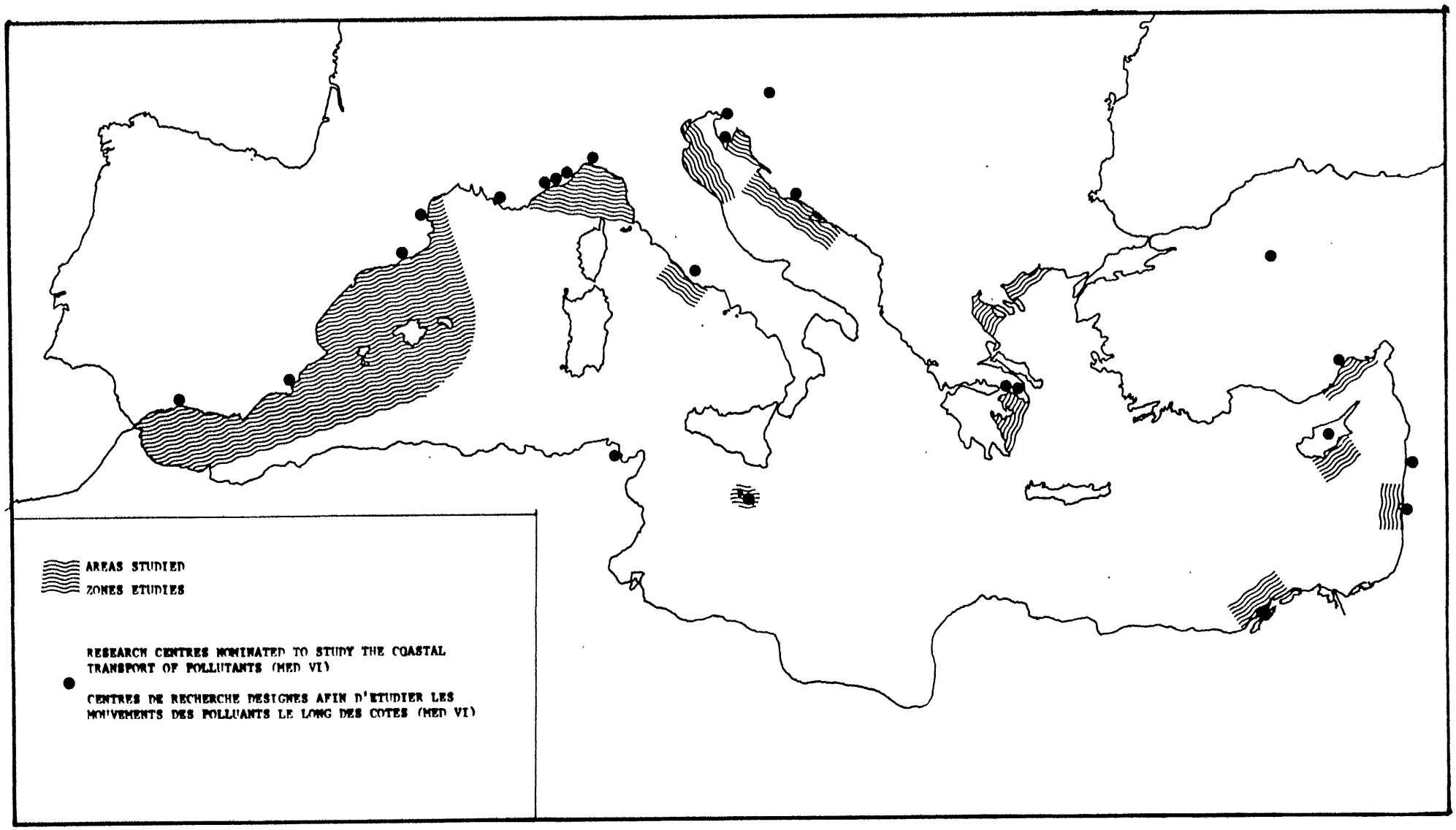
AREAS WHERE THE EFFECTS OF POLLUTANTS ON MARINE POPULATIONS AND ECOSYSTEMS ARE STUDIED AS PART OF MED POL

ZONES OU LES EFFETS DES POLLUANTS SUR LES PEUPLEMENTS ET LES SYSTEMES ECOLOGIQUES MARINES SONT ETUDIES COMME FAISANT PARTIE DU MED POL



AREAS WHERE THE COASTAL TRANSPORT OF POLLUTANTS ARE STUDIED AS PART OF MED POL

ZONES OU LES MOUVEMENTS DES POLLUANTS LE LONG DES COTES SONT ETUDIES COMME FAISANT PARTIE DU MED POL



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ANNEX VI: PROPOSAL FOR A JOINT MEDITERRANEAN CRUISE (MED CRUISE)

Proposal for a Joint Mediterranean Cruise (MED CRUISE)

This Annex is the reproduction of a proposal prepared by the IAEA/FAO/IOC/WMO/UNEP Steering Committee for a Joint Mediterranean Cruise planned for 4-6 months during 1978. The proposal was distributed to all principal investigators and heads of institutions participating in MED POL projects as well as to National Co-ordinators of MED POL asking for their comments and suggestions on the plans reflected in the document.

1. INTRODUCTION

As part of the Mediterranean Pollution Monitoring and Research Programme (MED POL), which is implemented as a 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 which can be compared with concentrations in similar matrices sampled in the coastal zones as part of the MED II and III monitoring programmes. Several expert consultation meetings have pointed out the need to obtain further data from the open Mediterranean and also the need for a 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 (paragraphs 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/Info.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.

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 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 meter 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,

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 (Figs. 1 and 2) - which are initiated and terminated at eleven different ports of call throughout the Mediterranean. The stations have been chosen so as to give good geographical coverage of all regional bodies of water which make up 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 (Fig. 3). Three examples are the Mediterranean and Atlantic 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 across the Bosporus. The detailed MED CRUISE plan is presented in Table 1.

The proposed cruise tracts and sampling stations outlined in Table 1 will require approximately four months to complete. This is considered the minimum time necessary to extensively survey the open waters of the Mediterranean. 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 will be taken by towing standard plankton nets at a depth of approximately 4 meters 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°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 approximatley 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 organisms to be collected are euphausiids, pelagic shrimp, pteropods, salps, myctophid fish, amphipods and chaetognaths, several species of which are ubiquitous throughtout the Mediterranean.

(iii) Benthic biota

Owing to the long times necessary and 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 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 alloted 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 liter 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 instal a GC 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 liter PVC Nishkin 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 shipment 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 autoanalyzer, 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 on selected stations in order to obtain a 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 scientists from abroad. This 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 3 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 alloted 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 outfitted with glass fibre filter traps and silicon 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 underway 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. Tar balls

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 use of a chartered vessel from USSR. It will be in the 50-70 meter 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.

5.2 Necessary deck, navigational and manoeuvring equipment, etc.

a. Winches

One hydrographic winch with at least 6000m 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 meters per minute.

A trawl winch is also required and should be capable of pulling a bottom dredge or trawls at depths up to 5000m. 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 in order to dredge samples in most areas of the open Mediterranean Sea is about 2500m. This winch should also be equipped with tensiometers and good capability of accurately measuring the amount of cable deployed, e.g. 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 up to 5000 meters 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, freezing space for at least 2000 liter capacity (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%) 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 observations, 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 5000m
2 induction salinometers
1 4-channel autoanalyser
1 fluorescence spectrophotometer and spare parts
2 small rubber dinghies
1 irradiance meter
2 desk top calculators
1 small centrifuge capable of 2000 g
10 plastic buckets (10 liters)
Large spool of sisal rope
Large spool of nylon cord
15 complete sets of raingear
1 quartz distillation apparatus (capable of 10 liter/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-meter plankton net rings
High speed plankton nets
2 zooplankton separators
4 1-meter diameter zooplankton nets with about 276-300um aperature
4 1-meter diameter phytoplankton nets with about 76 um aperature
4 neuston sleds and nets
2 3-meter Isaacs-Kidd mid-water trawl depressors and nets
4 Otter or beam trawls
2 bottom dredge with sieves and screen
Dip nets and hand lines
4 dissecting microscopes (30-100 X)
2000 100-ml glass plankton bottles
Adequate formal, alcohol, range of acids and fixatives
10 plastic sorting trays
5 complete dissection kits
2000 200-ml plastic bottles for sample storage

6.3 Water

2 sets of automatic pipets
6 30-liter PVC Niskin bottles (preferably on a rosette sampler with STD probe and electronic activator)
3 60-liter Bodman type bottles
100 35-liter plastic bidons
A 2000-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 backing 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 will 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.

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'W	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 9 (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	Dragica rise region
Leg 10 (5 days)		(39)	40°45'N	18°45'E	Shallow point of Otranto sill
		(40)	36°35'N	21°10'E	Deepest point in Mediterranean Sea. Bottom water formation

Table 1. PROPOSED MED CRUISE SCHEDULE

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 11 (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 12 (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 13 (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 14 (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)	35° 0'N	28°50'E	
		(65)	32°25'N	26°50'E	See Station 63
		(66)	33°35'N	26°30'E	
Leg 15 (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 16 (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)

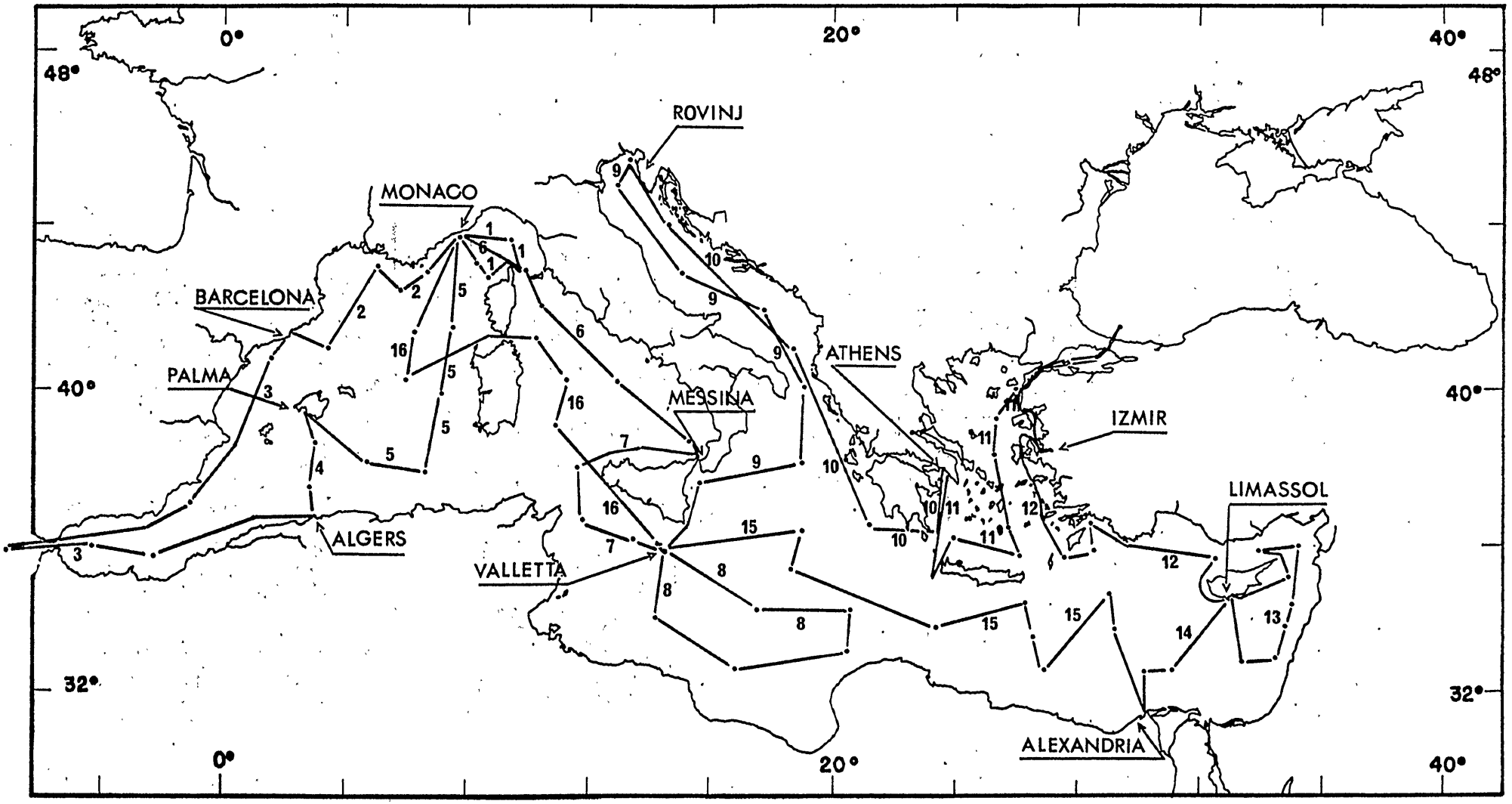

Fig. 1. 1978 MED-CRUISE tracts, Nos. 1 through 16 Points indicate standard open ocean stations (SOOS). Ports of call are also indicated. (No work will take place in territorial waters unless specifically requested by appropriate government bodies).

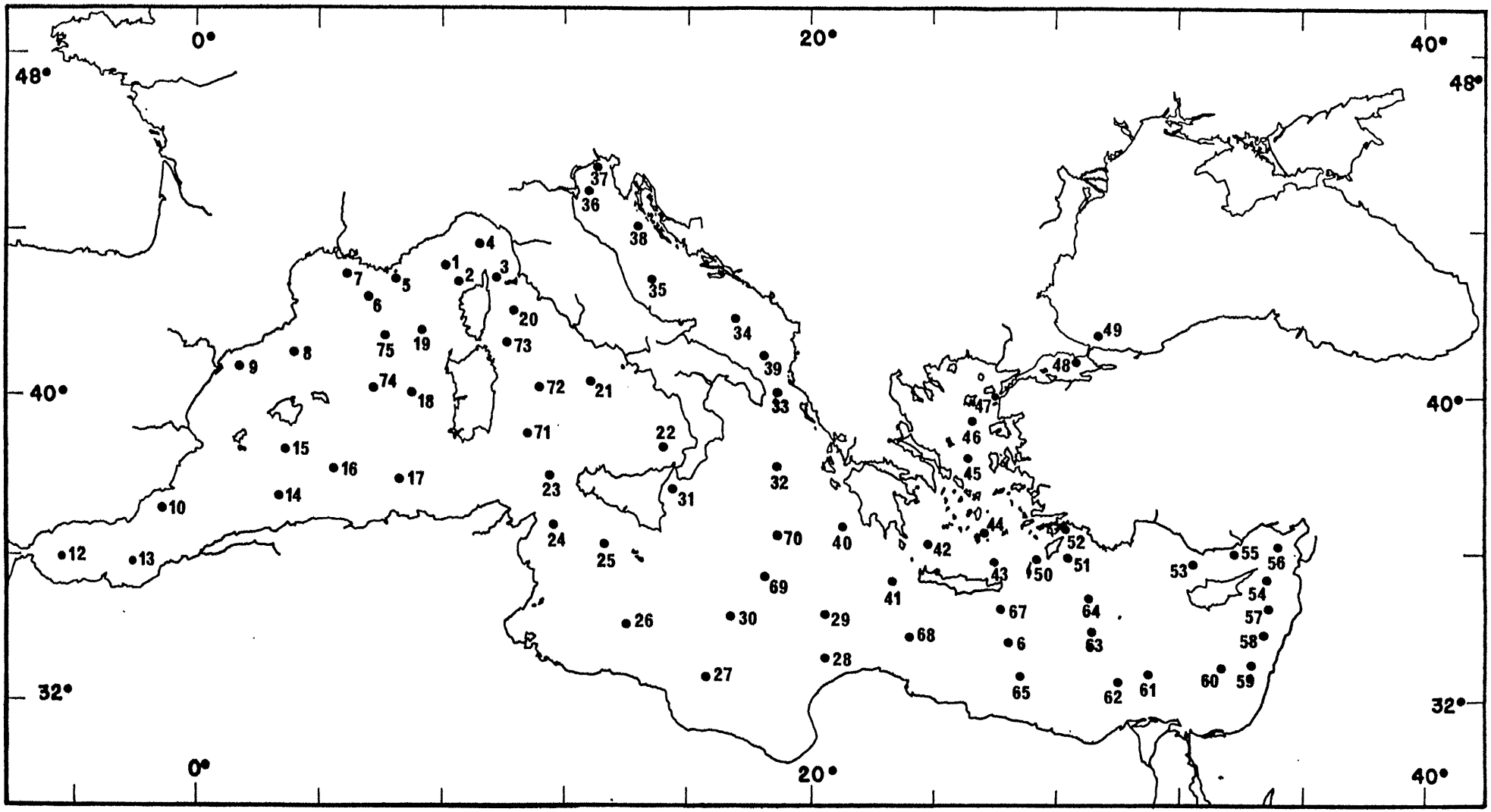

Fig. 2. MED CRUISE - standard open ocean station numbers

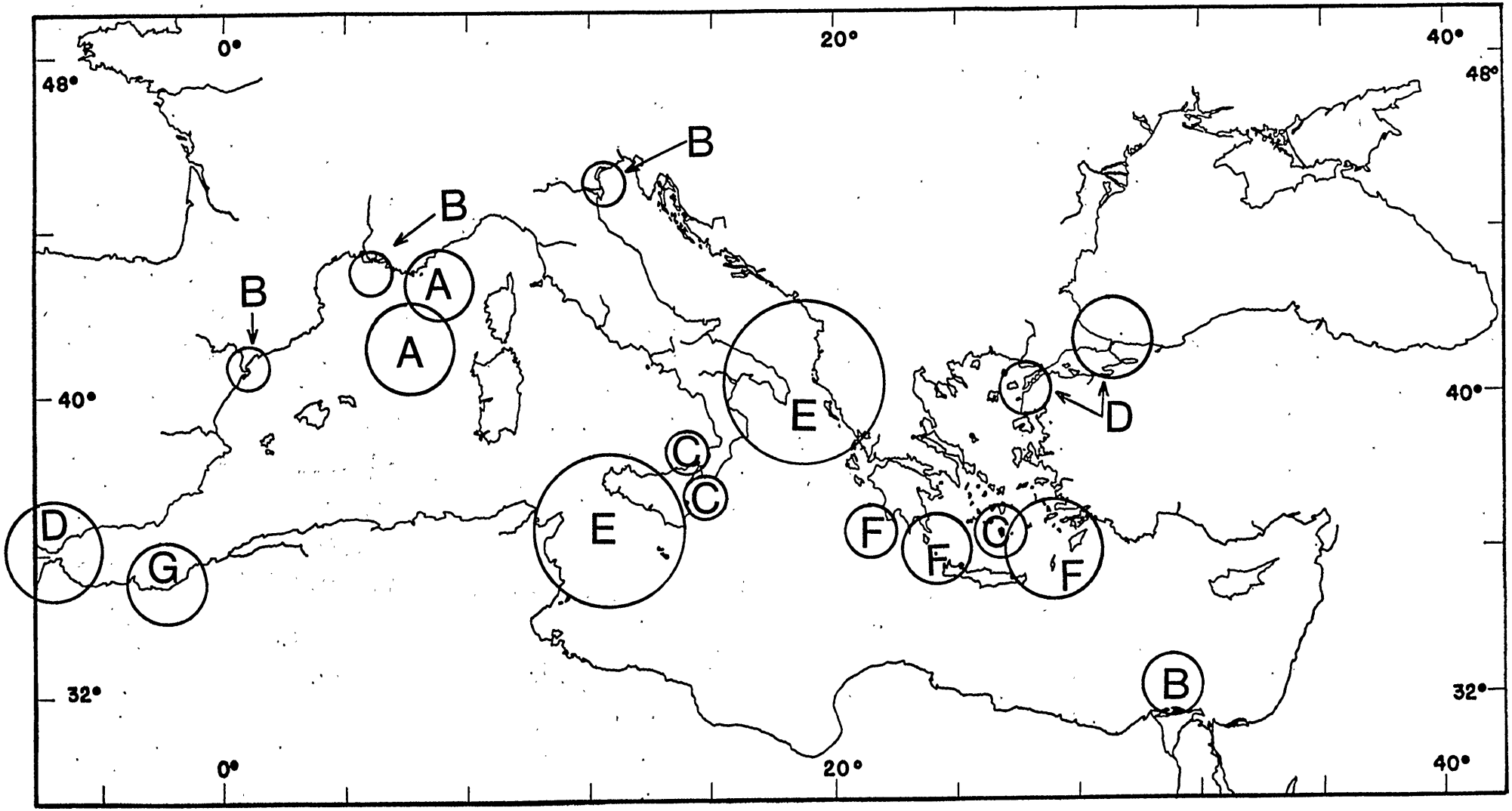

Fig. 3. MED CRUISE zones of special interest: A) High surface evaporation due to Mistral winds. Origin of western Mediterranean bottom water. B) Po, Rhone, Ebro and Nile river fans. C) Possible high volcanic input: Stromboli, Etna (active) Thira (inactive). D) Sills defining limits of Mediterranean water exchange with other seas. E) Sills separating Mediterranean regional seas. F) Deepest areas of Mediterranean. Origin of bottom waters.