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in the Mediterranean Sea
(MED POL Phase II)

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MEDITERRANEAN SEA

Report on a joint WHO/UNEP meeting

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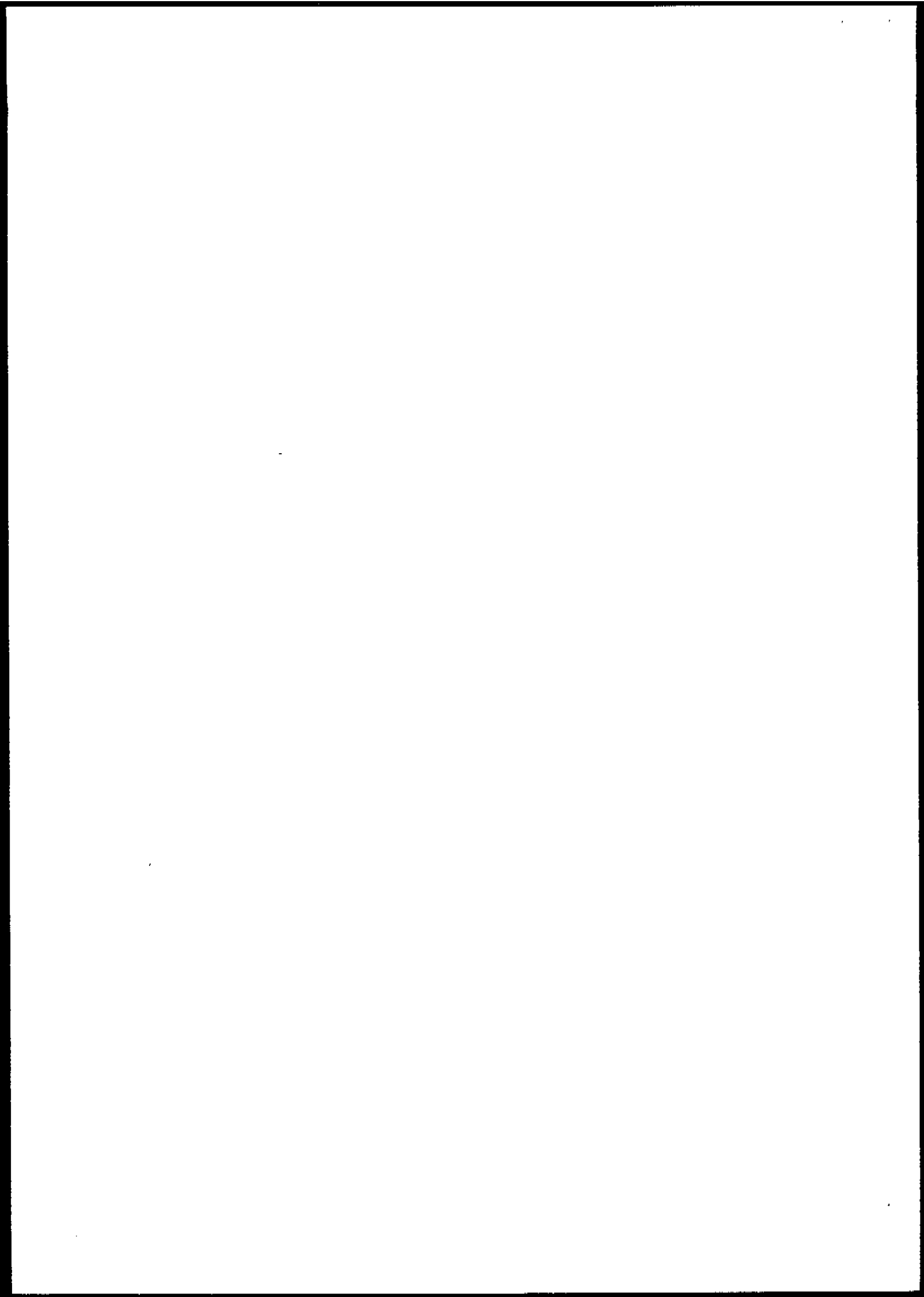
TARGET 20

Water pollution

By 1990, all people of the Region should have adequate supplies of safe drinking-water, and by the year 1995 pollution of rivers, lakes and seas should no longer pose a threat to human health.

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Foreword

One of the greatest health problems arising from marine pollution in the Mediterranean is the incidence of a number of diseases caused by bathing in polluted coastal marine areas, or through consumption of microbiologically contaminated seafood. Within the framework of the Mediterranean Action Plan, adopted by the states of the region in 1975, and more specifically as part of the Plan's scientific component, the long-term programme of pollution monitoring and research in the Mediterranean Sea (MED POL Phase II), WHO is actively engaged in upgrading the capability of the various countries in the region to effectively monitor the levels of microbiological pollution in affected coastal areas, to relate these to specific health effects, and to develop and enforce appropriate quality criteria and standards.

Under the terms of Article 10 of the 1976 Convention for the Protection of the Mediterranean Sea against pollution, Contracting Parties have undertaken to establish, in close cooperation with the international bodies which they consider competent, complementary or joint programmes, including, as appropriate, programmes at the bilateral or multilateral levels, for pollution monitoring in the Mediterranean Sea Area and to establish a pollution monitoring system for that area. Similarly, under the terms of Article 7 of the 1980 Protocol for the protection of the Mediterranean Sea against pollution from land-based sources, Contracting Parties have undertaken to progressively formulate and adopt, in cooperation with the competent international organizations, common guidelines and, as appropriate, standards or criteria dealing in particular with, *inter alia*, the quality of seawater used for specific purposes that is necessary for the protection of human health, living resources and ecosystems.

Practically all Mediterranean states have now established programmes to monitor the microbiological and related quality of their bathing beaches. These vary to a significant degree in scope and infrastructural support. Moreover, even in countries with comprehensive programmes, monitoring is still conducted on the basis of orthodox indicator parameters, the correlation between which and a number of health effects, mainly non-gastrointestinal diseases, has not yet been accurately established. In line with this situation, the quality criteria for bathing waters adopted on a joint basis by Mediterranean states in 1985 are only interim ones, pending the acquisition of the necessary scientific and epidemiological data on which to base measures of a more permanent nature.

In order to acquire such necessary data, WHO has been organizing studies on the development of methodology suitable for determination of concentrations of pathogenic and indicator microorganisms (including pathogen/indicator relationships) in various marine and related matrices under specific Mediterranean conditions, on factors affecting the survival and adaptation of pathogens and, in particular, microbiological/epidemiological studies on the correlation between coastal water and sand quality and health effects. A considerable amount of useful data has been obtained from these studies since their commencement in 1982.

Within the framework of the MED POL Phase II programme, a meeting on microbiological pollution of the Mediterranean Sea was jointly convened by WHO and UNEP, in collaboration with the Council of Europe's Euro-Mediterranean Centre for Marine Contamination Hazards, Valletta, Malta, with the following objectives:

- to evaluate the current situation regarding microbiological monitoring of coastal recreational and shellfish areas in the Mediterranean;
- to evaluate the results of research and other projects in the microbiological field carried out within the framework of the MED POL Phase II programme, in particular microbiological/epidemiological studies on the correlation between seawater and sand quality and health effects;
- to review the status of knowledge on the pollution of the Mediterranean Sea by pathogenic microorganisms;
- to recommend an appropriate reorientation of the microbiological component of MED POL Phase II to conform with present-day requirements, including the establishment of possible links with other programmes.

1. Opening of the meeting

The meeting took place at the Foundation for International Studies, Valletta, Malta. It was attended by 19 temporary advisers from ten Mediterranean countries and three from non-Mediterranean countries, and by two representatives each from the Council of Europe's Euro-Mediterranean Centre for Marine Contamination Hazards and the WHO Regional Office for Europe. A list of participants is given in Annex 1.

Dr L.J. Saliba, Senior Scientist, Mediterranean Action Plan, WHO Regional Office for Europe, opened the meeting and welcomed participants on behalf of the Regional Director, Dr J.E. Asvall. He also welcomed them on behalf of Mr Aldo G. Manos, UNEP Coordinator for the Mediterranean Action Plan. He outlined the importance of the meeting in that participants would be discussing a number of basic issues in the overall field of microbiological pollution prevention and control in the Mediterranean Sea. He expressed his thanks to the Foundation for International Studies for hosting the meeting, and to the Council of Europe's Euro-Mediterranean Centre for Marine Contamination Hazards for their active collaboration both in hosting the meeting and in financing the participation of two of the three non-Mediterranean experts present.

The Minister of Social Policy, the Hon. Dr Louis Galea, welcomed participants on behalf of the Government of the Republic of Malta. He mentioned the importance attached by Malta to matters pertaining to the environment, including initiatives taken in the United National General Assembly on the need to devise a global strategy in response to climatic changes, as well as on the importance of a study on problems of extraterritorial spaces and on the best means of achieving protection for this environment. He also referred to Malta's adoption, along with 28 other European countries, of the European Charter on Environment and Health in Frankfurt the previous week.

He mentioned Malta's close relationship with the MED POL programme since its original inception in 1975, as well as to Malta's longstanding excellent relationship with WHO since becoming a member state in 1965. He considered the subject-matter of the present meeting particularly important both from the health and socio-economic viewpoints. As was the case with the majority of Mediterranean countries, tourism formed one of the mainstays of Malta's economy, and his Government was doing its best to preserve the quality of the country's marine environment in such a way as to minimize adverse health effects caused by pollution. He then described Malta's legal and administrative setup for monitoring the quality of local recreational coastal waters, which he stated had been classified by various sections of the International European Press as being among the cleanest in the Mediterranean. As regarding quality criteria and standards for coastal recreational and shellfish waters, the main, if not the only purpose of such standards was the protection of human health. He suggested that the first essential step would be to arrive at recommendations based on prevalent expert opinion with such an endpoint as the primary concern. It would then be up to the relevant National Authorities to seek out ways and means of implementing such recommendations in line with their own particular needs and circumstances. He augured all success in the work of the meeting, and a fruitful conclusion to the week's discussions.

Professor Victor Axiak, Chairman of the Euro-Mediterranean Centre for Marine Contamination Hazards, welcomed participants on behalf of the host institution. He expressed his institution's pleasure at being able to collaborate actively with WHO and UNEP in this important meeting within the framework of MED POL. He then gave a brief description of his institution's aims and achievements since its relatively recent establishment by the Council of Europe. He also augured all success to the work of the meeting.

2. Scope and purpose of the meeting

Dr Saliba outlined the scope and purpose of the meeting. The whole of the current situation regarding microbiological monitoring of coastal recreational and shellfish areas in the Mediterranean had to be reviewed. This review also included discussions on the updating of a number of recommended methods for the determination of concentrations of pathogenic and indicator microorganisms in seawater, which had recently been the subject of ad hoc interlaboratory studies. The microbiological and epidemiological aspects of the research component of MED POL would also have to be reviewed. In particular, the relevant protocol for studies correlating recreational water quality and health effects had been revised and simplified on the basis of the recommendations of the WHO/UNEP Consultation on microbial pollution of Mediterranean coastal areas and associated health effects, held in Athens in September 1987. This protocol now had to be finalized.

Within the framework of its activities towards the progressive implementation of the Protocol for the protection of the Mediterranean Sea against pollution from land-based sources, WHO had recently commenced work on an assessment of the state of pollution of the Mediterranean Sea by pathogenic microorganisms. The present meeting would be asked to discuss the status of knowledge on this topic.

Dr Saliba reminded participants that the present meeting and its agenda were action-orientated. WHO required concrete practical advice from participants, in order to be able to present the best possible technical recommendations in the appropriate fora.

3. Election of Officers

Professor J.A. Papadakis was elected Chairman, Mr V. Gauci Vice-Chairman, and Professor R. Mujeriego Rapporteur. Dr L.J. Saliba acted as Secretary to the Meeting.

4. Adoption of the agenda

The provisional agenda was unanimously adopted.

5. Organization of the meeting

The Chairman explained the proposed organization of the meeting, including working hours and other arrangements. It was agreed that the meeting would work mainly in Plenary, with the option of setting up one or more ad hoc working groups should any particular topic or topics render such an arrangement advisable.

6. Review of the current situation regarding microbiological monitoring of seawater and beach sand in the Mediterranean

The meeting briefly reviewed the general situation in the Mediterranean regarding adverse health effects caused by microbiological pollution of coastal waters, prevailing quality criteria and standards for recreational and shellfish waters in the region, and the status of monitoring programmes, together with current recommended methodology for determination of the main microbiological parameters.

6.1 The general situation

The meeting agreed that health hazards through exposure to polluted seawater and/or sand, and through consumption of contaminated seafood could be considered particularly significant in the Mediterranean. Although the general situation was steadily improving through the establishment of sewage treatment facilities and the construction of submarine outfall structures, the bulk of municipal sewage in most parts of the region was still being discharged untreated into the immediate coastal marine zone, in many cases in the vicinity of recreational and/or shellfish areas.

Insofar as bathing was concerned, prevailing warm climatic conditions in the region not only resulted in a relatively long bathing season, but were also responsible for longer exposure periods to seawater and/or beach sand, as compared to the situation in other, more temperate areas. During the summer months, the sea constitutes the main recreational amenity for both the 130 million inhabitants estimated to live permanently along the Mediterranean coastline, and the tourists (variously estimated at 100 to 150 million annually) visiting the region. As a result most beaches, especially those in the vicinity of cities and in tourist resorts, were becoming heavily overcrowded, particularly on weekends. The heterogeneous nature of beach populations facilitated the spread of infections.

Although the general situation was steadily improving through the establishment of sewage treatment facilities and the construction of submarine outfall structures, the bulk of municipal sewage in most parts of the region was still being discharged untreated into the immediate coastal marine zone, in many cases in the vicinity of recreational and/or shellfish areas.

Participants reported that a Swedish study had revealed that 63% of the Salmonella cases reported in that country were the result of infections contracted overseas, mainly in Mediterranean countries, while another Swedish report showed that 90 to 95% of giardiasis, 10 to 16% of viral hepatitis, 34 to 53% of shigellosis and 92 to 95% of amoebic dysentery were imported cases. In addition, European tourist authorities had estimated that some 40% of the tourists on vacation at Mediterranean coastal resorts became ill at some time during or immediately after their visit. One third of these reported having been bedridden as a result, while one fifth had been forced to cut their vacation short as a result of illness.

While, undoubtedly, a portion of such tourist illness was associated with the consumption of unsanitary food or unsafe drinking water, as well as other types of exposure, there was ample evidence that a major source of illness in areas where the sea was polluted resulted from the consumption of sewage-contaminated shellfish and/or bathing at sewage-contaminated beaches. Recent epidemiological studies in a number of countries had provided clear evidence that a major contributing factor in becoming ill with viral hepatitis, a serious disease often resulting in permanent debilitating health damage, was the consumption of raw oysters, clams and mussels harvested in sewage-contaminated coastal waters. Other reputable epidemiological studies had indicated that, in some cases, as many as 5 to 10% of the children bathing in sewage-contaminated coastal waters developed serious gastroenteritis.

All the above was preventable, and it was considered by the participants that it was the responsibility of Governments to provide adequate safety against adverse health effects. Quality criteria and standards for recreational and shellfish areas in the region should therefore take the above-mentioned factors into account.

6.2 Coastal water quality criteria and standards

Criteria and standards for bathing water quality in the Mediterranean region differed, as expected, from country to country. From this point of view, countries could be broadly divided into two types: EEC Member States (France, Greece, Italy and Spain), which were bound by, and currently had their relevant national legislation based upon, the 1976 EEC Directive on the Quality of Bathing Waters; and non-EEC Member States (Albania, Algeria, Cyprus, Egypt, Israel, Lebanon, Libya, Malta, Monaco, Morocco, Syria, Tunisia, Turkey and Yugoslavia), whose legislation appeared to be mainly based on the conclusions of the WHO Working Group on guides and criteria for recreational quality of beaches and coastal waters (Bilthoven, 1974).

The EEC Directive was slightly complicated by the fact that it included two sets of standards (Imperative and Guide) for two of its microbiological parameters (total coliforms and faecal coliforms), and had only a guide value for a third (faecal streptococci). The four countries concerned were applying the Directive in different ways. Spain applied the Imperative values for both total coliforms (10,000/100 ml) and faecal coliforms (2,000/100 ml), but also

made use of the guide values in classification of areas according to quality. Greece applied the Imperative value for total coliforms, but had set a stricter limit (500/100 ml) for faecal coliforms. There appeared to be only partial application by these two countries of the other parameters listed in the Directive, which included Imperative values on *Salmonella* (0/litre) and Enteroviruses (0 PFU/10 litres). On the other hand, both France and Italy utilized the guide values for total coliforms (2000/100 ml) and faecal coliforms (100/100 ml), as well as for faecal streptococci (100/100 ml), in addition to all the other parameters (microbiological, chemical and physical) listed in the Directive.

Practically all other Mediterranean countries had modelled their national legislation on the WHO Bilthoven recommendations that highly satisfactory bathing areas show *E. Coli* counts consistently less than 100 per 100 ml and, to be acceptable, bathing waters should not give counts consistently greater than 1,000 *E. Coli* per 100 ml. A number of countries still utilized *E. Coli* as their standard indicator organism, others had changed to total and faecal coliforms. The state of actual enforcement of legislation also varied. While such legislation was longstanding and rigidly enforced in some countries, the situation was different in others, where the necessary infrastructure in terms of facilities and manpower was still being gradually developed.

In the case of shellfish waters, the same dichotomy between EEC and non-EEC Member States existed. France, Greece, Italy and Spain applied the 1979 EEC Directive which was based on microbiological limits (300 faecal coliforms per 100 ml of shellfish flesh plus intervalvular fluid) in the shellfish themselves. National legislation in France and Italy was considerably stricter. In other countries, statutory controls were either specific for shellfish waters themselves or, as in many cases, control was exercised over the acceptability or otherwise of the shellfish themselves after harvest within the framework of food safety or public health legislation.

The first assessment on the state of microbial pollution of the Mediterranean Sea had been prepared within the framework of the MED POL Phase II programme in 1983, and was based on the results of the 1976-1980 WHO/UNEP pilot project on Coastal Water Quality Control. The document contained formal proposals to Mediterranean Governments to adopt interim criteria for coastal recreational waters based on both faecal coliform and faecal streptococci concentrations, each equivalent (except for percentage sample compliance) to the EEC guide values. In the case of shellfish, proposals for water quality had been based on the same two microorganisms, and for shellfish quality on faecal coliforms in shellfish flesh.

In the case of recreational waters, Mediterranean States had formally adopted interim quality criteria on a joint basis in 1985 which, however, were based solely on faecal coliform concentration limits (100 per 100 ml in at least 50% of the samples, 1,000 per 100 ml in at least 90%). The relative resolution also contained a provision whereby any State already possessing standards and criteria of its own would continue to apply such, pending a comparative study between all existing standards in the region.

In the case of shellfish waters, a meeting of experts jointly convened by WHO and UNEP in 1987 had recommended environmental quality criteria identical to those contained in the EEC 1979 Directive. These were formally adopted by Mediterranean Governments later the same year. It was understood that the

scope of the resolution was only designed to cater for acceptability of marine areas for shellfish growing and/or harvesting, and did not in any way limit acceptability of the shellfish themselves for human consumption, which aspect would be handled by ad hoc public health or related legislation.

In reviewing the main problems regarding the development and adoption of coastal water quality criteria and standards on a joint basis, participants recognized the fact that considerable difficulties had been encountered when Mediterranean countries had been requested to agree on, and formally adopt common criteria and standards which would be legally binding upon them, particularly when such proposed criteria and standards were not identical to those already existing in parts of the region. Participants agreed that this situation could possibly be alleviated by presenting Mediterranean States with technical guidelines which would include recommended criteria and standards in the form of expert information and data on which to base national control measures, but which would not require formal legal adoption.

6.3 The status of microbiological monitoring programmes

Guidelines for monitoring the quality of coastal recreational and shellfish areas had been prepared by WHO within the framework of the MED POL Phase II programme, and issued by UNEP's Regional Seas Programme as part of its Series of Reference Methods for Marine Pollution Studies. For coastal recreational waters, the guidelines recommended faecal coliforms, faecal streptococci and at least one pathogen causing infection through contact, together with complementary observations, principally salinity and temperature, as the constituent parameters of minimum monitoring programmes. For extended monitoring programmes, the choice of parameters would depend to a large extent on the conditions prevailing in any particular locality. For shellfish areas, the guidelines had been brought more or less in line with the criteria adopted by Mediterranean States in 1987, and recommended faecal coliforms in the shellfish themselves as the main parameter, with weekly sampling during the peak consumption period in addition to the 3-month frequency laid down as a minimum. The guidelines also recommended that the water in the shellfish-growing areas be monitored (at the same frequency) for faecal coliforms, faecal streptococci and any pathogen considered important in the light of local requirements from time to time.

Participants agreed that the guidelines could be expanded to include a section on existing criteria and standards in the region as a guide to the development of national control measures. It was also considered that the section of the guidelines dealing with extended (as distinct from minimum) monitoring programmes should explain more clearly that the list of pathogenic organisms contained therein were not meant for inclusion in a recommended routine monitoring programme, but for special investigations carried out to meet specific requirements.

Since 1982, considerable effort had been directed towards the establishment or enhancement of national marine pollution monitoring programmes within the framework of the MED POL Phase II programme. These national programmes were being handled on an integrated basis, with sanitary monitoring of coastal recreational and shellfish areas as one of the components. Countries receiving financial assistance (Algeria, Cyprus, Egypt, Greece, Israel, Lebanon, Libya, Malta, Morocco, Syria, Tunisia, Turkey and Yugoslavia) signed a formal agreement with UNEP in which all monitoring

details were included. Countries not receiving financial assistance (France, Italy, Monaco, Spain) had agreed to send monitoring data to the Coordinating Unit of the Mediterranean Action Plan in Athens to enable evaluation of the overall position, and determination of trends, including correlation with control measures. The understanding was that all raw data received from countries was considered confidential, and no individual country data would be published in any form except with the specific approval of the country in question.

At present, all Mediterranean countries possessed a marine pollution monitoring programme covering all or part of the main coastal recreational and (to a lesser extent) shellfish areas. An evaluation of the Monitoring data for recreational waters submitted by seven countries (Algeria, Cyprus, Israel, Lebanon, Malta, Morocco and Yugoslavia) for the period 1983-1987 had been performed in early 1989. According to this evaluation, the conformity of sampling stations with the interim criteria adopted by Mediterranean Governments on a common basis in 1985 had risen from 78% (1983) to 96% (1987) in the case of stations with at least six samplings per year. In this regard, although the number of stations monitored differed slightly from year to year, the figures could be considered as providing a reasonable evaluation of the positive trend in the countries in question, taken as a whole.

Information was also available from reports of EEC Member States (France, Greece, Italy and Spain) in terms of the 1976 bathing water quality Directive. In France the number of monitoring stations with high to acceptable quality water (A, AB or B) had risen from 76.4% (1983) to 83% (1987), with a corresponding reduction in lower quality stations (23.6% in 1983 to 16.7% in 1987). In Italy, the number of stations conforming with Italian criteria (based on, but stricter than, the Directive) had risen from 68% in 1984 to 87.3% in 1988. In Spain, the number of stations with high quality water (A2) decreased from 65.2% in 1986 to 51.0% in 1987. Results from Greece were only available for 1987, and were restricted to Attica, where 77.7% of stations with at least 5 samplings per year had been found to be in conformity with requirements.

The information available with respect to these eleven countries was sufficient to indicate a general trend of improvement during the last five years over a stretch of the Mediterranean coastline covering practically the whole of the northern seaboard, the western part of the southern, and part of the central and eastern areas. Apart from this general trend, no other conclusions could be reached, and no comparisons between the different areas attempted, as (a) the larger portion of the southern and eastern seaboard could be considered as still unmapped in terms of coastal water quality, (b) the criteria and standards adopted by the different countries for acceptability showed a wide range of divergence both in the number of parameters measured and in the actual limit values applied for each, and (c) the analytical methods employed differ, approximately half the countries in the region utilizing the Most Probable Number (MPN) method for determination of the major bacterial indicator organisms, the rest the Membrane Filtration (MF) method. The two methods are not fully comparable.

6.4 Microbiological methodology

Participants reviewed the status of microbiological methods prepared by WHO and issued for the use of Mediterranean laboratories within the UNEP

Regional Seas Reference Methods series. It was agreed that all reference methods for the determination of bacterial indicator organisms in seawater by the membrane filtration culture (MF) technique should be updated to include a resuscitation step to ensure maximum recovery.

The meeting reviewed the report of the comprehensive study performed jointly by INSERM (Nice, France), the University of Malaga (Spain) and the Institute of Hygiene "Giuseppe d'Alessandro" (Palermo, Italy) in 1988 on the new proposed method for the quantitative determination of E. Coli from faecal coliforms, using the MUG (4-methylumbelliferyl-B-D-glucuronide) test. The results of this study indicated that the method in question was more sensitive and specific than the one in current use, but appeared to be considerably more expensive. It was agreed that it would not therefore be feasible to recommend substitution of the method at the present stage. However, the new method could be finalized and issued for use on an optional basis.

The meeting also reviewed the results of studies carried out in 1988 by the Istituto Superiore di Sanità (Rome, Italy), the Sewage Laboratory of the Works Department (Malta), the Environmental Health Division of the Health and Social Security Department (Tarragona, Spain) and the Institute of Oceanography and Fisheries (Split, Yugoslavia) on the comparison of different media for determination of faecal streptococci in seawater by the membrane filtration culture technique. These results corroborated the findings in the original study performed by the "Dr A. Felix" Public Health Laboratory (Tel-Aviv, Israel). It was therefore agreed that the current reference method should be modified by (a) replacing KF-Streptococcus agar by m-Enterococcus agar as the working medium and (b) specifying an incubation temperature of 44°C, at the same time stressing that at such a temperature, accurate control was essential.

In reviewing recommended methodology in general, participants agreed that methods for determination of total staphylococci and Pseudomonas aeruginosa, utilizing the multiple test tube (MPN) technique, should be developed. These parameters could be considered as indicators of bather density, rather than of faecal pollution. In addition, the current reference method for isolation of salmonellae in seawater and sewage should be considered for revision in the light of recent developments. In this regard, Salmonella, as well as other microorganisms, had been recorded as occurring in seawater as a result of transport by seagulls and other marine birds. Caution would therefore have to be exercised in the interpretation and health-related evaluation of the presence of Salmonella in coastal marine recreational waters.

The meeting reviewed the draft guidelines for quality control in microbiological monitoring of coastal marine waters, prepared by Professor R. Mujeriego (Spain), and agreed on a number of modifications, in particular the addition of a questionnaire designed to provide information on the facilities in individual laboratories. Following the completion of such modifications, the revised version would be sent to selected Mediterranean and other microbiologists (including participants at the meeting) for more detailed comments prior to the issue of the first substantive version.

The meeting agreed that an adequate overall assessment of the state of pollution of Mediterranean coastal recreational and shellfish areas could only be performed if all the laboratories participating in the MED POL programme implemented satisfactory quality assurance procedures. It was important,

therefore, to ensure that such laboratories utilized the new guidelines to the fullest extent possible. Furthermore, in view of the large number of Mediterranean laboratories participating in the microbiological component of the MED POL monitoring programme (over 50 through direct agreements alone), quality control at both intra-laboratory and inter-laboratory levels was essential to achieve and maintain intrinsic good quality and intercomparability of results obtained. This could be done through intercalibration exercises at regional, sub-regional and/or local levels, utilizing appropriate pre-prepared samples (which could be sent regularly to participating laboratories) to ensure such reliability and comparability. It was stressed that this need for standardization also applied to sampling techniques and to interpretation of results.

The meeting took account of the fact that for logistic and other reasons, it had not been found possible to carry out microbiological intercalibration exercises at region-wide level in the same manner as for chemical pollutants (i.e. through preparation and distribution of standard samples). It was felt, however, that WHO should review the position in this regard.

One of the principal problems identified during the series of intercalibration exercises organized by WHO between 1982 and 1985 had been the need for training, particularly in the case of newly-established laboratories. During 1988-1989, a budgetary provision for two intensive training courses of six days, one each for English-speaking and French-speaking participants, had been approved and held in Athens (9-14 May 1988) and Tunis (16-21 October 1989) respectively. The subject-matter of these courses was limited to determination of the main bacterial indicator organisms (total coliforms, faecal coliforms and faecal streptococci) in seawater, and faecal coliforms in shellfish. Two further courses had been approved for the 1990-1991 biennium.

The meeting reviewed the two main options regarding the subject-matter of these courses, which were as follows:

- (a) On the assumption that, at least for the next few years, the major microbiological parameters measured in marine pollution monitoring programmes covering coastal recreational and shellfish areas, will be faecal coliforms and faecal streptococci, to continue to concentrate on these two parameters, and extend manpower development quantitatively through making the two courses open only to new participants, mainly from laboratories not having already been represented in previous courses.
- (b) On the alternative assumption that expertise available in each individual country with regard to orthodox techniques is sufficient to enable such basic training to be organized within the countries themselves, to develop new course contents for 1990-1991, possibly concentrating on either the determination of pathogenic microorganisms in shellfish or the determination of microorganisms (other than faecal coliforms and faecal streptococci) in seawater and possibly beach sand.

Following discussion, the meeting recommended that, if possible, the course-content should include determination of both pathogenic and indicator bacteria. Otherwise, it should be devoted to pathogens only.

7. Review of the current situation regarding microbiological/epidemiological studies on the correlation between seawater and sand quality and health effects

A number of studies on the correlation between coastal marine water quality and health effects on exposed population groups had been conducted in the region over the past two decades, generally aimed at the acquisition of the necessary scientific evidence on which to base seawater quality criteria and standards. Most of these studies were relatively small-scale and, while some demonstrated various links between concentrations of a number of bacterial pathogens and indicators on the one hand, and the incidence of gastrointestinal symptoms on the other, the situation regarding non-gastrointestinal infections (mainly those affecting the skin, eye, ear and upper respiratory tract) could only be described as unclear. To a variable extent, practically all studies were handicapped, particularly in the interpretation of results obtained, by a number of confounding factors over which satisfactory control was difficult to achieve.

A draft protocol for microbiological/epidemiological studies had been initially discussed at a WHO/UNEP Consultation on the correlation between coastal water quality and health effects, held in Follonica, Italy, in October 1985. The revised draft was further reviewed by a WHO/UNEP Consultation on microbial pollution of Mediterranean coastal areas and associated health effects, held in Athens in September 1987. This latter meeting considered that the protocol, in its existing form, was too complicated, particularly considering the availability of intrinsic resources in Mediterranean institutions, and recommended that a simplified version be prepared.

In reviewing the revised and simplified version prepared in accordance with the 1987 Athens meeting's recommendation, the general situation regarding such studies was discussed on the basis of experience gained in the region. Results obtained so far from microbiological/epidemiological studies carried out in the Mediterranean confirmed that bathing in polluted waters carried an appreciable health risk in terms of gastrointestinal, respiratory and skin disease, and also indicated that young children (0-4 years of age) constituted a particularly vulnerable group. Among problems identified, participants referred mainly to the importance of diagnostic and interviewing procedures, which played a significant role in study design and implementation. It was emphasized that differentiation should be made between subjective and objective diagnoses, i.e. interviewees' perception of disease on the one hand and diagnosis as reported by clinical examination on the other. It was also agreed that interpretation of data, particularly those obtained from different areas, was difficult due to confounding factors, as well as to problems in obtaining adequate control groups.

Attention was drawn to the fact that a number of approaches existed in the planning, design and implementation of epidemiological studies correlating bathing water quality with health effects and as, so far, this was the only protocol prepared by WHO on the subject-matter, it could be misinterpreted as constituting the only approach recommended by the Organization for such studies. It was agreed by the meeting that in the final version of the protocol on microbiological/epidemiological studies correlating coastal recreational water quality with health effects, the title and introduction should be revised to make it clear that the protocol was designed primarily for Mediterranean studies within the framework of the MED POL programme, and

did not represent the only approach recommended by WHO for studies of this nature. It was also agreed that the revised introduction to the protocol should explain that other methods of approach existed, depending on prevailing national and/or local circumstances.

A number of amendments and modifications to the draft protocol were agreed upon. These included the need for adding a definition of a "non-swimmer" to clarify the differentiation process in test and control population groups, and the advisability of including at least one bacterial indicator of bather-load (such as total staphylococci). Follow-up procedures after the initial beach interviews were comprehensively discussed. It was agreed that telephone access in report areas could be difficult, because of the frequent desire of tourists not to be disturbed during their vacation period. Other follow-up methods would therefore have to be adopted.

The meeting agreed that summer camps and closed resort sites offered an excellent alternative for epidemiological follow-up of children and adult populations for periods of up to several weeks. However, the selection of non-swimming control groups could still constitute a practical difficulty, owing to the current pattern of coastal recreation on Mediterranean beaches adopted by both local and tourist populations, characterized by several bathing episodes during each day of the average 2 to 3-week vacation period, such episodes frequently occurring on different beaches.

The meeting considered that adequate training of interviewers was essential, particularly to prevent social interaction with interviewees, and to ensure adequate communication with foreign visitors. There was also a need for appropriate translation of medical symptoms in foreign languages. In this context, the meeting considered that the financial outlay involved in acquiring professional interviewers, as opposed to students, was more than justified.

During the course of the discussion, the meeting also briefly reviewed recently-completed and ongoing studies in Israel, Spain and the United Kingdom, which were presented by the respective principal investigators of these studies.

The meeting recognized the fact that epidemiological studies were considerably expensive, and that this constituted the main reason why such studies had only been conducted on a pilot scale in the Mediterranean. The importance of obtaining large-scale financial support from donor organizations and countries was again stressed.

8. Review of the status of knowledge on the pollution of the Mediterranean Sea by pathogenic microorganisms

The meeting noted that an assessment of the state of pollution of the Mediterranean Sea by pathogenic microorganisms was in the course of preparation by WHO, and the first draft of the document was scheduled for completion by late 1990. Data obtained so far from the monitoring and research component of the MED POL programme, as well as from international literature, was considerable, but not extensive enough to enable the drawing up of a reasonably-comprehensive assessment of the situation. In late 1988, all Ministries of Health in Mediterranean countries had been formally requested by the WHO Regional Office for Europe to provide information

available on (a) pathogenic microorganisms isolated in recreational and shellfish waters and in shellfish, and (b) any recorded incidence of infections attributed to bathing in polluted waters or to consumption of contaminated seafood. The response, however, had not been encouraging.

The meeting agreed that WHO should press Ministries of Health further for the provision of the required information. Participants themselves would also send any data they had available in the form of reprints, etc.

9. Reorientation of the microbiological component of MED POL Phase II, and links with other programmes

The meeting discussed the various microbiological topics currently being covered by projects conducted within the framework of the research component of the MED POL programme. These, as had been recommended by the WHO/UNEP Consultation on microbial pollution of Mediterranean coastal areas and associated health effects (Athens, 22-26 September 1987), were the following:

- the determination of the correlation between the main bacterial indicator organisms, to facilitate the interpretation of results among institutions using different indicators;
- the determination of indicators for viruses and potential pathogens, particularly agents causing non-gastrointestinal diseases associated with contaminated coastal water;
- the study of environmental factors affecting the fate of viruses;
- the study of the somatic and genetic changes of pathogenic and indicator microorganisms in the marine environment, with special reference to their virulence;
- comparative studies on pathogens of recognized importance, such as Campylobacter species, by networks of Mediterranean institutions;
- epidemiological studies correlating the quality of coastal water with effects on health;
- studies on the prevalence of fungal pathogens and of parasites on beaches along with their possible impact on health.

The meeting agreed that these topics should continue to be covered through relevant research projects. It was considered, however, that (a) studies on the determination of indicators for viruses and potential pathogens should also include those agents causing non-gastrointestinal diseases associated with contaminated shellfish (in addition to contaminated seawater), and (b) studies on the prevalence of parasites on beaches, along with their possible impact on health, should include protozoa.

The meeting similarly agreed that attention should be accorded to studies on the health impact of algal and related blooms, particularly in the Adriatic.

Possible links with other ongoing programmes in the region were discussed. It was agreed that all efforts should be made to coordinate research performed within the framework of the MED POL programme with that being performed (a) as part of relevant programmes sponsored by the EEC, and (b) under the aegis of the International Council for the Scientific Exploration of the Mediterranean Sea (ICSEM).

10. Recommendations

- (1) In view of the considerable difficulties encountered when Mediterranean States have been requested to formally adopt legally-binding criteria and/or standards which are at variance with those already existing in parts of the region, WHO and UNEP should consider an alternative mode of approach whereby States would be presented with technical guidelines which, while including recommended criteria and standards as a basis for national control measures, would not be legally binding on a common basis.
- (2) WHO should prepare a revised version of the guidelines for monitoring of coastal recreational and shellfish areas (Reference Method No.1) as early as possible.
- (3) WHO should modify and update all existing methods for determination of microbiological parameters in seawater in the light of available information, as early as possible.
- (4) WHO should issue the newly prepared guidelines for quality control in microbiological monitoring of coastal marine waters as early as possible. The guidelines should include appropriate questionnaires which could be utilized for an eventual survey of existing facilities and procedures in Mediterranean countries.
- (5) Apart from encouraging Mediterranean countries to utilize the quality control guidelines to the fullest extent possible, WHO should make efforts to organize intercalibration exercises at regional, subregional and local levels, to ensure reliability and comparability of results. Such exercises should utilize appropriate pre-prepared samples which could be sent regularly to participating laboratories.
- (6) In view of the expenses involved in the carrying out of microbiological/epidemiological studies correlating coastal recreational water quality with health effects, and the inability of such costs being met either from MED POL or WHO regular sources, WHO should make new efforts to obtain alternative funding to enable the studies to be performed.

Annex 1

LIST OF PARTICIPANTS

- Dr Ridha Ben Aissa
Laboratory of Water and Foodstuffs Bacteriology, Institut Pasteur de
Tunis, Tunis, Tunisia
- Dr Israel Epstein
Department of Laboratories, Ministry of Health, Jerusalem, Israel
- Mr Vincent Gauci
Water and Waste Laboratory, Sant'Antnin Sewage Treatment Plant,
Marsascala, Malta
- Dr Michel Gauthier
National Institute of Health and Medical Research (INSERM), Unit 303
"Mer et Santé", Nice, France
- Dr Phillippe René Bernard Guettier
State Secretariat for Environment, Neuilly-sur-Seine, France
- Professor Mohammed Hassar
National Institute of Hygiene, Rabat, Morocco
- Dr David Kay
University of Wales, Lampeter, Dyfed, United Kingdom
- Mr Kaj Krongard Kristensen
Tvaeragervej 3, Glostrup, Denmark
- Dr Julian Mamo
Health Services Information Unit, Department of Health, Valletta, Malta
- Professor Fernando Jose Mariño Fernandez
National School of Public Health, Ciudad Universitaria, Madrid, Spain
- Professor Rafael Mujeriego
Department of Environmental Engineering, School of Civil Engineering,
Barcelona, Spain
- Professor John A. Papadakis
Department of Bacteriology, Athens School of Hygiene, Athens, Greece
- Dr Walter Pasini
Italian Association for Tourist Medicine, Rimini, Italy
- Dr Edmund Bernard Pike
Water Research Centre, Marlow, Buckinghamshire, United Kingdom

Professor Vladimir Presecki

Virology Department, Institute of Public Health of SR Croatia, Zagreb,
Yugoslavia

Dr Michael Sammut

Department of Health, Valletta, Malta

Dr Jacques Semeria

Microbiology Laboratory, Scientific Centre of Monaco, Monaco,
Principality of Monaco

Dr Ahmed Taher Shaker

Occupational Health Department, Ministry of Health, Cairo, Egypt

Professor Hillel Shuval

Environmental Health Laboratory, Hadassah Medical School, Hebrew
University, Jerusalem, Israel

Professor George Stathopoulos

Laboratory of Hygiene, Medical Department, University of Thessaloniki,
Thessaloniki, Greece

Dr Maria Valeria Torregrossa

Institute of Hygiene "Giuseppe Alessandro", Palermo, Italy

Dr Anthony Vassallo

Department of Health, Valletta, Malta

Professor Lorenzo Villa

High Institute of Public Health, Rome, Italy

Dr Laura Volterra

Department of Environmental Microbiology, High Institute of Public
Health, Rome, Italy

REPRESENTATIVES OF OTHER ORGANIZATIONS

Euro-Mediterranean Centre for Marine Contamination Hazards

Professor Victor Axiak

Chairman, Euro-Mediterranean Centre for Marine Contamination Hazards.
Head, Department of Biology, University of Malta, Msida, Malta.

Mr Anton Micallef

Director, Euro-Mediterranean Centre for Marine Contamination Hazards,
Foundation for International Studies, Old University Building, St. Paul's
Street, Valletta, Malta.

WORLD HEALTH ORGANIZATION

Regional Office for Europe

Dr Louis J. Saliba

Senior Scientist, WHO/EURO Project Office, Coordinating Unit for the
Mediterranean Action Plan, Athens, Greece.

Dr Francis Laferla

Chief Technical Adviser, UNDP-Supported Project on European Cooperation
in the Control of Chemicals.

Ms Marie Rollo

Secretary, WHO/EURO Project Office, Coordinating Unit for the
Mediterranean Action Plan, Athens, Greece.

