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*Long-term Programme for Pollution Monitoring
and Research in the Mediterranean Sea
(MED/POL Phase II)*

HEALTH RISKS FROM MARINE POLLUTION IN THE MEDITERRANEAN

Report on a joint WHO/UNEP Meeting

Guardamangia, Malta
30 November - 3 December 1994

TARGET 20

WATER QUALITY

By the year 2000, all people should have access to adequate supplies of safe drinking-water, and the pollution of groundwater sources, rivers, lakes and seas should no longer pose a threat to health.

Keywords

SEAWATER

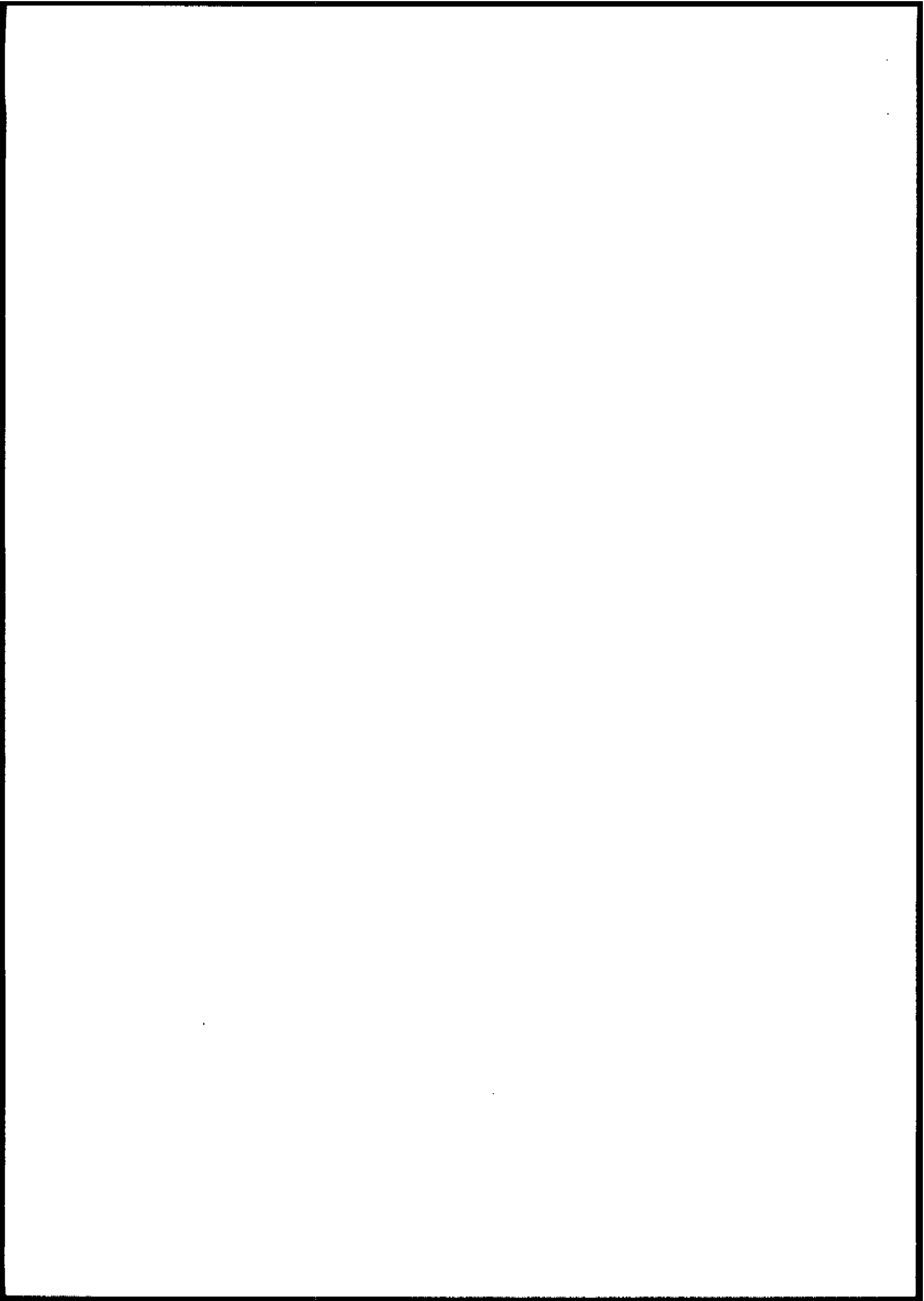
WATER POLLUTION – prevention and control

WATER POLLUTANTS – adverse effects

(1) UNEP

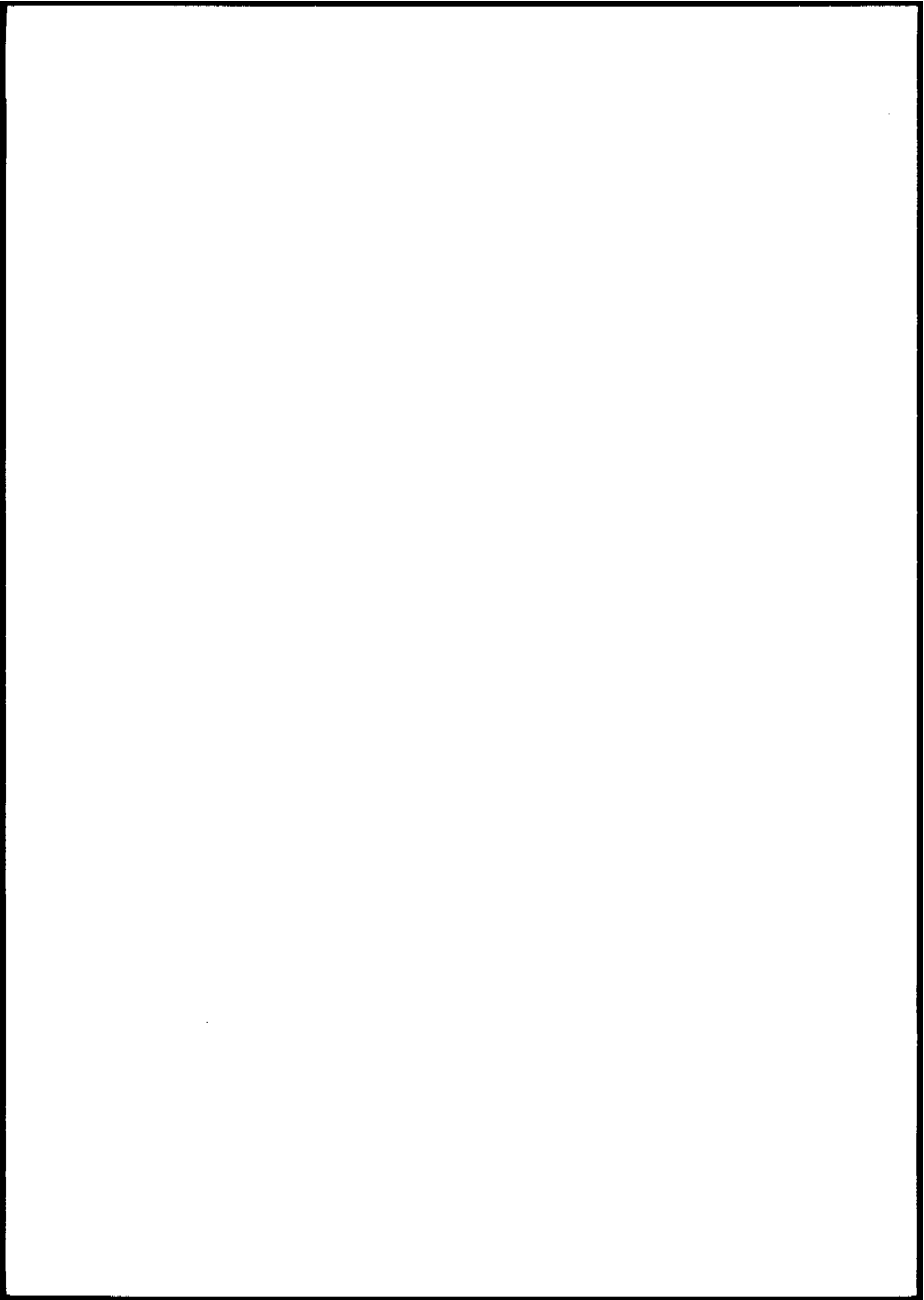
ABSTRACT

The risks to human health from marine pollution is acknowledged worldwide. Such risks normally arise from bathing in polluted seawater and from consumption of contaminated seafood, and are accentuated in those regions where climatic conditions result in relatively long bathing seasons and/or where seafood consumption is high. WHO and UNEP convened a Consultation meeting to review and finalize the draft document on the assessment of health risks from marine pollution in the Mediterranean. The participants agreed on detailed points regarding the wording for inclusion in the final text, and for additional paragraphs and updated information to be incorporated. In addition, a separate report for policy makers was prepared during the meeting, the final wording of which was agreed by the participants.



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Foreword

The risks to human health from marine pollution is acknowledged worldwide. Such risks normally arise from bathing in polluted seawater and from consumption of contaminated seafood, and are accentuated in those regions where climatic conditions result in relatively long bathing seasons and/or where seafood consumption is high.

One particular geographical area of concern is the Mediterranean where the sea provides the main recreational amenity both for local populations and the millions of tourists who visit the area annually. Seafood consumption is high, especially in the coastal areas.

The Mediterranean Sea is a relatively large body of water with an area of 3 million square Km, and a volume of over 4 million square Km. It is virtually enclosed and once inside the Mediterranean, the water circulates in a complex pattern with an average circulation time of approximately 80 years. It is relatively lacking in nutrients, though river outflows cause eutrophication phenomena in a number of coastal areas. Salinity is relatively high, varying from 36‰ at its western part to 38‰ at its eastern. There is very little interchange between coastal and open waters. Although small compared to other oceans of the world, it contains a greater range of peoples, cultures, meteorological and geographical differences than any other comparable area in the world.

The health hazards from marine pollution in the Mediterranean are accentuated by oceanographic factors such as the practically enclosed state of the sea and the relatively long circulation time of its waters. They are conducive to pollutant retention. The relatively warm prevailing temperatures are also responsible for long exposure periods to seawater and beach sand while bathing. In many parts of the region too, municipal sewage and industrial effluents are still being discharged untreated into the immediate coastal zone or reach it in this stage through rivers.

Governments of the area adopted the Mediterranean Action Plan in February 1975. The programme includes a legal component - the 1976 Barcelona Convention for the Protection of the Mediterranean Sea against Pollution and its related Protocols, and an environmental assessment component (The Long-term Programme of Pollution Monitoring and Research in the Mediterranean Sea) as part of which comprehensive monitoring has been performed since 1983.

During the last decade, a number of assessments on the state of pollution of the Mediterranean Sea by specific substances have been prepared within the framework of the MED POL programme. On the basis of such assessments, measures have been taken by Mediterranean governments to reduce pollution by these substances within the framework of the 1980 Athens Protocol for the Protection of the Mediterranean Sea against Pollution from Land-based Sources. Each assessment contains the appropriate human health risk component, but no overall health risk assessment has so far been performed.

The importance of such an assessment can be gauged by the size of the exposed population groups involved, which are the 130 million inhabitants estimated to live permanently along the Mediterranean coastline, and over 100 million tourists who visit the area annually.

The objectives of the present consultation, which was convened jointly by WHO and

UNEP, in collaboration with the Department of Health of Malta, were to:

- review and finalize the draft document on health risks from marine pollution in the Mediterranean;
- make appropriate recommendations for action that would be incorporated into the final document;
- examine progress with the Mediterranean Action Plan in identifying, preventing and controlling health risks from marine pollution in the Mediterranean;
- hold an informal discussion on the scope, format and content of the forthcoming WHO Guidelines on Recreational Water and Bathing Beach Quality, and to consider how the peer review process of the draft guidelines should be undertaken.
- identify any future research questions concerning the health risks, and consider ways that their associated information, education, and policy needs can be met.

1. Opening of the meeting

The meeting took place at the University of Malta Medical School. It was attended by 9 temporary advisers, one representative of the European Commission, and four representatives of the WHO Regional Office for Europe. A list of participants is given in Annex 3.

Dr George Kamizoulis, Senior Scientist, Mediterranean Action Plan, WHO Regional Office for Europe, welcomed participants on behalf of Dr J. Asvall, Regional Director, WHO Regional Office for Europe. He briefly outlined the background to the meeting and its role both within a Mediterranean and a European context.

Participants were also welcomed by The Honourable Professor John Rizzo Naudi, Parliamentary Secretary for Health, Malta, and Professor Frederick Fenech, Dean of the University of Malta Medical School.

2. Scope and purpose of the meeting

While substantial improvements in controlling pollution of the Mediterranean Sea by domestic and industrial effluent discharges had been made during the last two decades, the situation was still a cause for concern. For example, in a number of Mediterranean coastal areas, considerable actual and potential health risks associated with bathing, and with consumption of certain species of seafood, remained. To help clarify the situation for scientists, the draft WHO Regional Office for Europe document, "Assessment Of Health Risks From Marine Pollution In The Mediterranean", EUR/ICP/CEH 127, 1994, issued in cooperation with UNEP, was presented for detailed discussion and finalization.

This draft document was considered to be a major step forward because it provided an overall picture of the state of pollution of the Mediterranean Sea from the point of view of

its impact on human health. As such, and when finalized, it would facilitate preventive and remedial action on the part of the various public health authorities throughout the region. While a number of interesting and useful documents had been produced by the UN system on the status of individual pollutants in the Mediterranean and in which WHO was responsible for the human health component, this was the first time that the different health hazards and risks were being considered together.

The draft document was a direct contribution to the Mediterranean Action Plan (MAP) by the WHO Regional Office for Europe, from its current programme and its own regular budget funds. It was prepared by the WHO/EURO Project Office, Coordinating Unit for the Mediterranean Action Plan, Athens, Greece, and reviewed, prior to the meeting, by Professor Silvio De Flora, Director, Institute of Hygiene and Preventive Medicine, University of Genoa, Italy, and Professor Rafael Mujeriego, Department of Environmental Engineering, School of Civil Engineering, Polytechnic University of Catalonia, Barcelona, Spain.

3. Election of Officers

Dr Louis Saliba was elected Chairman, Professor Silvio De Flora, Vice-Chairman, and Dr Robin Philipp, Rapporteur. Dr George Kamizoulis acted as Secretary to the meeting.

4. Adoption of the agenda

The provisional agenda was unanimously adopted. As risk management has to be mindful of cultural, social and regional priorities, an informal discussion on the forthcoming WHO Recreational Water and Bathing Beach Quality Guidelines was also included. As well as the MED POL programme, the WHO EURO Black Sea project and EC Proposal for a Council Directive concerning the quality of bathing water were selected to help illustrate how these Guidelines could be used in the intersectoral work needed for comprehensive risk management of problems involving the recreational water environment.

5. Organization of the meeting

(i) *Chairman's introduction:*

The Chairman reported that the draft document was mainly prepared and compiled from many other documents including previous MED POL papers and reports, literature searches and monitoring results. Due to unavoidable delays in processing information, it had though only included information up to 1991. He asked that as far as possible, and during the meeting, participants should help to update this information as much as possible.

After finalization, the document would be presented to the next meeting of the Contracting Parties to the Barcelona Convention and its related Protocols in Barcelona in 1995. That year will be the 20th anniversary of the MED POL programme. During the meeting, representatives of the Contracting Parties to the Barcelona Convention 1976, were likely to ask which stage the MED POL programme had reached, what improvements had been made as a result of its findings, and how the programme should further evolve. He noted that as well as sanitary engineers and laboratory scientists, administrators, policy makers and politicians would also see the document. In addition, he reported that the scope and

orientation of the MED POL programme was designed to help countries develop their own monitoring and control programmes. Accordingly, he requested that, in making any recommendations for future work, participants should carefully consider proposals that were realistic, practicable, acceptable and that could be readily implemented in terms of their cost implications. As its member states need to advise and help protect the health of their residents while abroad in the Mediterranean area, and as well as having member states that border the Mediterranean sea, the Chairman particularly welcomed the participation of the European Commission at this meeting.

(ii) **Conduct of the meeting:**

The meeting was conducted in plenary session with the draft WHO report, Assessment of Health Risks From Marine Pollution In The Mediterranean, EUR/ICP/CEH/127/6, 1994; pp.246, as the basis for open discussion between all participants. During the meeting, participants tabled several other relevant papers for inclusion in the discussion. These papers were:

- (a) WHO. Comments Received On "Assessment of Health Risks from Marine Pollution in the Mediterranean". ICP/CEH/127, 25 September 1994, pp.17.
- (b) Charoenca, N., and Fujioka, R.S. Association of staphylococcal skin infections and swimming. Water Quality International '94, Budapest, Hungary. Conference Preprint Book 3: Health Related Microbiology, 1994; pp.26-34.
- (c) Kay, D., *et al.* Predicting likelihood of gastroenteritis from sea bathing: results from randomised exposure. The Lancet 1994; 344: 905-909.
- (d) Charlet, F., *et al.* Epidemie de gastro-enterites virales liee a la consommation de palourdes en Charlente-Maritime. Bulletin Epidemiologique Hebdomadaire 1994; No. 37, 169-171.
- (e) Editorial. Proposal for a Council directive concerning the quality of bathing water. COM(94) 36 final - 94/0006(SYN). Official Journal of the European Communities; No. C 112: 3-10.
- (f) Editorial. Quality requirements for bathing water. Official Journal of the European Communities 1976; No. L 31: 5.

- (g) Philipp, R. A Written Memorandum: The Commission of the European Communities Bathing Water Directive: 6177/94, COM (94) 36 final. Environmental Epidemiology Report No. 181, University of Bristol, 1994; pp.11.
- (h) Philipp, R., and Hodgkinson, G. Recreational Water and Bathing Beach Quality: a draft WHO Environmental Briefing Paper. Environmental Epidemiology Report No. 178, University of Bristol; 1994: pp.17.
- (i) WHO . Guidelines For Health-Related Monitoring of Coastal Recreational and Shellfish Waters. Part I: General Guidelines; Part II: Bacterial Indicator Organisms; Part III: Selected Bacterial Pathogens; Part IV: Statistical Methods; Part V: Quality Control. pub. WHO Regional Office for Europe in cooperation with UNEP, 1994; EUR/ICP/CEH 041.

6. Review of draft document on Health risks from marine pollution in the Mediterranean

The main achievements of monitoring, research and activities for the progressive implementation of the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-based Sources, were reviewed by the participants at the meeting. These included:

- the establishing of sanitary monitoring programmes;
- an outline code of practice for waste management in coastal areas;
- guidelines for conducting microbiological/epidemiological studies correlating coastal water quality with health effects;
- comprehensive guidelines for health-related monitoring;
- comprehensive guidelines for waste discharge into the Mediterranean marine environment.
- the development and enhancement of national programmes for regular monitoring of pollution sources and recreational and shellfish waters;
- recommendations to governments on appropriate control measures to be taken so as to help ensure the sustained economic wellbeing of the Mediterranean area and the health of its resident and visitor populations;
- interim environmental quality criteria for microbiological and mercury standards in recreational and shellfish waters;
- measures to prevent pollution from mercury, lubricating oils, cadmium and cadmium compounds, organotin, organohalogen and organo-phosphorus compounds, persistent synthetic materials, radioactive substances, pathogenic microorganisms, carcinogenic, teratogenic and mutagenic substances;

- publication in 1994 by the WHO Regional Office for Europe, in cooperation with UNEP, of the five-part "Guidelines For Health-Related Monitoring Of Coastal Recreational And Shellfish Areas" (EUR/ICP/CEH 041).

Discussion on the draft WHO document EUR/ICP/CEH 127, was based on four themes:

(a) *Intended readership of the report:*

Participants agreed that, given its format, content and technical detail, the intended readership of the report was the scientific community and that this included microbiology laboratory staff, marine and food scientists, toxicologists, public health specialists, sanitary engineers, epidemiologists and clinicians. As such it needed introduction with a separate short document. This is addressed below in Section 6(c).

(b) *Details of the present draft report:*

It was agreed that the title of the document should be altered to:

"Health Risks from Marine Pollution in the Mediterranean":

Part II: "A Review of Hazards and Health Risks

and that it should be preceded by a separate document:

Part I: "Implications For Policy Makers" (q.v. Sect. 6 (c)).

Participants spent a considerable amount of time in detailed discussion of the Part II document so as to agree on specific wording for amendments, deletions and additions in the text.

They also agreed that, in the text, reference should be made to:

- principal and recent research findings since 1990;
- the effect of heavy/continuous rainfall on agricultural runoff and animal source contribution to recreational water quality;
- problems of outbreaks of Hepatitis A associated with clams and other shellfish;
- the respiratory irritation syndrome associated with dinoflagellates in sea-water;
- recent British studies for the association of faecal streptococci with gastrointestinal symptoms;
- the problems of physical and psychological hazards from discarded litter,

- sanitary and medical wastes;
- the development and application of techniques involving bacteriophage indicators of recreational water quality;
- the pathogenicity of *vibrios*;
- the rate of die-off of bacteria, expressed as T_{90} ;
- problems of algal blooms and biotoxins.

Arrangements were made for individual participants to prepare contributions on these themes and forward these to WHO for inclusion in the document.

(c) *A separate document for Policy Makers:*

To heighten awareness amongst public health and environmental policy makers of the health-related issues of recreational and seafood growing waters, participants agreed that a short document of some eight pages was needed for politicians and policy makers, and that it should include comment on:

- the Long term Programme for Pollution Monitoring and Research in the Mediterranean Sea (MED POL PHASE II);
- the contribution of MED POL PHASE II to sustainable development;
- ways in which control measures were introduced in terms of quality criteria and standards based on "acceptable" concentrations of bacterial indicator organisms;
- implications for public health of the microbiological and chemical hazards and their associated health risks;
- economic aspects of the threats to public health;
- a checklist of points for policy makers to consider.

It was agreed that this document should become:

"Health Risks From Marine Pollution In The Mediterranean:

Part I: Implications for Policy Makers",

and that it should be based on material in a University of Bristol Environmental Epidemiology Report prepared previously for WHO, (q.v. (q.v. Section V (ii) (h) above), and the draft WHO report, "Assessment Of Health Risks From Marine Pollution In The Mediterranean", EUR/ICP/CEH 127.

This document was prepared during the meeting by the rapporteur and adopted by participants. They agreed that it should be published by WHO and

widely distributed (Annex 1).

(d) *Links between the MED POL Programme, the Black Sea Project, and the WHO Guidelines on Recreational Water and Bathing Beach Quality:*

WHO staff noted that over the past three years there had been requests from some countries for guidelines on recreational water and bathing beach quality, and for these to become linked with the WHO Guidelines on Drinking Water Quality, and the WHO Air Quality Guidelines for Europe. Recent political developments in Europe with the emergence of many new countries and their need to change administrative and procedural systems, had accelerated this need for guidance. Accordingly, in 1992, a decision was made to develop the Recreational Water and Bathing Beach Quality Guidelines, and to include fresh waters as well as marine waters.

Whereas in the past, and as with the MED POL programme, guidance had mainly been based on the microbiological quality of bathing water, this guidance was now recognized as being too narrow. Within WHO, equal importance was now being attached to other aspects of water quality, i.e. the beach, bathers themselves, and requirements of other water user groups such as subaqua divers and dinghy sailors. Based on the Frankfurt Declaration of Health, published as the WHO European Charter on Environment and Health, 1989, aesthetic issues had also become important. They included general appearance and odour of the water, the quality of the beach including physical injury from 'sharps', the presence of litter, and the availability of toilet, litter disposal and catering facilities. Apart from member states of WHO/EURO, development of the guidelines was being encouraged to date from colleagues in Argentina, Australia, the Middle East, Morocco, Thailand, WHO/EMRO, Canada, and USA (through its Association of Public Health Physicians and on behalf of the US Environmental Protection Agency). WHO/HQ were supporting the project and intended to convene an inter-regional meeting to identify whether it should be a global project or remain restricted to Europe.

The process of developing the guidelines had included discussion with colleagues in June 1993, and during a MED POL Phase II WHO/UNEP meeting on the microbiological quality of coastal recreational waters. At that time managers, and one overall editor, were appointed to oversee the preparation of chapters on microbiological, chemical, algal, aesthetic, physical and control issues. Due to competing pressures of other work, difficulties were however experienced with some contributions and in completing the allocated tasks. Hence the strategy was changed, and the editor had been invited to prepare the draft guidelines for peer review. This was also not one event but an on-going process in which, after the first edition, a review process would take place and, as appropriate, further editions would appear.

In 1995 a range of steps would be undertaken:

- (a) the draft document would be completed with fully-referenced chapters in the WHO Collaborating Centre for Environmental Health Promotion and Ecology, University of Bristol, England;

- (b) the draft would be discussed with chapter managers;
- (c) an authoritative international review meeting would be convened;
- (d) the guidelines would be published with specific recommendations, including how they might vary in the light of local conditions and specific requirements, particularly if there was reason to believe the health risks vary.

It was though, important to note that details of how the guidelines should be applied and work in the risk management process was an issue of national sovereignty.

During the meeting, two examples were used to discuss the development of guidelines from risk assessment studies, issues of national sovereignty and adoption of working standards that are useful for risk management purposes. These examples are included in Annex 2.

7. Conclusions and recommendations

The meeting made the following recommendations:

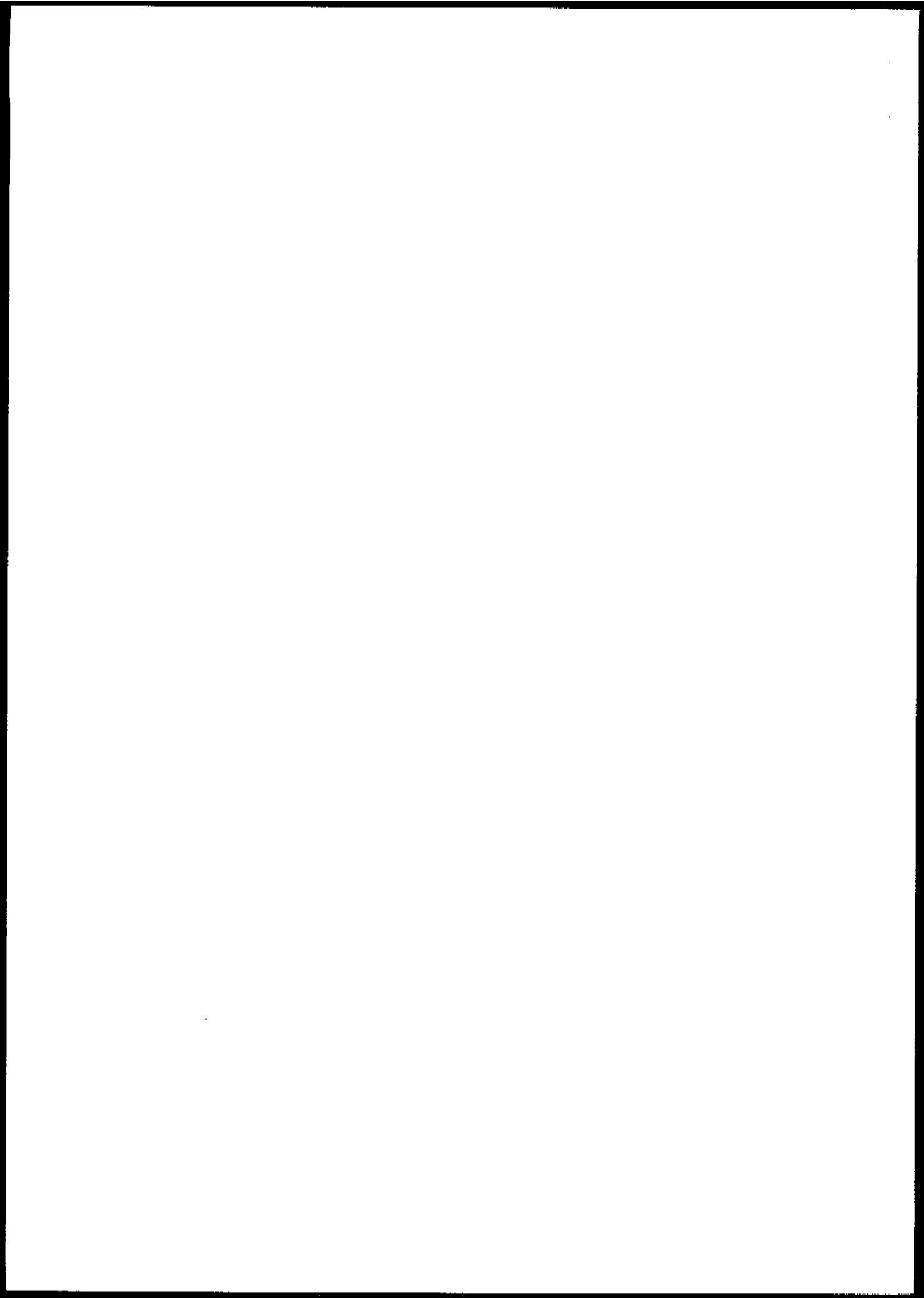
1. Environmental conditions in the Mediterranean are different to those of temperate European water zones. Studies that have previously been undertaken in cooler European waters should therefore be continued in the Mediterranean sea, to examine and compare the survival times in warmer seawater of organisms such as faecal indicators (bacteria and bacteriophages) and pathogens (enteric bacteria, enteric viruses and parasites).
2. Dose-response health effects studies are needed for exposure of swimmers in microbiologically contaminated Mediterranean waters, and particularly across a wide range of faecal streptococci concentration levels. The studies should also take into consideration the duration of exposure, the ambient temperature, general weather conditions and social behaviour of the bathers.
3. The contribution to receiving recreational waters of microorganisms such as fungi (e.g. *Candida* and dermatophytes) and to bacteria (e.g. *Staphylococci*) from human sources is little understood but of widespread interest. Attention should be given to microbiological studies of these anthropogenic sources and the potential for transmission between bathers. These studies should be undertaken towards the general objective of elucidating potential and actual health impact, and identification of any need to limit the density of users on a beach.
4. In areas where potential pollution sources exist, consideration should be given to establishing screening programmes for trace metal, radionuclide and organic compound concentration levels in seafood flesh, and for effecting control programmes as appropriate.
5. Wherever appropriate, and for both recreational and seafood growing waters as well as for seafoods, methodologies should be updated to incorporate

analytical and related techniques in current or proposed use, and to ensure they are accompanied by appropriate quality assurance programmes.

6. Wherever possible, and as a priority, simple and readily affordable but nevertheless reliable techniques for pollution measurement in shellfish, other seafoods and recreational waters should be developed. For example, for viral pollution these methods may include molecular biological techniques such as polymerase chain reaction (PCR) and, as indicators, the recovery of bacteriophages.
7. The frequency and severity of health effects from exposure in different parts of the Mediterranean Region to polluted shellfish and other seafoods is not sufficiently documented. As a basis for routine monitoring and practical control measures, microbiological and toxicological studies should be undertaken to determine the nature and extent of the health hazards. Epidemiological studies should also be undertaken for any associated health risks to human populations.
8. The adequacy of available depuration techniques to ensure food safety in the Mediterranean for shellfish and other seafoods is being questioned. These techniques should be reassessed and, if necessary, researched and appropriate remedial measures taken.
9. Towards sustainable development, environmental health programmes, supported if necessary by a legislative framework, need to have clearly stated management systems that define immediate and long-term remedial actions to be taken when compliance with standards is not adhered to, and that will ensure the health and wellbeing of local and tourist populations from their exposure to seawater. In collaboration with WHO, the Mediterranean Action Plan should define criteria for the action thresholds and establish an integrated management system.
10. Biomonitoring, molecular epidemiology and analytical epidemiological studies should be promoted in order to evaluate long-term health effects resulting from pollution of the marine environment.
11. Appropriate studies should be undertaken in order to evaluate intermediate biomarkers in marine organisms as early warning signals of marine pollution with compounds or complex mixtures that have toxicological relevance.

8. **Closure of the meeting**

Dr Kamizoulis thanked participants for their work during the meeting, and for their written and verbal comments received on the report. He also thanked the Host country and all the people who had contributed to the success of the meeting. In formally closing the meeting, Dr Louis Saliba also expressed his thanks to the participants and his gratitude to the University of Malta Medical School for hosting the meeting and for their kind hospitality.



Annex 1

HEALTH RISKS FROM MARINE POLLUTION IN THE MEDITERRANEAN

PART I : IMPLICATIONS FOR POLICY MAKERS

INTRODUCTION

This report is intended for policy makers with responsibilities for environmental health. It outlines health risks from marine pollution in the Mediterranean and describes the public health and economic benefits of control measures. A checklist is included.

WHO/EURO, jointly with UNEP, has also published two scientific documents within the framework of the Mediterranean Action Plan, that deal with the assessment of health risks and the design and implementation of monitoring programmes in the Mediterranean.

THE LONG TERM PROGRAMME OF POLLUTION MONITORING AND RESEARCH IN THE MEDITERRANEAN SEA

Due to the present and widespread interest in recreational water quality, politicians and local government must become aware of the need for users to have an informed, rational and objective appraisal of the risks associated with use. As a basis for local programme development, WHO encourages active participation by the general public, individual initiatives, and collaboration between different sectors in society as important ways of procuring action in environmental health. WHO also sees this approach as an essential part of the broad strategic framework for sustainable development.

Based on the experience of the preliminary phase of MED POL, the second phase - the Long-term Programme of Pollution Monitoring and Research in the Mediterranean Sea (MED POL Phase II) - was developed and finalized in 1980, adopted successfully at technical and formal levels in 1981, and became operational in 1982. Originally designed to cover the period 1981-1990, it was eventually extended up to the end of 1995. Basically, it consists of three elements: monitoring, research and activities for the progressive implementation of the 1980 Athens Protocol on pollution from land-based sources. All three elements include health-related components.

As pollution of coastal recreational areas constitutes a major issue in the Mediterranean, particularly as it may affect tourism, activities have gone beyond the strict scope of the pilot project on coastal water quality control. Apart from laying down the foundation of sanitary monitoring programmes, the matter of recreational water quality standards has been extensively reviewed during WHO expert meetings. The outcomes included an outline code of practice for waste management in coastal areas, preliminary guidelines for conducting microbiological/ epidemiological studies correlating coastal water quality with health effects (considered necessary for obtaining the sound epidemiological evidence on which quality standards and criteria would eventually have to be based),

comprehensive guidelines for health-related monitoring, and even more comprehensive guidelines for waste discharge into the Mediterranean marine environment.

The current phase of the MED POL programme contains an even stronger health related component than in the preliminary phase. Emphasis is given to the development and enhancement of national programmes for regular monitoring of pollution sources and recreational and shellfish waters, and recommendations to governments on appropriate control measures to be taken. Studies are also being undertaken on microbiological methodology for seawater and shellfish analysis, the implementation of laboratory quality control measures, and for the evaluation of survival times and adaptation of pathogens in the marine environment, pathogens-indicator relationships, epidemiological studies correlating recreational water quality with human health effects on exposed population groups, potential carcinogenicity and mutagenicity of marine pollutants, biological monitoring of population groups exposed to pollutants via seafood consumption, and waste management from land-based pollution.

THE CONTRIBUTION OF MED POL TO SUSTAINABLE DEVELOPMENT

The MED POL programme is part of a broad strategic framework for sustainable development in which:

- (a) the concept of sustainable development was agreed at the United Nations Conference on Environment and Development held in Rio de Janeiro in June 1992. "Sustainable development" was defined by the World Commission on Environment and Development (WCED) as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". WCED argued too, that "concern for sustainability - the ability to maintain the desirable elements of the status quo into the future".
- (b) the WHO Health for All programme for Europe requires all Member States to develop and implement policies that will conserve natural resources and promote sustainable development, and introduce a multidisciplinary and intersectoral approach to planning and managing health issues.
- (c) the WHO European Charter on Environment and Health 1989, reported that: "environmental health... includes both the direct pathological effects of chemicals, radiation and some biological agents, and the effects (often indirect) on health and wellbeing of the broad physical, psychological, social and aesthetic environment". it added that "every individual is entitled to an environment conducive to the highest attainable level of health and wellbeing", and that: "every individual has a responsibility to contribute to the protection of the environment, in the interests of his or her own health and the health of others". This Charter was endorsed in 1994 by the Ministers of Environment and the Ministers of Health of the European Member States of WHO in their Helsinki Declaration on Action for Environment and Health in Europe.

Apart from the 130 million inhabitants estimated to live permanently along the Mediterranean coastline, over 100 million tourists visit the area annually. During the summer months, the sea constitutes the main recreational amenity for local and tourist

populations alike, as a result of which most beaches, especially those in the vicinity of cities and tourist resorts, are heavily overcrowded, particularly on weekends. The heterogeneous nature of beach populations further facilitates the spread of infections. The prevailing warm climatic conditions not only result in a relatively long bathing season, but are responsible for longer exposure to seawater and/or beach sand, as compared to the situation in other, more temperate, countries. In addition, considerable amounts of shellfish are grown or harvested in the area, and consumed by both local and tourist populations. The total consumption of shellfish in Mediterranean countries has been estimated at over 12,000 metric tons annually, most of which is consumed in coastal areas.

Accordingly, the public health and amenity benefits from accessibility and use of recreational and shellfish growing areas can only be sustained with widespread multidisciplinary risk management and pollution control programmes. The principles of the 1989 European Charter on Environment and Health should therefore be followed when developing any policy for managing recreational and shellfish growing waters and formulating laws, regulations, incentives and good practices. These principles should include country, regional and local mechanisms for involving people in the development of policy and its implementation.

CONTROL MEASURES

Water and seafood quality control measures vary from country to country. In many cases, control measures in terms of quality criteria and standards are practically based on "acceptable" concentrations of bacterial indicator organisms. While such organisms can provide a reasonable estimate of the degree of sewage pollution, and perhaps a relatively satisfactory correlation with concentrations of bacterial gastrointestinal pathogens, they have so far not been accepted as providing any clear correlation with the presence and density of either viruses or non-gastrointestinal pathogens. In general, there is very little control over the quality of beach sand, which has only recently being recognized as a factor to be considered in the transmission of a number of skin and other contact infections, including fungal ones.

IMPLICATIONS FOR PUBLIC HEALTH OF THE MICROBIOLOGICAL HAZARDS

Many pathogenic microorganisms (bacterial, fungal and viral) which are recognized causes of human disease, are prevalent in the coastal marine areas of the Mediterranean, with a number of species endemic in various geographical zones. It is apparent that the present situation is resulting in adverse health effects on both local and tourist populations. Regarding the latter, as many as 19% of Hepatitis A cases occurring in Frankfurt were attributed in one study to the consumption of contaminated mussels and oysters in the Mediterranean by German tourists. Furthermore, and although it is not clear whether the source of infection was marine or otherwise, a Swedish study has reported that 63% of the *Salmonella* cases reported in that country were the result of infections contracted overseas, mainly in Mediterranean countries. Another Swedish report showed that 90-95% of giardiasis, 10-16% of Hepatitis A, 34-53% of shigellosis and 92-95% of amoebic dysentery were imported cases. European tourist authorities have also estimated that some 40% of tourists on vacation at Mediterranean coastal resorts became ill at some time during or immediately after their visit, one third of these reporting having been bed-ridden as a result, and one fifth having been forced to cut their vacation short as a result of such illness. Again

though, it is not clear whether the source of the infection was marine or otherwise. Nevertheless, whereas undoubtedly a portion of such tourist illness is associated with the consumption of unsanitary food or unsafe drinking water as well as other types of exposure, there is ample evidence that a major source of illness in areas where the sea is polluted can result from the consumption of sewage-contaminated shellfish and/or bathing at sewage-contaminated beaches.

Another problem is that of algal biotoxins in shellfish and it is a relatively recent one in the Mediterranean. More information is required for the resultant health effects, particularly from areas known to be subject to regular or sporadic eutrophication or "algal bloom" phenomena.

IMPLICATIONS FOR PUBLIC HEALTH OF THE CHEMICAL HAZARDS

The possible health risks of chemicals in marine waters used for recreational, shellfish and seafood growing purposes, are from the presence of trace metals, radionuclides, pesticides, agricultural waste, oils, detergents and illicit dumping of toxic waste. Generally, for recreational waters, but depending on the circumstances, there will be significant dilution of contaminants. The potential risks from chemical contamination of recreational waters, apart from toxins produced by marine algae or other exceptional circumstances, are therefore very much smaller than the potential risks from microbiological contaminants. Although more information is needed, it is unlikely that water users will come into contact with sufficiently high concentrations to cause ill health following a single exposure, or even repeated exposures. There has, however, been some suggestion of a relationship with long-term health effects such as cancers and damage to the immune system in marine animals. It is therefore important to ensure that any health risks are minimized.

In seafood however, the levels of chemical contamination do give cause for concern. For example, many shellfish can concentrate by several thousand-fold in their flesh the levels of trace metals, radionuclides and pesticides found in the surrounding seawater. The bio-accumulation of mercury in tuna fish and shellfish, cadmium in mussels, arsenic, organotin compounds from antifouling paints used on yacht hulls, organohalogen compounds (particularly PCB's), some pesticides and polycyclic aromatic hydrocarbons (PAH's) can cause sufficiently high levels that could interfere with commercial harvesting and sales of shellfish and other seafood.

ECONOMIC ASPECTS AND THE ASSOCIATED BENEFITS TO HEALTH

There is increasing interest in the concept of reciprocal maintenance - "that we should look after the things that look after us". This interdependence is the key to environmental economics and eco-audit.

The World Commission for Development (the Brundtland Commission) stated that development requires the maintenance of ecosystem integrity as well as economic and social stability. Understanding that excessive microbiological and chemical contamination can severely affect the economic benefits of recreational water use is therefore essential. Aesthetically unpleasant water can also be a significant deterrent to the uses of bathing waters, and with profound economic effects. In 1989, for example, the beaches and bathing

waters of Rimini, Italy, were affected by unpleasant-looking mucilage produced by the decay of algae, and which was deposited on the shoreline. It caused a 40% reduction in tourism that bathing season with significant economic loss and for which WHO identified the following economic losses: the number of tourist days lost; the reduced use of hotels, restaurants, bathing resorts and other amenities; damage to tourist-dependent activities (food industry, general commerce, etc); damage to fishery activities; and damage to the "image" of the area as a tourist resort.

Furthermore, in a number of Mediterranean countries, whole consignments of mussels regularly have to be destroyed because of contamination with algal biotoxins. Normal routine analysis of shellfish does, however, not include safety from other microorganisms such as vibrios, viruses and microtoxins.

The state of sewage contamination and littering of bathing beaches can also deter visitors. High incidence rates of gastrointestinal illness after bathing in sewage-polluted water have for example, been associated with public perception of the aesthetic appearance of bathing water and bathing beach quality. Public opinion can also be influenced dramatically by news media coverage of changing local situations.

These issues are important for local sustainable development as, for many resort towns the quality of their coastal recreational waters is an essential element in their marketing strategy. In all areas where there is a heavy dependence on tourism, and from an overall viewpoint, the preservation (or indeed restoration) of waters used for recreational, shellfish and other seafood growing purposes, must therefore be a priority. Locally, there is often the need for a permanent solution, and one based on the prevention of pollution at its point of origin. It is also essential to have programmes for keeping beach and recreational water areas clean, as well as public education and sanctions that will encourage a responsible attitude to litter and to human, animal, industrial and domestic wastes, by the water users themselves.

The emergence of new recreational water and seafood quality standards will in itself demand attention to economic costs and benefits associated with the existence of an institutional infrastructure for monitoring on a routine basis, and the implications when areas are considered unsuitable for bathing or shellfish harvesting as a result of pollution. Closure or rehabilitation measures need close scrutiny. Rehabilitation, for example, would normally be in the form of sewage/industrial effluent treatment plants and/or outfall structures. Although they represent a considerable capital investment, and apart from any operational and maintenance costs involved, the loss of environmental opportunity for recreational water users and commercial fishing purposes may have a more devastating and prolonged economic effect. Accordingly, cost-effectiveness analysis involved in developing strategies related to local recreational water users and commercial fishing purposes must include identification of all the social benefits, including those difficult to express in monetary terms and not easily quantified, namely those of positive health, well-being, improved quality of life, increased fitness that beach and water activities and fish consumption encourage, the acquisition of new skills, and the joy, pleasure and excitement that most people get from recreational water contact. It is after all widely recognized by public health professionals, educationalists, health promotion officers, social and sports scientists, that participation in watersports activities is of enormous benefit, not only physically, but also to the personal, social, mental and spiritual development of children and adults. The economic

consequences for sustainable development of denying a local recreational area to the public or a seafood growing area to the community, must therefore be part of recreational and shellfish growing water and bathing beach quality appraisal.

A CHECKLIST OF POINTS FOR POLICY MAKERS TO CONSIDER

To help protect public health, and in the context of integrated coastal zone management, policy makers should ensure that arrangements exist for the following aspects:

Human Health: exposure patterns, health effects, epidemiological investigations, risk estimations, preventive measures, and information for the public.

Pollutants of Health importance: types, sources, duration, levels, distribution, degradation and environmental effects, monitoring programmes, control measures, costs and benefits of control;

Development Plans: investment strategies for public health engineering and tourism development and management;

Local Control: legal responsibilities, communication with district councils and owners, information contact points for public and news media relations, emergency action plans, short and long-term remedial measures, the availability of lifeguards, rescue equipment and first aid points, warning systems for unsafe conditions, appropriate litter disposal facilities as well as their regular emptying, and training of local staff;

Public: guidelines on whom to contact for further information, safety advice and health protection during bathing and food consumption.

Policy makers should also consider any need to:

- raise public awareness of environmental quality issues and their relevance to health problems;
- encourage environmental health research into problems and threats to the coastline;
- monitor the fate and time trends for different pollutants of health importance;
- help interdisciplinary education on health protection from environmental pollution;
- strengthen their cooperation with international agencies having similar and/or complementary objectives for health protection from marine water activities and consumption of seafood.

Annex 2

LINKS BETWEEN THE MED POL PROGRAMME, THE BLACK SEA PROJECT, AND THE WHO GUIDELINES ON RECREATIONAL WATER AND BATHING BEACH QUALITY

1. THE BLACK SEA PROJECT

In the Black Sea Project, standards have been agreed with the six Black Sea countries for recreational waters. They include *E. coli* and *Streptococcus faecalis*. The new working standard for the first 12 months starting in May 1995, is 100 faecal streptococci/100ml. It has been derived on the basis of recent British work in temperate waters by Kay, *et al*, funded by the UK Government Departments of Environment and Health, the Welsh Office and the National Rivers Authority, and in which 32 faecal streps/100 ml has been identified as a threshold for likely GI effects in healthy adults (q.v. Section 5 (ii) (c), the present EC Guideline value of 100 faecal streps/100 ml., and the recent EC proposal of 100 faecal streps/100 ml for the Guideline value and 400 faecal streps/100 ml for the Imperative value. This new working standard in the Black Sea will be reviewed when the WHO Guidelines on Recreational Water and Bathing Beach Quality are published.

Consideration has been given to reducing this standard by a factor of 10 for children and for non-healthy adults. It has however been equally noted that, for practical risk management, extrapolation to this extent would give an unworkable approach to standards setting.

2. THE EUROPEAN UNION

In the European Union (EU), the relationship between risk assessment and risk management is of critical importance, particularly as the EU has a responsibility to prepare not just guidelines, but standards that place obligations on member states. In countries which are member states of the European Union, legislation is now based on the relative European Community's Directives, when appropriate. Other countries which are not member states, but have economic links with the Union, have modelled their legislation on these Directives to various extents. In these respects, and to amend the 1975 Directive, an EC proposal for a Council Directive concerning the quality of bathing water was submitted by the European Commission on 29 March 1994.

Risk management, it was noted at the meeting, needs a multidisciplinary approach in which cultural, social, economic and regional development priorities as well as scientific issues need to be considered. Accordingly, in the process of policy making, setting standards, and in making its proposals for a revised Directive, the EC seeks the best available information. In the present review process for bathing water quality, comments have been sought during the formative stages of the past three years from individuals, committees, and member states with their national experts. Advice has been obtained from scientists, physicians, epidemiologists, legal experts, administrators, engineers, economists

and non-governmental organizations as representatives of the public.

The EC Proposal for a Council Directive concerning the quality of bathing water was distributed to participants. Attention was drawn to several points: the proposed Directive as well as the present one, concerns the quality of "bathing waters" and does not apply to those used for other recreational purposes; the major microbiological modifications to the present Directive include removal of total coliforms, replacement of faecal coliforms with *E. coli*, introduction of an Imperative value for *Streptococcus faecalis*, and addition of bacteriophages as a new indicator. Participants noted these changes. An important new notion introduced by this proposal is the obligation of the Member States to inform the public about the state at the bathing zones. Comment followed on differences between risk assessment and risk management, and on the WHO work (q.v. Section V (ii) (i), to help address the scientific issues of microbial monitoring including the choice of indicator organisms, guidelines for standards setting, position of sampling stations, sampling procedure, statistical techniques, transport methods and analytical techniques.

With respect to these above two examples of current work to establish guidelines, it was noted that in 1977, and in a MED POL Report, "Health Criteria and Epidemiological Studies Related to Coastal Water Pollution", the WHO Regional Office for Europe explored issues of risk assessment and risk management. Points that emerged in that report are restated here as they still apply and were covered in comments made by participants at the present meeting:

"Recreational water criteria....are a dose-response type of relationship between illness and water quality. Their translation into guidelines requires a decision as to the "acceptable risk" of symptoms of varying degrees of severity, or of specific diseases. This decision is influenced by social, economic, and political as well as health factors. Decisions as to standards and the pollution control programmes necessary to achieve them are essentially political. They should be followed by the choice of the appropriate strategy, based on cost-effectiveness analysis. However, some types of cost-benefit analysis may be instructive and useful in defining the economic inputs. Due attention should be given to identifying all the social benefits, including those difficult to express in monetary terms and not easily quantified, namely the benefits of positive health, well-being, and improved quality of life. In addition, the social consequences of denying the recreational resource to the public must be considered."

An internal WHO paper was then presented, outlining the process being established by WHO during 1994 to develop guidelines for recreational water quality. The process builds upon experience gained with the development of WHO guidelines for drinking water quality and was illustrated with findings of a study recently reported from temperate waters. The proposed process was endorsed by workshop participants and further comment is being sought.

3. INITIATING DEVELOPMENT OF ONE/MORE WHO GUIDELINE VALUE(S) FOR RECREATIONAL WATER

WHO and EURO in particular has for some time been active in the development of a book to be entitled 'Guidelines for Recreational Water and Bathing Beach Quality. Whilst a first draft of the guidelines is in an advanced stage of preparation, no attempt has been made as yet to consider numerical values of key indicators or parameters which might

indicate the adequacy of quality from a health viewpoint and which take into account the most recent research findings.

It is anticipated that there will be considerable pressure for such values to be put forward and to do so is consistent with the position adopted by WHO in other arenas (such as drinking water quality).

This paper is an initial attempt to outline the process by which such guidelines might be decided upon.

Concerning recreational water quality

The development of scientifically-derived guideline values can be seen as a process involving nine steps:

- (i) There is good epidemiological evidence from the United Kingdom (Kay *et al*, 1994), supported by preliminary data from current work in New Zealand (McBride *et al*, 1993), of a relationship between faecal streptococci as indicators of faecal pollution of recreational waters and minor gastrointestinal symptoms amongst bathers. There is weaker evidence concerning other indicators and other disease states. Most evidence concerns bathing in coastal waters.
- (ii) There is no universally-applicable risk management formula. For this reason, WHO has previously elected to propose Guideline values. 'Acceptable' excess disease rates are especially controversial. It is therefore proposed to develop guideline values for recreational water quality to be adapted in light of local, national or international criteria of 'acceptability'. Guideline values are not standards. In publishing guideline values, WHO seeks to explain their significance and how they are derived, and indicates how they might be interpreted or modified in light of regional or local factors including population behaviour, exposure patterns, social, economic, cultural and climatic aspects. The translation of guidelines (which represents a risk assessment) to standards (which constitute part of risk management) is outside the role of WHO although it may advise upon how such a translation may be made.
- (iii) Based upon the work of Kay *et al*, (1994), an exposure to water containing 40 faecal streptococci/100 ml in a single bathing season corresponded to an excess probability of gastrointestinal symptoms of 0.05 for an individual bather who entered the water for at least 10 minutes and immersed their head at least three times during that time (i.e. one in 20 such bathers would experience gastrointestinal symptoms).
- (iv) It is important that the eventual WHO Guideline be comprehensible. It would therefore be better expressed in terms of the proportion of "bathers" developing gastrointestinal symptoms per annum (or per bathing season).
- (v) A working definition of a "bather" might be a person receiving 20 exposures of the type studied by Kay *et al* (1994) per annum (bathing season). This could, for instance, be during a 10 day holiday in which the bather entered the water twice per day; or through a person visiting a local beach one day every two weeks during a 20 week bathing season and entering the water twice per visit.
- (vi) Based upon the above, an 'average' bather would suffer one excess instance of

minor gastrointestinal symptoms per season (year) if bathing in a water containing 40 faecal streptococci/100 ml. This estimate of risk assumes that the probability of symptoms of ill-health resulting from a recreational water exposure is not influenced by recent previous exposures.

- (vii) Children and other groups such as the immunocompromized, the elderly and those suffering ill-health may be more susceptible to minor gastrointestinal symptoms than the healthy adults studied in the above-mentioned work of Kay *et al* (1994). Ethical questions limit the probability of obtaining high-quality data concerning such groups.

It would be hard to defend a position through which an "acceptable" water quality would be expected to lead to children suffering more than one bout of illness in their annual holidays.

To reduce the likelihood of ill-health amongst these more susceptible groups to the risk levels similar to those noted above for healthy adults, a correction factor of two is recommended.

- (viii) This logic process would result in a guideline value of 20 faecal streptococci/100 ml.
- (ix) Given the complexity of the relationship between faecal indicator density in recreational waters and human health effects a more sophisticated approach than outlined above (i.e. a single 'cut-off value') may be appropriate. Some work in this regard has been done and in Denmark, for instance, a statistical aggregate of the results of testing over a season is used to compensate for the inadequate number of data generated. Insufficient epidemiological data exist to support wider adoption of such an approach.

NOTES:

- (a) As further evidence becomes available regarding other health problems (such as attack rates for eye and ear symptoms), a similar exercise to that outlined above should be followed.

If evidence becomes available for specific diseases such as cholera, hepatitis A or typhoid then a similar exercise to the above should also be followed.

It should be noted that where such health effects are causally associated with faecal contamination they will be additional to the minor gastrointestinal symptoms addressed above and may lead to the adoption of a stricter guideline. Furthermore, and as consequences of the recreational use of water, other health effects may have very different levels of acceptability to the symptoms outlined above. In other words, the acceptance of one bout of minor gastrointestinal symptoms per season by bathers does not imply that such a rate would be acceptable for other morbidity.

Such a process might lead to the incorporation of other parameters or indicators of water quality into the monitoring and standard-setting process.

- (b) No adequate evidence exists at present to alter the above logic or conclusion for different types of water (sea/fresh; warm/cool), or climatological zones, except to take into account differences in exposure frequency and duration.

- (c) A single guideline value is proposed for all recreational uses of water. Insufficient evidence exists at present to do otherwise. The quality of water to which special interest groups (such as body, board and windsurfers, subaqua divers, canoeists and dinghy sailors) are exposed, should be included in monitoring programmes. In this context, recreational use of water is understood to mean all uses leading to the likelihood of significant contact (such as those mentioned above).
- (d) Where disinfection is used to reduce the density of indicator bacteria in effluents and discharges the presumed relationship between faecal streptococci (as indicators of faecal contamination) and pathogen presence may be altered. This alteration is at present poorly understood. In water receiving such effluents and discharges faecal streptococci counts may not provide a reasonable estimate of the risk of suffering from mild gastrointestinal symptoms.

COMMENTS:

Because the proposed guideline value differs radically from standards in current use worldwide it will be essential that it is clear to all that:

- (i) the guideline value is a risk assessment based upon the best available scientific evidence;
- (ii) as WHO has previously noted (WHO, 1977), it is up to society to define 'acceptable' excess disease and for national authorities to apply the guideline principle for risk management under their specific condition (i.e. to undertake risk management); and
- (iii) it is important to note that it is possible or even likely that the sector response to such a guideline will be that it is 'unachievable'. Whilst such a conclusion may be debated, the fact that it is unachievable in the short term and will not be achieved in a geographically extensive area in the longer term is fairly certain. These considerations are important. They move the principal risk management strategy for minor gastrointestinal symptoms away from standards and enforcement and towards informed individual choice (and, potentially therefore towards competition between resort/destinations based upon relative safety).

Concerning Beach Quality

No attempt is made here to initiate quantification of guidelines for the microbiological quality of beaches. Nevertheless, it would be appropriate that this were attempted and the result incorporated into the WHO Guidelines for Recreational Water and Bathing Beach Quality in preparation.

Logically, this area may be divided as follows:

The beach *per se*

- intrinsic characteristics (large waves, strong currents, steeply shelving beaches, proximity to rocks and sharp material on the floor of the bathing zone may make a beach unsuitable for certain purposes);
- anthropogenic influences (presence of hazards which may be eliminated such as

medical and sanitary waste washed ashore, and discarded broken glass).

Associated facilities in as much as they may promote health and safety:

- first aid points;
- lifeguards;
- systems for warning of unsafe (usually sea) conditions;
- provision of life rings;
- educational activities or facilities;
- system for provision of information regarding the above to the public.

It is likely that some statistics are available regarding the above - albeit from a limited geographic area - which would assist in developing or discarding guidelines for these; for instance national studies on the effectiveness of providing life rings/lifeguards; on drowning/near drowning versus strong currents, and the like. (In the UK for example, 25-50 per cent of drownings during water sports activities have been associated with alcohol consumption, (Rouse, 1991).

Much of the above will depend on the exact nature of recreational use - life rings may, perhaps, be more effective in harbours than along the open coast, waves may be a danger to swimmers but beneficial to board surfers, etc.

It may be inappropriate or impossible to propose guideline values per se for (some of) the above in which case it will be essential that the WHO Recreational Water and Bathing Beach Guidelines include a review of relevant literature including statistics regarding these aspects.

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Annex 3

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