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

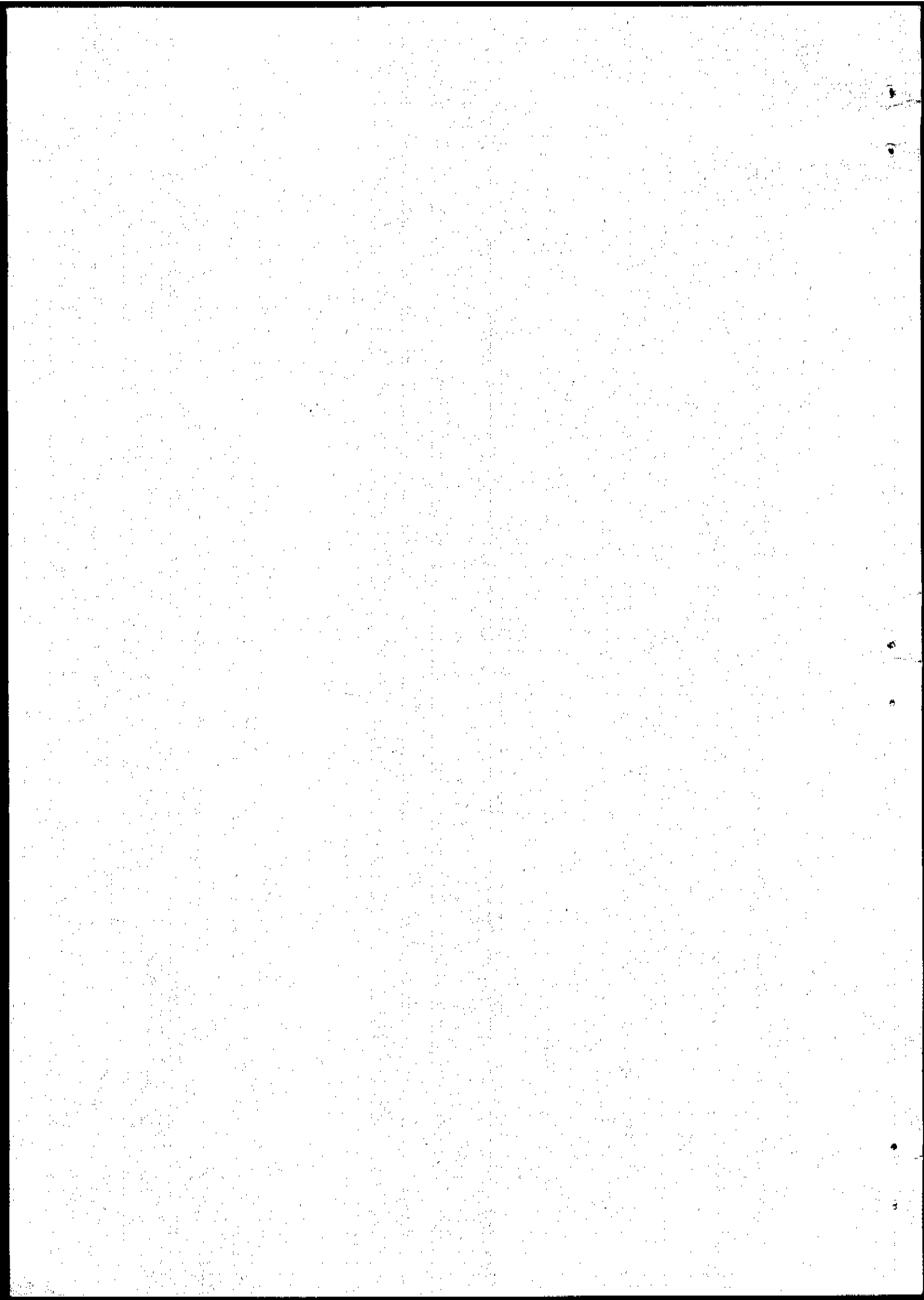
CORRELATION BETWEEN COASTAL WATER QUALITY AND HEALTH EFFECTS



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WORLD HEALTH ORGANIZATION
Regional Office for Europe
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Report on a joint WHO/UNEP Meeting

Follonica
21-25 October 1985



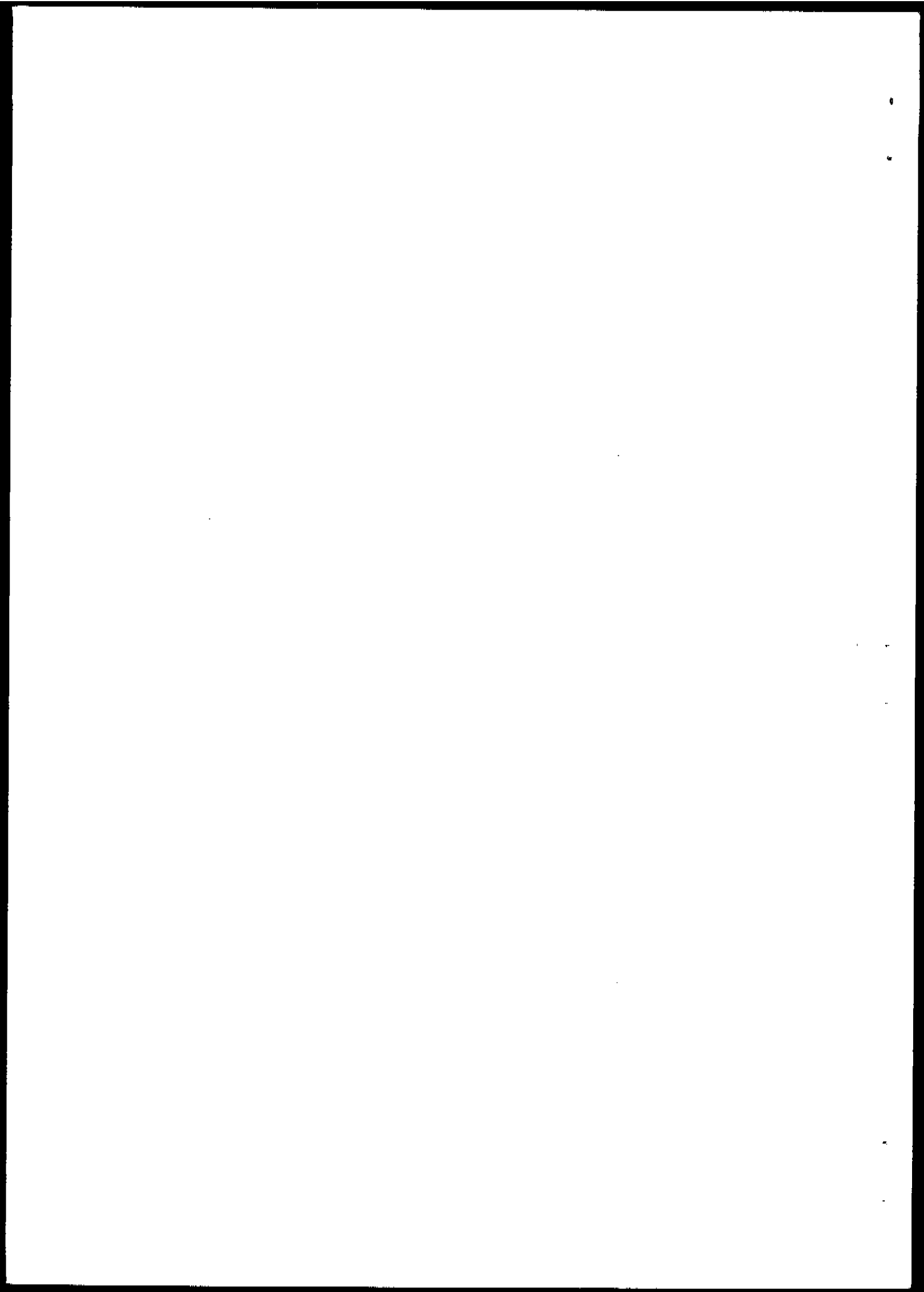
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FOREWORD

The first phase of the Joint Coordinated Mediterranean Pollution Monitoring and Research Programme (MED POL Phase I), conducted between 1976 and 1981 within the overall framework of the Mediterranean Action Plan sponsored by the United Nations Environment Programme (UNEP), included a pilot project on Coastal Water Quality Control (MED POL VII) jointly coordinated by WHO and UNEP. This pilot project included the microbiological and related monitoring of selected coastal recreational and shellfish-growing areas and shellfish by thirty national laboratories in the Mediterranean region, the initiation and promotion of scientific studies on the epidemiological evidence of health effects caused by pollution in coastal areas, and the development of principles and guidelines for coastal water pollution management.

During the course of this pilot project, a consultation meeting was jointly organized by WHO and UNEP in Athens from 1 to 4 March 1977. The task of this meeting was to review the epidemiological factors and health criteria on which quality standards for coastal waters are based and to develop a methodology for epidemiological research programmes intended to provide reliable data for application in the field. The meeting made recommendations for long- and short-term epidemiological studies, and agreed on guidelines for the conduct of "week-end" epidemiological-microbiological studies for developing recreational water quality criteria, as well as guidelines for studies on organized vacation groups. The meeting also recommended interim criteria for the microbiological quality of coastal recreational waters.

As a result of this and other meetings held within the framework of the same pilot project, interim environmental quality criteria for coastal recreational waters, shellfish-growing waters and shellfish were developed, based on the use of faecal coliforms and faecal streptococci as indicator organisms. At the same time, the research component of the Long-term Programme for Pollution Monitoring and Research in the Mediterranean Sea (MED POL Phase II), designed to cover the period 1981 to 1990, included, as one of its approved activities, the performance of epidemiological studies related to the confirmation (or possible revision) of the proposed environmental quality criteria (standards of use) for bathing waters, shellfish-growing waters and edible marine organisms.

Research projects within this activity were initiated in 1982. Work was handicapped by the fact that, although similar studies on the correlation of the quality of coastal bathing and/or shellfish-growing waters had been performed both within and outside the Mediterranean region, these had been mainly conducted on a fragmentary basis.

At the fourth Ordinary Meeting of the Contracting Parties to the Convention for the Protection of the Mediterranean Sea against Pollution and its related Protocols, held in Genoa from 9 to 13 September 1985, Mediterranean coastal States agreed to take transitional measures that would ensure as a minimum common requirement that the quality of bathing waters would conform with the proposed interim WHO/UNEP environmental quality criteria concerning faecal coliforms. They also agreed to continue to provide full support to the research and monitoring component of MED POL Phase II relevant to the assessment of the environmental quality of bathing waters, shellfish and shellfish-growing waters, in particular, inter alia, to the

expansion of the present programme of epidemiological studies to achieve the necessary information on the relationship between water quality and health effects.

Within the framework of the MED POL Phase II programme, a consultation meeting on the correlation between coastal water quality and health effects was convened jointly by WHO and UNEP in collaboration with the Institute of Mutagenesis and Differentiation, National Research Council, Pisa, with the following objectives:

- to review the results of completed and current epidemiological studies in the subject area, with particular emphasis on their achievements and their shortcomings;
- to formulate a proposal for collaborative regional epidemiological studies that could be carried out in the Mediterranean;
- to formulate draft guidelines for such studies;
- to review the results obtained to date from those aspects of the MED POL Phase II monitoring programme that relate to the proposed epidemiological studies;
- to make appropriate recommendations.

A number of experts from Mediterranean Institutions which were participating in relevant studies within the framework of MED POL activities, together with a number of other Mediterranean and non-Mediterranean experts, were invited to attend the Consultation meeting. In addition, the following International Organizations were invited to send representatives: FAO, IOC, UNESCO, WMO, IAEA and the Commission of the European Communities.

1. Opening of the meeting (Agenda item 1)

The meeting took place at the Villaggio Svizzero, Follonica (Grosseto) from 21 to 25 October 1985. It was attended by 18 participants from ten Mediterranean countries and two from a non-Mediterranean country. There was one representative of the Commission of the European Communities and two Staff members of the WHO Regional Office for Europe, one of whom also represented the UNEP Coordinating Unit for the Mediterranean Action Plan. A list of participants is given in Annex 2.

Mr J.I. Waddington, Director, Environmental Health Service, WHO Regional Office for Europe, opened the meeting and welcomed participants on behalf of the World Health Organization. He briefly outlined WHO's participation in the Mediterranean Action Plan. The subject of the present meeting was one of the most important topics in this regard. He explained that the regular programme of the WHO Regional Office for Europe had a definite orientation towards the solving of new problems to meet the demands of an industrialized society. These problems, connected with land use, water quality and air pollution, affected health but were not only a function of human health in the strict sense of the word, and national responsibility for their solution was of an interministerial nature. In health care, the focus was now on preventive as opposed to purely curative measures, and this involved the whole field of

environmental health at community level, together with lifestyles at the personal level. Within the Organization's overall policy of Health for All by the Year 2000, the Regional Office had developed 38 targets, including seven in Environmental Health. The two most relevant to the Mediterranean Action Plan were that all countries should have adequate supplies of safe drinking water by 1990, and that by 1995, the pollution of lakes, rivers and marine waters should no longer pose threats to human health. The scope of the present meeting was linked to the latter target. Epidemiological studies on the relationship between seawater quality and health effects were necessary to develop firm quality criteria. The current ones were only of an interim nature, and there were discrepancies between them and the criteria enforced by the European Economic Community. In this context, it should be remembered that the Mediterranean has specific characteristics of its own, and also that recent developments in the comparative importance of recreational water-borne diseases had come to light. The programme Mediterranean States were involved in was not an academic one. Its implementation would incur investments in all countries, and work performed therefore had to relate to costs already incurred as well as costs having to be incurred. The programme presented a challenge to the scientists involved, and results obtained had to be practical and action-oriented. Finally, Mr Waddington expressed his thanks to the host institution for the facilities and hospitality provided, and mentioned the appropriateness of the venue selected - a Mediterranean coastal tourist resort - for this particular meeting.

Professor G. Bronzetti welcomed participants on behalf of the Institute of Mutagenesis and Differentiation, National Research Council, Pisa. Apart from its long-standing links with WHO, the institution had been an active participant in the research component of MED POL Phase II since the programme of activities was initiated in 1982, and it was a pleasure to be able to host this meeting. Italy was facing the health problems of an industrialized society, and protection of its coastal recreational waters was a top-priority issue. He augured a fruitful result for the meeting.

2. Scope and Purpose of the meeting (Agenda item 2)

Dr L.J. Saliba, Senior Scientist, Mediterranean Action Plan, WHO Regional Office for Europe, explained the scope and purpose of the meeting. Apart from reviewing completed and ongoing epidemiological studies, participants had to agree on the finalization of the draft protocol for studies to be carried out in the Mediterranean region (document ICP/CEH 001 m06/8), and identify those institutions which could participate in the programme. The group also had to identify those pathogenic organisms considered to present a health hazard to bathers and shellfish consumers in the region in the light of available knowledge, and the indicator organisms connected with them, and to identify, to the extent possible, the specific material on sampling and analytical methodology, factors affecting pathogen survival and pathogen/indicator correlation.

3. Election of Officers (Agenda item 3)

Professor L. Villa was elected Chairman, Professor A.F. Abdel Latif Vice-Chairman and Professor R. Mujeriego Rapporteur, Dr L.J. Saliba acted as Secretary to the Meeting.

4. Adoption of the agenda (Agenda item 4)

The provisional agenda was unanimously adopted.

5. Organization of the meeting (Agenda item 5)

The Chairman explained the detailed organization of the work of the meeting, including the timing of sessions and other arrangements. It was agreed that an ad hoc working group would initially study the draft protocol and submit a revised version to the plenary.

6. Review of accomplished and ongoing epidemiological studies correlating the quality of coastal recreational waters, shellfish-growing waters and shellfish, with health effects (Agenda item 6)

Professor H.I. Shuval presented a paper entitled "Thalassogenic infections - Health effects associated with microbial contamination of marine bathing waters and shellfish growing areas: A critical review" (document ICP/CEH 001 m06/6). In addition, Professor E. Geldreich presented a paper entitled "A review of epidemiological evidence, criteria and standards correlating health effects with shellfish quality, and two other papers on the bacteriological examination of seawater in relation to health risk assessment were presented by Professor J. Brisou and Professor J.A. Papadakis respectively. Some of the most significant points raised during the presentation of the papers and the ensuing discussions are summarized below.

6.1 Marine recreational waters

Thalassogenic infections can be defined as human infections whose source is the sea and are normally associated with microbial contamination of the sea resulting from the disposal of wastewater therein and/or microbial contamination directly from the bodies of bathers in restricted coastal bathing areas. Such exposure to contaminated seawater, containing human pathogens, may lead to infection and disease among bathers who ingest some seawater. Another category of infections also associated with bathing may be caused by microorganisms such as Staphylococcus aureus, Clostridium welchii, Pseudomonas aeruginosa and Candida albicans which are nearly always present in man, but may give rise to disease when the resistance of the individual who harbours them is lowered, as might occur in the case of extended periods of bathing in cold water. These same organisms may also cause infection as a result of being forced into breaks or ruptures of delicate membranes in the ear or nose resulting from the trauma associated with diving into water. While all the above four species of microorganisms may also be found in polluted water, the suggestion that a bather suffering from infection has acquired it from polluted water should be treated with reserve unless there is strong supporting evidence to the contrary.

Most coastal recreational beaches are in the vicinity to urban areas. The disposal of urban wastewater, laden with pathogenic microorganisms, to the sea in the vicinity of such beaches has always been of concern to public health authorities as a possible route of infection. In 1918, a study conducted by the American Public Health Association (APHA) on the prevalence of infections associated with bathing places led to a tentative proposal that total bacterial counts and total coliform counts be used as water quality indicators in the health evaluation of bathing places. However, even a number of years later, there was still a dearth of epidemiological evidence connecting the contamination of bathing waters with health problems.

Information on thalassogenic infections and/or disease in relation to microbial contamination of the sea can be obtained from two primary sources: reports of investigators of disease outbreaks associated with microbial contamination of marine bathing areas, and specific retrospective or prospective epidemiological investigations with the aim of determining the relationship between thalassogenic infections and/or disease and the microbial quality of the seawater. A third possible source is through the use of deductive reasoning based on minimal infectious doses, amount of seawater ingested, immunity status, and other possible environmental and host variables.

A number of outbreaks of typhoid fever in the United Kingdom, United States, Egypt and Israel have been linked with gross contamination of specific bathing locations. The evidence regarding the transmission of virus diseases by bathing in polluted waters is mixed. Studies on the possible transmission of poliomyelitis by this route have been mainly inconclusive. The situation regarding enteroviruses is different. Although enteric virus diseases have been definitely linked with bathing water contamination, it is still not clear whether the primary source of such contamination in the various outbreaks reported was sewage discharge or the bathers themselves. Studies on outbreaks of ear, eye, nose and respiratory diseases have tended to confirm that these could have been swimming-associated, and in a number of instances, exacerbated by poor water quality. At the same time, however, very little correlation was obtained between disease incidence and sewage pollution of the bathing localities concerned. One positive finding on a Shigellosis outbreak definitely linked swimming in sewage-polluted water with transmission of the disease.

Only a very limited number of epidemiological studies have been designed with the intention of determining the correlation, if any, between health risks and the concentration of specific microbial pollution indicator organisms. The results of the US Public Health Service Study in 1953, which reported a significant excess of disease among bathers over non-bathers, in some cases irrespective of water quality, has given rise to considerable controversy over interpretation of results obtained. The UK Public Health Laboratory Service carried out an extensive bacteriological and epidemiological study of bathing in sewage-contaminated coastal waters between 1953 and 1959. The conclusions drawn were that there was little, if any, risk of enteric disease from swimming in sewage-polluted water unless aggregate faecal material was found therein, and that aesthetic considerations would limit beach usage long before the development of a significant risk of swimming-associated enteric disease. These conclusions, and the resulting recommendation that microbial standards for bathing waters as usually proposed had little scientific validity, have been queried. It is also doubtful whether the conclusions, even if correct for the specific diseases studied and for the special situation existing at the relatively cool bathing beaches in the United Kingdom, would be applicable to polluted beaches in more temperate climate such as the Mediterranean, where the period of exposure to seawater is much longer.

The United States Environmental Protection Agency study in 1983 incorporated a more vigorous definition of swimmers to allow for a beach-going but non-swimming control group to eliminate the bias from non-swimming-associated illnesses, as well as a system for validating gastrointestinal symptomatology. The results obtained showed that the risk of gastroenteritis associated with swimming in marine waters impacted with

municipal wastewaters was related to the quality of the water as indexed by the mean enterococcus density. In this study, the widely-used faecal coliform indicator proved to be a relatively poor predictor of gastrointestinal disease. The results also confirmed a previous EPA study (1979-1982) which showed a strong correlation between "highly credible" gastrointestinal symptoms and the enterococcus and E. coli content of the water, together with the lack of association between faecal coliforms and swimming-associated gastroenteritis.

A similar study conducted in Alexandria in 1981 also showed a strong association between gastrointestinal symptoms and enterococcus and E. coli densities, the relatively lower disease rates being ascribed to higher immunity in the local population. A pilot prospective epidemiological study conducted in Tel-Aviv in 1983-1984 gave similar results. An epidemiological study carried out at 24 beaches in Malaga and Tarragona in 1979 indicated that there appeared to be a real public health hazard associated with bathing in coastal waters of unsatisfactory microbiological quality. In this case, intestinal infections had morbidity rates of below 1%, and the most frequent ailments observed were skin, ear and eye infections, a significant association being obtained between the last two and the habit of immersing the head in the water while bathing. In addition, microbiological limits in terms of faecal coliforms did not appear to provide consistent public health protection in the presence of comparable concentrations of faecal streptococci. A study on five beaches in France in 1983 resulted in differences in the incidence of conjunctivitis and skin infections between bathers and non-bathers, and an association between the incidence of colds, abdominal discomforts, nausea and pruritis and the habit of immersing the head while bathing. On the other hand, no important differences were observed between polluted and non-polluted waters.

The results of these studies appear to afford strong evidence that bathing in sewage-polluted water can cause a significant increase in the incidence of gastrointestinal diseases. The majority of studies also show a high degree of correlation between disease incidence and the concentration of enterococci and E. coli in the seawater. As a conclusion, swimming activities in coastal areas where faecal pollution is present carry a real public health risk. However, while enteric diseases appear to be prevalent in certain areas, different types of ailments, such as ear, eye, throat and skin infections, have been observed to be prevalent in other coastal areas. Furthermore, the incidence of reported illnesses vary widely (from below 1% in certain studies to 22% in others) mainly in relation to age groups. In this regard, although the 0 to 4 age group appears to be the most susceptible to gastrointestinal infections, the high incidence rates (nearly 22%) reported in certain cases leads to the suspicion that other factors, i.e. non-swimming-associated ones, may be partially responsible.

Practically all epidemiological studies conducted have correlated morbidity data with the concentration of faecal indicator organisms. In a number of cases, the incidence of non-enteric diseases was recorded, and no direct relationship found with seawater quality as expressed in terms of such faecal indicators. In view of the repeated observations of the relative predominance in certain areas of respiratory diseases and skin infections, there is an obvious need to focus on one or more specific indicators of non-enteric pathogens in addition to the continued use of a faecal indicator system. The problem of non-enteric pathogens may be of particular importance

in comparatively warmer climates, where water contact by bathers is normally of long duration. One other significant aspect is the possible association of non-enteric pathogen occurrence with high-density bather populations in recreational waters. In this context, the need exists for more specific information concerning the relative importance of the person-to-person route of infection, as compared to the incidence associated with contact with water and/or beach sand.

6.2 Shellfish-growing waters and shellfish

Many pathogens found in sewage have now been detected in shellfish, particularly in those growing waters which are heavily polluted. Salmonella is a prime example of a bacterial pathogen frequently encountered in contaminated shellfish. Enteric viruses have been detected in various species of bivalves, as also echoviruses and coxsackie A viruses. What is most alarming from the public health aspect is the incidence of bacterial and viral pathogens in molluscs from approved harvesting waters.

Quality criteria for growing waters depend to a large extent on the type of shellfish harvested. Bivalve molluscs are able to concentrate waterborne pathogens from low-density occurrences in water because of their filter mechanism. On the other hand, a number of crustacea, such as crabs, have different feeding habits which in many instances limit pathogen accumulation to levels only equal to that of the surrounding water or in the contaminated mussels on which they feed. The problem of identifying areas of pathogen-free crabs for harvesting is further complicated by virtue of their mobility which provides opportunities for them to acquire viruses from polluted waters before being trapped in high-quality waters.

The use of shellfish depuration techniques or "self-cleaning" of these animals from polluted waters in an attempt to flush out microbial hazards and render the product safe for public consumption is questionable. Salmonella typhi murium has been reported to have persisted in oysters for 49 days, having been detectable for 14 days in an accepted depuration protocol specifying that no faecal coliforms should be detected from the water after a 48-hour shellfish retention period. Virus retention in shellfish appears to be even longer than that of bacterial pathogens. As an example, virus carriage for hepatitis A in oysters has been reported to range from six to eight weeks. Carriage of enteric viruses in oysters for a period of five months with little reduction in numbers and no loss in infectivity has been found to be possible during winter months when shellfish metabolism declined to a minimal level. This condition is probably the major reason for occasional reports of virus outbreaks from raw shellfish consumption during winter and the occasional poor correlation with virus in shellfish-growing waters or from examination of depuration waters.

The comparatively large number of outbreaks of typhoid fever, infectious type A hepatitis and cholera have provided the epidemiological evidence that wastewater-contaminated shellfish, particularly molluscs normally eaten raw, constitute an extremely effective vector in disease transmission. Other outbreaks of gastrointestinal diseases have involved Campylobacter and Norwalk virus.

While a zero tolerance for sewage organisms is unachievable in most shellfish-growing waters, there needs to be a maximum contaminant level determined, below which there is freedom from unacceptable health risk. Determination of the amount of faecal contamination which can be tolerated in the growing water is a complex problem because of a variety of factors. There is no constant level of pathogens in sewage, the ratio between indicators and most pathogens varying with every unit volume of waste flowing from the outfall. A specific level of faeces in wastewater may be relatively free of pathogens at one moment and have a high potential for pathogen transmission through shellfish the next.

Current epidemiological methods do not appear to be sensitive enough to effectively detect virus disease transmission through water because clinically observable illness occurs only in a small number of individuals who become infected, and because of the widely-varying incubation periods before the onset of symptoms. Furthermore, virological methods are currently unavailable for all suspect aetiologic agents of gastroenteritis. These facts and the acknowledged understanding of a low infective dose for virus infection have led to the suggestion that the presence of any detectable enteric virus in water is indicative of a potential viral disease hazard.

6.3 Determination of coastal water quality

The successful correlation between coastal water quality and health effects depends on the exact terms in which the former is defined, and the relationship of the indicator organisms selected to the diseases or ailments identified as bathing-associated. In addition, in many instances, the accuracy of the various methodologies utilized has often been questioned.

The current methodology for determination of microbial colonies in water has been elaborated and initially utilized for determination of drinking water quality. Seawater is different in many respects, one of the main ones being its marked bactericidal action. Questions naturally arising are: (1) whether microbiological methods applied to drinking water are suitable for examination of seawater; (2) whether the traditional bacterial indicators for drinking water quality are equally valid for seawater in terms of correlation with diseases encountered; and (3) in how many instances has the relationship between recorded disease incidence and exposure to seawater been confirmed by isolation of the same pathogenic organism from seawater and the patient in question.

Bacterial indicators have traditionally been used to define the level of viable sewage organisms which survive wastewater treatment processes and natural die-off. This approach implies that the presence of these organisms is indicative of the presence of faecal pollution which may also contain some pathogenic agent, provided the pollution equivalents are of a significant magnitude. Unfortunately, this assumption provides only indirect evidence for the presence of pathogens and may, at times, underestimate or overestimate the actual pathogen occurrence. Therefore, data gathered from periodic sanitary surveys of the drainage basin are important in providing an additional input in the interpretation of water quality conditions and the significance to be associated with bacterial indicator densities encountered.

Of the indicators used to detect faecal contamination in water, none have been found to perfectly mimic the occurrence and persistence of all waterborne pathogens that cause intestinal diseases. However, the current state of research has not yet identified any new candidate indicator that surpasses conventional indicators in terms of all desirable characteristics.

Attention should also be focussed on media improvements that are responsive to better recovery of stressed strains of indicator organisms in the marine environment, where several factors, such as sunlight, salinity, chemical pollutants and microbial toxins are known to produce stress in populations of the most commonly used indicator organisms (total coliforms, faecal coliforms, *E. coli* and faecal streptococci), this stress increasing progressively to the point of eventual death of the organism. Many instances have been recorded of inadequacies of methodology to proved recovery of stressed organisms, both with the membrane filtration culture (MF) and multiple tube (MPN) procedures.

There is therefore the need both to look into existing methodology for the determination of traditional indicator organisms to obtain a better correlation between these and the types of pathogens, mainly enteric, with which they can be associated, and also to search for new indicators which can provide a better indication of seawater quality in terms of health hazards connected with non-enteric diseases. Such hazards may not necessarily be related to pollution by sewage.

7. Review of draft proposal for epidemiological studies in the Mediterranean region, including guidelines for such studies (Agenda item 7)

The Secretariat present document ICP/CEH 001 m06/7 (Draft proposal for Mediterranean regional epidemiological studies correlating coastal water and shellfish quality with health effects, and Dr B. Fattal presented document ICP/CEH 001 m06/8 (Draft Protocol for epidemiological studies correlating coastal water quality and health effects). Professor L. Villa presented the proposed Italian study on children in summer camps, scheduled to start in 1986 on the Adriatic coast in the Marche region. The meeting also reviewed the annexes to the 1977 document on health criteria and epidemiological studies related to coastal water pollution (document ICP/RCE 206(5)).

After extensive review and discussion of the above documents, the meeting agreed that the original guidelines for the conduct of epidemiological - microbiological studies for developing recreational water criteria (Annexes I and II to the report of the 1977 Athens meeting - document ICP/RCE 206(5)) could still serve as the outline basis for the new Mediterranean protocol, but would have to be extensively revised and updated on the basis of the new draft protocol (document ICP/CEH/001 m06/8), also incorporating the material contained in the proposed Italian study, and new developments in the field as discussed and agreed on by the meeting. The following points were among the main ones stressed.

7.1 Study populations

In view of the large tourist influx into the Mediterranean area, it was important to carry out epidemiological studies in those countries where both local population groups, particularly families with small children, and/or tourists coming from abroad could be studied. This of course would not detract from the importance of studying purely national population groups.

7.1.1 Local population groups

Since young children have been shown to be the most susceptible group to swimming-associated gastrointestinal disease, samples should be designed in such a way that primarily family groups with as many young children as possible be selected, preferably those families with at least one child under the age of five years.

7.1.2 Children's summer camps

Large groups of children (either local or foreign) attending organized beach-side summer camps also provided a good population sample for epidemiological studies. In this case, the probability of finding a sufficient number of non-swimming controls would be small, so that the approach would have to be different. The meeting agreed that the best possible way to achieve comparative data would be to divide the camp population into two groups bathing at beaches with different water quality levels, though in all cases within local permissible limits.

It would be essential for both groups to have identical environmental conditions, such as food, water-supply, etc. Care would have to be taken to control possible infection within the camp area from non-swimming sources (i.e. common use of towels, etc.). Pre-tests on the selected beaches would have to be made to assure fairly constant indicator organism levels, since the sample population would be submitted to daily exposure, and inconstancy of water quality would make proper evaluation difficult. Daily records of swimming exposure and disease symptoms should be recorded in each camp.

7.1.3 Foreign tourists

Overseas tourists are particularly susceptible to local endemic diseases, since they normally have lower levels of acquired immunity as compared with local populations. Studies on tourists should preferably include family groups with children, but if this would not be practical, the study of adult populations, whose levels of acquired immunity would be expected to be relatively low, would also be satisfactory. Studies on tourists should also assume multiple exposures to the same beach, emphasizing the importance of selecting beaches with fairly constant water quality.

7.1.4 General

It was agreed that in general, it would be preferable to interview as large a sample as possible on a given day, rather than small numbers of individuals on many different days. The importance of sound training of individuals selected as interviewers was emphasized, as also the importance of ensuring that all personnel involved in the study, including medical and paramedical personnel, should use the same techniques to ensure intercomparison of data.

7.2 Definitions of swimmers

The meeting agreed that swimmers could best be defined as (a) individuals who enter the water and immerse their heads, and who were actually swimming on the day of the study, and (b) individuals, particularly children, who do not

actually swim in the strict sense of the word, but who spend time at the water's edge and whose faces are splashed by wave action or other means, thus affording an opportunity to ingest seawater. In addition, the following special population categories should be identified.

- individuals entering the water up to the waist or shoulders, but not immersing the head whatsoever. This group could be of interest for dermatological symptoms.
- children, particularly infants, not actually entering the sea, but having extended contact with the wetted area of beach sand.

7.3 Indicator organisms

7.3.1 Indicators for enteric diseases

The meeting agreed that indicators for enteric diseases in seawater, beach sand and sediments should include faecal coliforms, Enterococci and E. coli. Additional indicators could be included in any particular study to meet local needs and practices. It was felt important, however, that such extra parameters should not be determined at the expense of reducing the total number of tests below the minimum required for practical evaluation.

7.3.2 Non-enteric indicator organisms

In view of the important new evidence accumulated in recent years indicating that many swimmers are affected by non-enteric symptoms, these parameters would have to be included in the study. In this regard, pathogens involved in non-enteric infections were agreed to include three major areas: (a) affecting the eyes, ears and upper respiratory tract, (b) causing skin rashes and (c) causing urinogenital tract irritation. It was acknowledged that many of the causative agents are opportunist pathogens that become a problem for bathers with weakened natural defences as a result of excessive exposure to sun, salt concentration, bruises and skin abrasions, extensive vapour contact in the lungs, extended exposure from water contact, and the shedding of organisms by adjacent bathers in high-density recreational waters.

Candidate indicator organisms selected to obtain information on those water quality conditions that could impact on bathers' risks of contracting non-enteric infections could be either acknowledged opportunist pathogens or organisms common to the body-surface of bathers and correlated with bather density in the recreational water environment.

In this context, viral agents, particularly adenoviruses and enteroviruses can be responsible for a broad spectrum of clinical symptoms that also involve respiratory tract infections. They are excreted in large numbers by affected individuals, are highly cytopathogenic for tissue culture substrates, and easily detectable. It was however acknowledged that the relatively high cost involved could be a major factor in deciding whether or not it would be possible to incorporate a virus examination in any particular epidemiological study, and consideration could be given, as an alternative, to the use of bacteriophage detection as an indirect measure of virus occurrence, as

bacteriophages have the additional advantage of being easily detectable in a relatively short time as compared to human viruses, and the tests involved are less expensive to perform.

The meeting agreed that, pending the compilation of a final list of non-enteric indicator organisms, which could only be prepared after a specific in-depth study, an interim test, from which selections could be made for each particular study according to needs and circumstances, could include total staphylococci, Klebsiella, Pseudomonas aeruginosa, Aeromonas hydrophila, Candida albicans, total fungi, and adenoviruses. The recommended methods of determination are included in the final version of the protocol (Annex 1). In this context, the meeting cautioned that while these methods have been demonstrated to be satisfactory for fresh water, the media and procedures might have to be evaluated for optimum recovery and selectivity in the marine environment, particularly under different degrees and kinds of pollution characteristic of different climates, as well as seawater conditions such as eutrophication. Furthermore, prior to application in a special epidemiological study on bathing waters, candidate methods would have to be checked for differential accuracy, minimal false positive reactions, interference from non-target organisms in the aquatic flora, water turbidity blocking water passage, and discrete colonial growth on membrane filters. It would also be conceivable that media recommended might require some modification because of the effect of natural salt concentration in the sample. The introduction of various flora from the bodies of bathers into the marine environment could create a stressed organism condition, and require modified laboratory procedures for processing critical environmental strains. Such situations could very well require the use of preselective steps followed by selective enrichment or temperature acclimation to optimize recovery.

The meeting agreed that for practical reasons, only a limited number of indicator organisms which might be associated with non-enteric disease could be added to the environmental test programme in the epidemiological studies.

7.4 Sampling

The meeting agreed that for week-end type studies, at least 2, but preferably 3 sampling sites should be sampled at each beach at 3 different time periods during the day intensive interviews are carried out. For multiple-day exposure studies, the same should be performed as a pre-test, followed by a reduced frequency during the study period. All samples should be representative of the seawater mass in direct contact with most bathers. It was also considered that one or two samples per day should be taken of the wetted sand at the water-beach interface.

7.5 Diseases and symptoms

The meeting agreed that there should be a common core list of disease symptoms included in the questionnaire used in all studies to ensure the required degree of comparability. However, individual studies could add additional areas for intensive investigation according to local conditions and interests. For this reason, it was agreed that sunburn and urinary and vaginal symptoms be included in the questionnaire.

The difficulties in obtaining verification of symptoms reported (except under special conditions), such as those prevailing in studies on children in summer camps) was recognized. It was agreed that the procedure for determining "highly credible symptoms" be used, i.e. disablement, confinement to bed, vomiting, diarrhoea with fever, nausea, stomach pains accompanied by fever, or symptoms as a result of which the patient would abstain from work and/or seek the advice of a physician.

The meeting considered it important that a method be developed to determine whether tourists returning to their home country from stays at Mediterranean beach resorts developed serious diseases such as infectious hepatitis, typhoid fever or any other specific infection of identified aetiology, such as shigellosis. Several approaches should be evaluated, such as follow-up interviews 4 to 6 weeks after return of the tourists to their home country. This would preferably have to be carried out by medical personnel in the home countries collaborating in the study.

The meeting also felt that the investigation of aetiological agents of swimming-associated gastrointestinal diseases was particularly important, and that the sero-epidemiological approach was the most suitable method to make progress in this area. The protocol for studies on tourists should therefore include an optional serological test programme of a sub-sample of those tourists developing acute symptoms of gastrointestinal disease and a matched control group. The first blood sample should be taken at the resort hotels immediately following the reporting of gastrointestinal symptoms, the second at least 14 days later, after the tourist's return to his home country. This would enable paired samples of acute and convalescent sera to be obtained. Sera should be tested for antibodies, rotavirus and norwalk agent, as well as for other candidate viral aetiological agents. Similar tests for virus should also be made on faecal specimens.

7.6 Period of study

The meeting agreed that epidemiological studies in the Mediterranean area could normally be carried out during the regular bathing season, which in many areas extends from May to October. However, in certain areas, tourist studies could also be carried out during the winter months. It would be desirable to commence studies early in the bathing season so as to obtain as large a sample as possible of persons exposed to the sea for the first time of the season.

7.7 Localities for studies

The meeting agreed that local microbial standards and guidelines for acceptable bathing beaches should be met at all study sites; that fairly stable concentrations of indicator organisms were required for study beaches, and that selected study beaches should be those frequented by large populations, particularly families with young children, to enable large samples of bathers to be identified and interviewed on any given study day. Also, for those sites exposed to pollution from adjacent sewage outfall structures, open beaches with good water exchange characteristics should be selected.

In this latter context, it was recognized that many popular bathing beaches in the Mediterranean are of a partially closed nature with relatively poor water exchange. The meeting agreed on the possibility of carrying out

studies at such beaches where the build-up of body contact organisms might provide the primary source of microbial contamination of the water. Such study sites should be as free as possible from external contamination from sewage sources, and under the situations prevailing in such studies, samples of water should be taken at various times during the day so as to determine the build-up of microbial indicators and/or pathogens as a function of bather load, including a first sample taken before the arrival of most bathers on the beach.

A revised protocol for epidemiological-microbiological studies in the Mediterranean to correlate coastal recreational water quality with health effects, based on the methodology agreed on during the meeting, is given at Annex 1.

8. Review of current studies of monitoring of coastal recreational waters, shellfish-growing waters and shellfish in the Mediterranean (Agenda item 8)

The meeting reviewed the status of current monitoring of coastal recreational waters, shellfish-growing waters and shellfish in the Mediterranean within the framework of MED POL Phase II. All operational monitoring programmes had such components, either as parts of already ongoing national programmes, or recently established. In a number of instances, however, countries had long-standing programmes of sanitary monitoring of coastal waters as part of their national public health programmes which were not part of MED POL and the results therefore unobtainable through this programme. The acquisition of basic data was difficult in some instances, even through national Governmental Authorities, as the programmes being undertaken were, to a large extent, the responsibility of various regional or local authorities and/or municipalities.

In the MED POL programme proper, problems were still being encountered with comparability of results obtained. The series of intercalibration exercises on microbiological methods organized by the WHO Regional Office for Europe within the framework of MED POL, and attended by scientists from the majority of Mediterranean countries engaged in this programme had shown that even strict adherence to the standard reference methods developed for analysis of the different microbial parameters was not enough, and there existed several variations in interpretation and evaluation techniques. Furthermore, there were some doubts about the value of certain media used, even though these conformed to general international practice.

The research projects currently completed or ongoing within the framework of Activity D (Epidemiological studies) of the MED POL research component were briefly reviewed. These covered the following topics:

- Epidemiological studies on the relationship between the microbial quality of seawater and the health of swimmers
- Comparative studies of fungi in polluted beaches, and their relative importance vis-à-vis disease incidence
- Studies on the hygienic quality of coastal waters and their relation to public health

- Studies on the relation between densities of indicator organisms and microbial pathogens in seawater
- Research on enteric viruses in aquatic environments
- Investigations on neurotoxins in shellfish
- Epidemiological studies on morbidity and viral antibodies among bathers exposed to varying levels of microbial pollution of seawater

9. Future actions and recommendations (Agenda item 9)

The meeting made the following recommendations :

1. In the detailed protocol for epidemiological studies, sampling, analysis and interpretation of microbiological parameters should follow existing Mediterranean guidelines and reference methods. This protocol should be made available to Institutions within the region as soon as possible.
2. Negotiations should begin with relevant institutions in the Mediterranean region to enable epidemiological studies to begin within the framework of MED POL in 1986.
3. During the studies, the following should be kept in mind:
 - the final goal of the project, i.e. the provision of data that will either confirm the present interim environmental quality criteria or require their revision;
 - the need for results to be applicable to the Mediterranean as a whole;
 - the need for correlation with work already being carried out as part of the MED POL monitoring programme.
4. WHO should, together with countries and institutions potentially involved in carrying out epidemiological studies, explore the possibility of obtaining external funding. Considering the importance of such studies to both local populations and tourists, and the relative susceptibility of the latter, such funding could be sought from those northern countries that send tourists to the Mediterranean region.
5. Within the framework of MED POL, microbiological reference methods, including the evaluation of results, should be developed and updated. The epidemiological studies and methods developed as part of WHO's regular programme should be adaptable to Mediterranean conditions.
6. A list of pathogenic microorganisms considered as marine pollutants should be developed as part of the progressive implementation of the protocol for the protection of the Mediterranean Sea against pollution from land-based sources.

7. In the fields both of the survival of pathogens and of pathogen/indicator correlation, gaps in existing knowledge should be filled through appropriate MED POL research projects. In this regard, institutions that could contribute towards the implementation of this programme should be identified.

Annex 1

PROTOCOL FOR EPIDEMIOLOGICAL-MICROBIOLOGICAL STUDIES
IN THE MEDITERRANEAN TO CORRELATE
COASTAL RECREATIONAL WATER QUALITY WITH HEALTH EFFECTS

1. Scope

1.1 This protocol is intended as a guide in the design and conduct of prospective controlled epidemiological-microbiological studies to determine the relationship between the concentrations of specified microorganisms in coastal recreational and defined symptoms of disease among swimmers and non-swimmers exposed at bathing beaches with various levels of microbiological contamination.

1.2 The eventual objective, on the basis of data obtained, is the development of health effects with water quality criteria, the desired criteria being quantitative relationships of the dose-response type between adverse health effects attributable to the recreational use of water, and the water quality as measured by microbiological, chemical or physical indicators of its state of pollution (usually by municipal sewage waste).

1.3 There are two possible basic designs. The first assumes that a situation exists in which hydrographic, pollution and beach-usage conditions complicate the epidemiological design, that there is marked day-to-day variability in pollution levels at the beaches, and that swimmers visit different beaches on different days during a given 1-2 week period. The second design does not assume the conditions above, and is directed at special study groups (mainly campers and tourists), as well as local inhabitants regularly using the same beach.

2. Definition of swimmers

2.1 Swimmers are defined as:

2.1.1 Individuals who enter the water and immerse their head and/or actually swim on the day of the study

2.1.2 Individuals, particularly children, who do not swim, but who spend time in the water or at the water's edge, and whose face is splashed by breaking waves, thus providing an opportunity for ingestion of seawater.

2.2 The following special population categories should also be identified:

2.2.1 Individuals who enter the water up to their waist or shoulders, but who do not immerse their head whatsoever, and do not perform any activities likely to cause ingestion of seawater (this group will be of interest for dermatological symptoms)

2.2.2 Children, particularly infants, who do not actually enter the sea, but who do have extended contact with the wetted area of beach sand.

2.3 The fullest possible information on swimming habits of individuals within population samples should be obtained to determine the type of exposure. The duration of exposure - i.e. time actually spent in the sea, is equally important.

3. Determination of water quality

3.1 Parameters to be determined in seawater:

3.1.1 Concentrations of the following indicators of enteric diseases should be determined in seawater itself:

Faecal coliforms
Enterococci
E.coli

3.1.2 If for practical reasons, only two of the above can be performed, the final selection should be governed by the fact that on the one hand, enterococci and E.coli concentrations in seawater have been found to show the highest correlation with enteric disease symptoms among bathers, while on the other hand, faecal coliforms are normally the designated indicator in several international and national quality criteria and standards in the Mediterranean region. It would therefore be necessary to determine (a) either enterococci or E.coli, and (b) faecal coliforms.

3.1.3 In addition, other bacterial indicators may be included to meet local needs and practices, provided that the work involved in determining such additional parameters does not affect the minimum number of tests required to ensure proper seawater quality evaluation.

3.1.4 At least one indicator of non-enteric disease should also be included. Selection of particular microorganisms, depending on local requirements and capabilities, should be from among the following:

Staphylococcus aureus
Klebsiella,
Pseudomonas aeruginosa
Aeromonas hydrophila
Candida albicans
Total fungi
Adenoviruses

3.2 Parameters to be determined in sediments and sand

3.2.1 In view of the considerable evidence indicating that the microbiological quality of wetted beach-sand and sediments are important parameters in determining the environmental quality of bathing areas, monitoring of these matrices should be an integral part of epidemiological-microbiological studies correlating coastal water quality with health effects.

3.3.2 Indicators of enteric disease should be the same as for seawater (i.e. faecal coliforms, enterococci and E.coli).

3.3.3 Indicators of non-enteric disease should also be selected from the same list given for seawater (3.1.4 above), the most appropriate microorganisms being Staphylococcus aureus, Pseudomonas aeruginosa, Candida albicans and total fungi.

3.3 Sampling and analytical methods

3.3.1 Determination of each parameter should be performed using the appropriate reference method in the series developed for use in the longterm programme of pollution monitoring and research in the Mediterranean Sea (MED POL Phase II) to enable intercomparison both between individual studies and with other data from the Mediterranean.

3.3.2 Recommended methodologies for determination of those parameters associated with non-enteric bathing infections are given in Appendix 1.

3.3.3 Seawater samples should normally be taken 10-15 cm below the surface in the area where most bathers congregate. This may vary to some extent according to local conditions. The samples should be representative of the seawater mass in direct contact with most bathers. Sediment samples should be taken from the bottom in the same areas. Sand samples should be taken from wetted surface beach sand at the water-beach interface.

4. "Week-end" type studies

4.1 Study season

Studies should be conducted at week-ends, during the bathing season (normally May-October in most Mediterranean countries).

4.2 Participants in the study

4.2.1 Participants are recruited at the beach, preferably as family groups. Theoretically, all families present at the beach on the day of the study (interview) who have at least one child below the age of four should be interviewed. Two study populations, both present at the beach at the same time and place, should be obtained - swimmers and non-swimmers. These should preferably be both represented in each family group, in order to control, at least in part, for disease variations from food-borne and other sources. Beach interviewing should start as early in the bathing season as possible, in order to enable comparison of bathers coming to the beach for the first time during the season with others who have been to the beach several times.

4.2.2 Depending on how follow-up work is to be obtained (i.e. by home interview, telephone, etc.), appropriate criteria will have to be used in selection of participants for interview, on grounds of future accessibility.

4.3 Study phasing

The study should be conducted in three phases:

- Phase I : pretest

- Phase II : comparison of a barely-acceptable with a relatively unpolluted beach
- Phase III: examination of beaches along a pollution gradient

4.4 Phase I - Pretest

4.4.1 Objectives

The objectives of the pretest are:

- (a) To determine the suitability of tentatively selected beaches as regards population density, demographic distribution, family groupings, rate of mid-week swimming, numbers of swimmers as compared with non-swimmers, and pollution levels at the beaches.
- (b) To test the epidemiological techniques as regards cooperation at the beach interview, the availability of home telephones (questionnaires sent by post have been found to be of little use), and the return rate on follow-up interviews.
- (c) To obtain an estimate of the background (non-swimmer) illness rate (needed in estimating the sample size for the phase II and III trials).
- (d) To test the reliability of the information to be obtained on beach activity.
- (e) To test the microbiological methodology and refine the sampling schedule.

4.4.2 Tentative selection of beaches

Available information on pollution levels, beach usage, bathing habits and demography should be used in selecting the beaches to be examined for suitability during phase I (Pretest). Within-day and between-day variations in the densities of bacterial parameters selected should be examined.

Between five and ten beaches should be surveyed in order to locate relatively polluted and unpolluted beaches according to bacteriological tests of seawater. Beaches should be considered as relatively polluted if bacterial counts fall just within international and/or national standards. Beaches can be considered unpolluted if counts are 25% or below of accepted standards. Two beaches, one barely-acceptable, and the other unpolluted, should finally be selected, both with fairly stable indicator organism levels. At least 2, and preferably 3 samples should be taken at each beach at 3 different time-periods during the day intensive interviews are carried out.

4.4.3 Reliability of beach activity information

Just prior to the pretest trials, the reliability of the information to be obtained on beach activity should be tested, as follows. Teams of observers should go to the beaches. Each observer should focus on a single family group, noting which members enter the water, which immerse their heads in it, if possible, which swallow water, and the type and

duration of activity in the water. At the end of the day, he should ask an adult member of the family to describe the activity of each member. Comparison of answers and observations should make it possible to estimate the reliability of the information to be obtained in the actual trials.

4.4.4 Sample size

A total of about 600 usable responses at each beach (about 125 families) should be obtained over 2 - 3 weeks-ends. A usable response is defined as the information obtained from a respondent who was not a mid-week swimmer and from whom follow-up information was obtained. Obviously, records should be kept of the numbers of people whose responses were not usable and why those responses were rejected.

4.5 Phase II - Comparison of a "barely acceptable" with a "relatively unpolluted" beach

4.5.1 Sample size

This may be as large as 8,000 - 12,000 participants distributed between the four study populations. The exact number required should be determined from the analysis of the pretest data, and depends on: (1) the expected background (non-swimmer) illness rate; and (2) the magnitude of the excess incidence among swimmers as compared with non-swimmers which, if it exists, should be detected by the study. Table 1 provides a guide in determining the minimum number of persons to be included in the study for each of the swimmer and non-swimmer groups on each beach.

Table 1

Minimum sample size for each of swimmer and non-swimmer groups on each beach

Incidence among non-swimmers %	Excess incidence among swimmers to be detected		
	30%	50%	100%
1	21 100	8 500	2 600
2	10 700	4 200	1 300
3	7 100	2 800	850
4	5 300	2 100	600
2	4 200	1 600	500
3	2 000	750	250

Note: Based on $\alpha = 5\%$ (probability of type-one error) and $\beta = 10\%$ (probability of type-two error)

For example, if the expected background illness rate is 5% and if an excess incidence of 30% or more (i.e. an incidence rate of 6.5% or higher) among swimmers is to be detected, at least 4 200 swimmers and 4 200 non-swimmers should be studied on the beach.

4.5.2 General features of Phases I and II

During phases I and II, trials are conducted simultaneously on two beaches. There will therefore be four study-populations: swimmers and non-swimmers on each beach. The data collected can be analyzed for the entire swimming season or segregated and examined by trial (week-end). Taken as a whole, the non-swimming controls belong to the same groups as the swimmers. Since all the participants have been at the beach, a swimming-associated symptom rate can be obtained by subtracting the rate for non-swimmers from that for swimmers.

4.6 Phase III - Examination of beaches along a pollution gradient

The objective of this phase of the study is to produce the data which, with those available from phases I and II, will define the indicator-illness ratios (criteria). Ideally, the trials should be conducted at beaches situated along a pollution gradient produced by a single pollution source or cluster of sources. Often this is not possible, but two alternative procedures are then available: (1) trials can be conducted at a number of beaches whose pollution levels, as measured by the water quality indicators, fall on a gradient but which have different sources of pollution; or (2) trials (at week-ends) can be conducted at a beach which shows considerable day-to-day variability in the indicator density. The trials can then be analyzed by regression analysis, in which each trial provides a point on the expected indicator-illness regression line.

4.7 Protocol

4.7.1 Recruitment and information to be collected

Beach interview participants should be recruited as family groups about the time they are preparing to leave the beach. Contact should be established with an adult member of the family. The interviewer should introduce him/herself, present his/her identification, explain the purpose of the study and request the participation of the subject family in the study. The interviewer should then ask the subject if he/she or any member of the family has been swimming mid-week just prior to the trial. If the answer is yes, that individual should be rejected from the study. If this is true of most of the children in the family group, the family should be excluded and the interview terminated. The interviewer should then obtain relevant information, including the following:

- (a) Name, address (local and permanent), telephone number, relationship of respondent to other members of the group (all of whose telephone numbers and addresses should be obtained).
- (b) Demographic and swimming activity information on each member of the group; head wet; when in water; total time in water; whether water was swallowed; relevant health information; why non-swimmers are not swimming;
- (c) Information on whether each member of the group was exposed to possible infection from contaminated food and/or beverages.
- (d) The interviewer should observe the bathing suit and hair of each member of the group to see whether they are wet.

A model questionnaire form is given in Appendix 2. This may have to be modified, depending on local conditions. In general, however, the beach questionnaire should be short, but should include information on the demographic data (age, economic status, etc.) and swimming status of bathers during the day of the beach interview and during the week prior to the beach interview and during the week prior to the beach interview. It should preferably also include questions as to whether bathers suffered from the same morbidity symptoms on the day of the beach interview or a day before, in order to perform a special data analysis of "healthy" swimmers and non-swimmers.

4.7.2 Follow-up studies

The follow-up inquiry should be conducted by personal interview or telephone some 3 - 10 days after the week-end trial (questionnaires sent by post are generally unproductive). If the proportion of participants with telephones is less than 50%, telephone questionnaires should be abandoned. If the return on the follow-up inquiry is less than 75%, a sample of the appropriate population will have to be located and questioned. The information to be obtained is as follows:

- (1) Whether participants went swimming mid-week following a week-end trial (those who did so should be excluded from the study).
- (2) Additional demographic information (particularly on socioeconomic status).
- (3) Symptomatology. This information should be obtained by questions on symptoms subsequent to the trial, and on symptoms or illness in the week prior to the trial, and questions designed to indicate the severity of the illness, i.e., whether the participant was hospitalized, visited a physician, received medication, remained home from school or work, or stayed in bed. The symptoms covered should include the following:

Gastrointestinal

vomiting
diarrhoea
stomach ache) colic
nausea)

Respiratory

sore throat
bad cough
running nose
pain in chest

General

skin lesions (rash)
sunburn
red or runny eyes
earache or discharge
fever (more than 38°C)
headache (severe, several days)

If the main information sought concerns bacterial diseases, the follow-up enquiry 3 to 10 days after the beach interview is sufficient. If, however, viral infection (such as viral hepatitis, which has a long incubation period) is under study, a 2 - 6 week interval is required between the beach and follow-up interviews. In both cases, the length of time spent actually swimming, or at the beach, should be ascertained. A model questionnaire, which would have to be adapted for specific local conditions, is given in Appendix 3.

4.8 Coding of data for computer analysis

Data on beaches, temperature, wind direction, wave height and bacteriological tests of seawater should be coded according to a special code sheet. The beach and follow-up interview questionnaires should also be coded on a special code sheet. Model code sheets are given in Appendix 4 and Appendix 5 respectively.

4.9 Statistical analysis of data

One relatively simple approach to the statistical analysis is presented below although other, more complex methods may be warranted in certain circumstances:

4.9.1 Incidence rates and relative risks

Table 2 shows the classification of subjects according to disease experience and the exposure to an aetiological factor.

Table 2

Typical classification of subjects in a prospective study

Exposure (swim)	Disease		Total
	+	-	
+	a	c	a+c
-	b	d	b+d
Total	a+b	c+d	a+b+c+d

The incidence rate among swimmers and non-swimmers is $a/(a+c)$ and $b/(b+d)$. Relative risk clearly expresses the strength of association between exposure and the disease involved. Relative risk is computed as the ratio of the incidence rate of the disease among swimmers to the corresponding rate among non-swimmers (Mantel and Haenszel, 1959), namely,

$$\text{Relative risk} = \frac{[a/(a+c)]}{[b/(b+d)]}$$

If the incidence rate is small, a is much smaller than c, and b is much smaller than d, and hence

$$\text{Relative risk} = (a/c)/(b/d) = ad/bc$$

4.9.2 Standard errors of incidence rates

These standard errors are calculated as follows:

if the rate of a symptom in a group is r , and N is the total population in this group, then the standard error (SE) = $r(100-r)/N$.

4.9.3 Determination of statistical significance between incidence rates

The significance of differences between the incidence rates are defined as follows:

if SE is the standard error, and R is the morbidity symptom incidence rate, then the significance of differences between the incidence rates of groups i and j will be:

$$SE = \sqrt{r(100-r)/N}$$

$$Z = (R_i - R_j) / \sqrt{(SE_i)^2 + (SE_j)^2}$$

The P values of Z are found in the table of cumulative normal distribution.

Data analysis involves calculation of morbidity symptom incidence rate per 100 persons, swimmers and non-swimmers, for each beach and all beaches cumulatively according to the various bacterial concentrations found in the seawater.

Plotting of the differences (or ratio - relative risks) between the incidence rates of enteric symptoms, swimmers and non-swimmers, according to logs of bacterial indicator concentration in seawater at different beaches, may be performed. Correlation coefficients and slopes may be calculated.

It is important to take into account certain confounding factors such as socio-economic status, number of children in family, etc. and to carry out appropriate adjustments.

5. Studies on organized vacation groups

Insofar as possible, multiple-exposure studies of this type should be carried out following the principles of controlled field trials in which the rates of beach/water-associated illness among swimmers are compared to those for non-swimmers at beaches having different levels of water quality. Procedures for the studies should, in general, and insofar as applicable, follow those described for the week-end type studies, with the following exceptions:

5.1 Duration of the study

This should extend throughout the vacation period of the organized group. The duration of the follow-up observation period should include an additional four-week period at the home location of the group.

5.2 Phasing of the study

5.2.1 Ideally, the phasing should be the same as for the week-end type studies. The main objectives of the pretest (Phase I) will however depend on the particular groups to be surveyed, and would generally be the following:

(a) To determine the suitability of tentatively selected beaches as regards population density, demographic distribution, family groupings (if applicable), rate of swimming during period of stay, number of swimmers as compared with non-swimmers, and pollution levels at the beaches.

(b) To test epidemiological techniques as regards cooperation at beach or hotel interview (in the case of tourist groups) and the methodology for follow-up interviews, both during the actual study-period and on return of participants to their homes.

(c) To obtain an estimate of the background (non-swimmer) illness rate.

(d) To test the reliability of the information to be obtained on beach activity.

(e) To test the microbiological methodology and refine the sampling schedule.

5.3 Test beaches and study populations

The groups to be studied should be carefully selected and defined as ones which travel, arrive and leave a hotel or camp together. In addition, the logistics of follow-up inquiries will be enhanced if the group arrives from and returns to the same city. The groups should be located at well defined and confined areas (hotels, camps) and, preferably, should use a single private or public beach.

The source of pollution is important; the number of individuals who contribute to this source should be in excess of 1000. It is preferable that the sewage comes from raw or treated wastes of local inhabitants rather than from the tourists themselves.

Ideally, the population involved should be relatively homogeneous and they should be under the medical supervision of a single practitioner or health centre.

5.4 Sampling of beaches

5.4.1 The same parameters (enteric and non-enteric indicators) should be measured as for the "week-end" type studies, with adjustments to cater for local circumstances. Prior to the pre-test, intensive sampling will have to be carried out daily over a period of several weeks to determine that the indicator organism levels at any given beach are fairly constant.

5.4.2 During the pre-test, 2 to 3 seawater sampling sites per beach should be sampled at three different time periods during the day. During the study periods (Phase II and Phase III), the sampling frequency can be

reduced at beaches with known stable indicator concentrations to 1 or 2 times per day, depending on the extent of diurnal variations. Sand and sediments should also be sampled.

5.5 Diseases to be studied

5.5.1 Although illness information will be obtained in the form of the symptomatology, whenever possible efforts should be made to confirm the diagnosis and the aetiology of the disease by microbiological and/or serological tests.

5.5.2 The symptoms covered should normally be the same as for the "week-end" type studies (4.7.2). In certain circumstances, it might be required to concentrate on non-enteric diseases. An example of a dermatological record chart which could be used for studies in children's summer camps in cases where the main problems are dermatological, is shown in Appendix 6.

5.6 Beach questionnaires and follow-up

For tourist and other family groups, the beach and follow-up questionnaires should be modelled on those given in Appendices 2 and 3 respectively. In the case of children's summer camps, relevant information on swimming activity and symptoms developed thereafter (if any) should be recorded on appropriate charts prepared by the medical personnel organizing the study.

5.7 Other routes of transmission

For tourists and other family groups, the same information should be obtained as for the "week-end" type studies on exposure to potentially contaminated food and/or beverages. In the case of organized summer camps for children, administrative and other arrangements should be made to eliminate or at least minimize such potential exposure.

5.8 Control populations

These will consist of (a) non-swimmers among the study population, and (b) swimmers and non-swimmers of comparable demography at another beach of different (preferably high) water quality. In the case of children's summer camps, the proportion of non-swimmers in the study population will necessarily be small.

5.9 Constraints

The major constraint on the use of this experimental design is that, during the stay of the group being studied, the quality of the water should be relatively constant and the individuals should not visit other beaches whose quality is significantly different from the one being used for the study.

Appendix 1 : Recommended methodologies for determination of microbiological parameters associated with non-enteric bathing infections

Indicator candidate	Illness correlation	Procedure water / sediment		Medium	Reference
Total staphylo-coccus	Respiratory, Dermatitis, Ear & eye infection	MF	-	Vogel-Johnson agar	1
		-	Broth	+ 0,5% sodium pyruvite m - Staphylococcus Broth	1
<u>Klebsiella</u>	Respiratory, Skin rash	MF	-	m - Kleb agar	2
<u>Pseudomonas aeruginosa</u> aerogroups 0-11, 0-6, 0-9	Dermatitis, Otitis externa	MF	-	m - PA agar	3
		MPN	MPN	Modified Drake medium	
<u>Aeromonas hydrophila</u>	Respiratory, Skin infection	MF	-	m - Aeromonas agar	3
<u>Candida albicans</u>	Vaginal infections	MF	-	M - Candida albicans agar	3,4
Total fungi	Skin infections	MF	agar	Cook's Rose Bengal agar	3
Adenoviruses (Surrogate; coliphage)	Respiratory, eye		Viral concentration	Tissue culture Hela, Hepa, Vero, etc.	3
			Plate culture	E.coli host for RNA phages	3,4

1. Seyfried, P. et al.: American Journal of Public Health, 1071-1075 (1985)
2. Geldreich, E.E. and rice, E.W.: Water Quality Technology Confr., Denaes (1984)
3. Standard Methods for Water and Wastewater, 16th edition, American Public Health Association (1985)
4. Annual Book of ASTM Standards, Section 11.02, Water and Environment Microbiology (1982)

Appendix 2 (cont'd)

8- Whether any of the family members has today or had yesterday any of the symptoms listed in Table 2. Write the name and insert "1" under the appropriate symptom/s. For a negative answer - insert "0" under the other symptoms.

Table 2: List of symptoms that family members have today or had yesterday

No	Name	Heavy cough	Cold	Throat infection	Vom- it- ing	Sto- mach ache	Nau- sea	Diar- rhea	Fever	Skin sores	Ear- ache
1											
2											
3											
4											
5											
6											
7											
8											

9- During the last week, has any family member, who is at the beach today, swum in any beach or pool? If yes, list his name in Table 3, insert "1" if he swam, or "0" if he did not swim, and also note the name of the beach or pool. In case nobody of the family was at any beach/pool, write "No".

Table 3: Details on swimming of family members during the last week

	1	2	3	4	5	6	7	8
Family member								
Swim								
Beach/Pool name								

10- Table 4 lists the names of family members at the beach today, the number of visits to beaches in general and to this beach during this bathing season

Table 4: Visits to the beaches by the family members

No	Name	No. of visits to beaches to date (inclusive)	Number of visit to to this beach
1			
2			
3			
4			
5			
6			
7			
8			

Appendix 4 : Model code sheet for recording bacteriological testing
of seawater, sediment and sand

Code Sheet	Line No.	Beach Name	Date of sampling			Time at which a sample was taken at beach	
			day	month	year	hours	minutes
/ 5 /	0 /	1 /	/	/	/	/	/
1	2 - 3	4 - 5	6 - 11			12 - 15	

1. Name of beach (squares 4-5)
Prepare the list and codes for beaches

2. Day of the week / /
16

3. Colour of flag (swimming permission - indicator of wave height)
 (1) White/Blue-white (2) Red
 (3) Black (8) Unknown / /
17
 (9) No flag on beach

4. Water sample temperature when drawn at the beach (°C) / / /
18 19

5. Wind direction / /
20
 (1) West (2) East (3) North
 (4) South (5) South-east (6) South-west
 (7) North-east (8) North-west (9) Unknown

6. Wave height (cm) / / / /
21 - 23

7. Air temperature at the beach (°C) / / /
24 25

8. Time of sample arrival at laboratory / / / / /
26 - 29

9. Temperature of sample at the time of arrival at lab (°C) / / / /
30 - 31

10. Time of sample plating / / / / /
26 - 29

11. Sample pH / / / /
36 - 37

Appendix 4 (cont'd)

Matrix (seawater, sediment, sand)	Bacterial indicator	Procedure and medium	Bacterial counts CFU/100 ml*
.....	<u> / / / /</u> 38 - 40
.....	<u> / / / /</u> 41 - 43
.....	<u> / / / /</u> 44 - 46
.....	<u> / / / /</u> 47 - 49
.....	<u> / / / /</u> 50 - 52
.....	<u> / / / /</u> 53 - 55

* CFU - colony forming units

Appendix 5 : Model code sheet for beach and follow-up interviews

Beach interview

/ 1 /	/ 1 /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
1	2		3 - 7		8 - 9				10 - 15					
title/line/		family no.			/ beach /		date							

Type of interview (square no. 1): (1) Beach interview
(2) Follow-up interview

Family number (squares 3-7): Running numbers of families interviewed (00001) and so on ...

Beach (square 8-9): Prepare list and codes for the beaches

Date (squares 10-15): Including day, month, year

Question 1 - Respondent's code:

/ / / / /
18 - 19

- | | |
|---------------|-----------------|
| (01) Mother | (04) Babysitter |
| (02) Father | (05) Other |
| (03) Relative | (06) Unknown |

Question 2 - Address: Prepare codes for cities, and special codes for tourists

/ / / / /
18 - 19

Question 3 - Time of interview: Exact hour that interview started (hour and minutes)

/ / / / /
20 - 23

If interview started at a certain hour and continued later on, the hour refers to the second time, during which all the interview lasted without a break

Question 4 - Day of week: (1) Sunday (2) Monday... (7) Saturday

/ / / / /
24

Question 5 - Do you have a telephone at home?

/ / / / /
25

- (1) There is a phone at home
- (2) No phone at home, but the parent's have one
- (3) No phone at home, but there is one at friends/neighbors
- (4) No phone at home, but there is one at the wife's place of work
- (5) No phone at home, but there is one at the husband's place of work
- (6) No phone at home, but there is one someplace other than in 2-5
- (7) There is no possibility to call
- (8) Refuse to answer

Question 6 - What time did you reach at the beach?

/ / / / /
26 - 29

Hours and minutes
(9999) Unknown

Appendix 5 (cont'd)

Question 2 - Birthdate (only month (18-19) and year (20-21) or birth)*

____/____/____/
18 - 21

- (0000) Unknown
- (9999) Refuse to answer

*If age appears, translate to year of birth according to date of interview while month of birth is 00.

Question 3 - Country of birth

____/____/
22 - 23

Prepare list of codes for the countries

Question 4 - Whether he/she swam on the day of the interview?

____/
24

- (0) Did not swim according to respondent
- (1) Swam according to respondent but the interviewer did not verify with the member
- (2) Swam according to respondent and the interviewer verified this
- (3) Did not swim according to respondent but the interviewer found that he/she did
- (8) Refuse of answer
- (9) Unknown

Question 5 - If he/she did not swim, list the reason

____/____/
25 - 26

Prepare the list of codes of reasons

Table 2 - List of symptoms the family member has today or had yesterday (Question 6 below)

Question 6 - Whether he/she has today or had yesterday one of the following symptoms:

____/____/____/____/____/____/
27 - 32

- | | |
|-----------------------|-----------------------|
| (00) No symptoms | (07) Diarrhea |
| (01) Heavy cough | (08) Fever |
| (02) Cold | (09) Skin sores |
| (03) Throat infection | (10) Earache |
| (04) Vomiting | (98) Refuse to answer |
| (05) Stomachache | (99) Unknown |
| (06) Nausea | |

List up to three symptoms (27-28) - symptom 1; (29-30) - symptom 2; (31-32) - symptom 3.

Table 3 - Details on swimming of family members during the last week (Questions 7-9 below)

Question 7 - Whether he/she was at any beach or pool during the last week?

____/
33

- (0) no
- (1) yes
- (9) unknown

Appendix 5 (cont'd)

Question 8 - Did he/she swim?

 /
34

- (0) He/she did not swim (1) He/she swam
(9) Unknown

Question 9 - Where did he/she swim?

 / /
35 - 36

Prepare the list and codes of beaches

- (10) Swimming pool

Table 4 - Visits to the beaches by family members (Questions 10-11)

Question 10 - Number of visits to any beach to date (inclusive)

 / /
37 - 38

- (01) One visit
(02) Two visits... and so on
(98) Refuse to answer
(99) Unknown

Question 11 - Number of visits to this beach:

 / /
39 - 40

As appears in Question 10 above

Appendix 5 (cont'd)

Question 2 - Whether he/she has been to the beach or pool since the interview

 /
18

- (0) no (1) yes (9) unknown

Question 3 - Did he/she swim?

 /
19

- (0) Did not swim (1) Swam
(8) Refuses to answer (9) Unknown

Question 4 - Name of beach/pool
Prepare list and code of beaches

 /
20 - 21

- (10) Pool

Question 5 - Whether he/she developed one of the following symptoms since the day of the beach interview

 /
22 - 27

- | | |
|-----------------------|-----------------------|
| (00) No symptoms | |
| (01) Heavy cough | (07) Diarrhea |
| (02) Cold | (08) Fever |
| (03) Throat infection | (09) Skin sores |
| (04) Vomiting | (10) Earache |
| (05) Stomachache | (98) Refuse to answer |
| (06) Nausea | (99) Unknown |

List up to three symptoms (22-23) - symptom 1; (24-25) - symptom 2; (26-27) - symptom 3.

Question 6 - Have he/she seen a doctor?

 /
28

- (0) Did not see doctor (1) Saw doctor
(2) Had medical help-nurse/pharmacy (8) Refuse to answer
(9) Unknown

Question 7 - Have you been tested for it?

 /
29

- | | |
|----------------------------|-----------------------------------|
| (0) No test done | (1) Throat test |
| (2) Urine test | (3) Stool test |
| (4) Throat and urine tests | (5) Throat and stool tests |
| (6) Urine and stool tests | (7) Throat, urine and stool tests |
| (8) Refuse to answer | (9) Unknown |

Question 8 - Was the patient home bound?

 /
30 - 31

(list no. of days)

- (00) Not home bound
(01) Patient was homebound for a day
(08) Refuse to answer
(99) Unknown

Appendix 6 : Model for dermatological record chart

Summer camp _____

Name: _____

Date of birth: _____

Place of birth: _____

Address: _____ Telephone No. _____

Father born in: _____

Mother born in: _____

Family anamnesis

Allergic conditions _____

Diabetes _____

Other _____

Physiological anamnesis

Height _____ Weight _____

Pathological anamnesis

Infectious conditions also of dermatological significance _____

Allergic conditions _____

Pharmacological intolerances _____

Immunological disorders _____

Other _____

Personal information

Animal pets (describe) _____ Date of last contact _____

Medicaments taken (describe) _____ date _____ quantity _____

Local therapy (describe) _____ date _____ quantity _____

Cosmetic products (describe) _____ date _____ quantity _____

Objective dermatological examination

Colour of skin _____ pink / pale pink / dark

Tattooing _____

Colour of hair _____

Appendix 6 (cont'd)

Diagnosis

<u>Current dermatoses</u>	<u>Suspected</u>	<u>Clinically verified</u>	<u>Verified by laboratory examination</u>	<u>Pathogen</u>
Aphthoses	_____	_____	_____	_____
Angular chelitis	_____	_____	_____	_____
Dermatophytes	_____	_____	_____	_____
Ecthymosis	_____	_____	_____	_____
Erysipelas	_____	_____	_____	_____
Erysipeloides	_____	_____	_____	_____
Erythrasmosis	_____	_____	_____	_____
Superficial folliculites	_____	_____	_____	_____
Deep folliculites	_____	_____	_____	_____
Furunculosis	_____	_____	_____	_____
Favus	_____	_____	_____	_____
Scabies	_____	_____	_____	_____
Pyogenic granuloma	_____	_____	_____	_____
Herpes simplex	_____	_____	_____	_____
Herpes zoster	_____	_____	_____	_____
Hydroadenitis	_____	_____	_____	_____
Impetigo	_____	_____	_____	_____
Intertrigo	_____	_____	_____	_____
Lymphangitis	_____	_____	_____	_____
Thrush	_____	_____	_____	_____
Paratuberculosis	_____	_____	_____	_____
Pityriasis	_____	_____	_____	_____
Axillary Trichomycosis	_____	_____	_____	_____
Chickenpox	_____	_____	_____	_____
Warts	_____	_____	_____	_____
Vulvo-vaginitis	_____	_____	_____	_____
Others (describe)	_____	_____	_____	_____
Diffuse dermatitis of uncertain aetiology	_____			
Contact dermatitis	_____			
Photosensibilization	_____			

Lesions resulting from contact with marine or other organisms

Algae _____
 Annelid worms _____
 Jellyfish _____
 Sea anemones _____
 Echinoderms _____
 Insects _____
 Sponges _____
 Scorpionfish _____
 Other (describe) _____

Appendix 6 (cont'd)

Description of organisms which could be related to phenomena observed _____

Other pathological conditions _____

Conjunctivitis _____

Otitis _____

Enteric infections _____

Current dermatoses

Date of appearance _____

Initial site _____

Spread _____

Relationship of dermatosis with any other pathological condition (describe) _____

Previous therapy _____

Current therapy _____

Recurrence _____

Recovery _____

Annex 2

LIST OF PARTICIPANTS

TEMPORARY ADVISERS

- Professor A.F. Abdel Latif
Academy of Scientific Research and Technology, Cairo, Egypt
- Mr S. Atallah
Department of Environmental Hygiene, Ministry of Health, Tunis, Tunisia
- Professor N. Benmansour
Ministry of Health, National Institute of Hygiene, Rabat, Maroc
- Professor J. Brisou
23 Avenue Claude Farrère, Toulon, France
- Professor G. Bronzetti
Istituto di Mutagenesi e Differenziamento del CNR, Pisa, Italy
- Professor V. Cabelli *
Department of Microbiology, University of Rhode Island, Kingston, USA
- Dr G. Donati *
Clinica Dermosifilopatica, Universita "La Sapienza", Rome, Italy
- Professor F.M. El-Sharkawi
Environmental Health Department, High Institute of Public Health,
Alexandria, Egypt
- Dr B. Fattal
Environmental Health Laboratory, School of Public Health and Community
Medicine, The Hebrew University of Jerusalem, Jerusalem, Israel
- DR E. Geldreich *
Water Engineering Research Laboratory, US Environmental Protection
Agency, Cincinnati, USA
- Dr V. Krikelis
Enterovirus Laboratory, Institut Pasteur Hellenique, Athens, Greece
- Professor R. Mujeriego
Escuela Tecnica Superior D'Enginyers de Camins, Canals i Ports,
Universitat Politecnica de Barcelona, Barcelona, Spain
- Professor J.A. Papadakis
Department of Bacteriology, Athens School of Hygiene, Athens, Greece
- Professor R. Picchietti *
Via Novelli 12, Ancona, Italy
- Dr G. Rallo *
Cattedra di Programmazione e Organizzazione dei Servizi Sanitari,
Istituto di Medicina Legale, Universita "La Sapienza", Rome, Italy

Mr S.A. Shawaf

Department of Water Pollution Control, Ministry of Irrigation, Damascus,
Syrian Arab Republic

Professor H.I. Shuval *

Environmental Health Laboratory, School of Public Health and Community
Medicine, The Hebrew University of Jerusalem, Jerusalem, Israel

Dr T. Stroffolini

Laboratory of Epidemiology and Biostatistics, Istituto Superiore di
Sanita, Rome, Italy

Dr A. Vassallo

Department of Health and Environment, Valletta, Malta

Professor L. Villa

Laboratory of Environmental Microbiology, Istituto Superiore di Sanita,
Rome, Italy

Dr Laura Volterra *

Laboratory of Environmental Microbiology, Istituto Superiore di Sanita,
Rome, Italy

REPRESENTATIVES OF OTHER ORGANIZATIONS

Commission of the European Communities

Dr J. Vaccarezza

Environment, Consumer Protection and Nuclear Safety, Brussels, Belgium

WORLD HEALTH ORGANIZATION

Regional Office for Europe

Mr J.I. Waddington

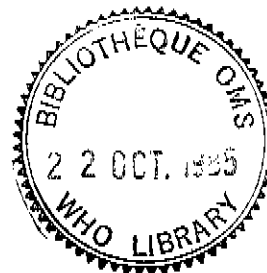
Director Environmental Health Service

Dr L.J. Saliba **

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

* Not paid by WHO

** Also representing UNEP MED Unit, Athens



WHO/UNEP Consultation meeting
on the correlation between coastal
water quality and health effects

Follonica, 21-25 October 1985

ICP/CEH 001 m06/1
9062I
30 September 1985
ORIGINAL: ENGLISH

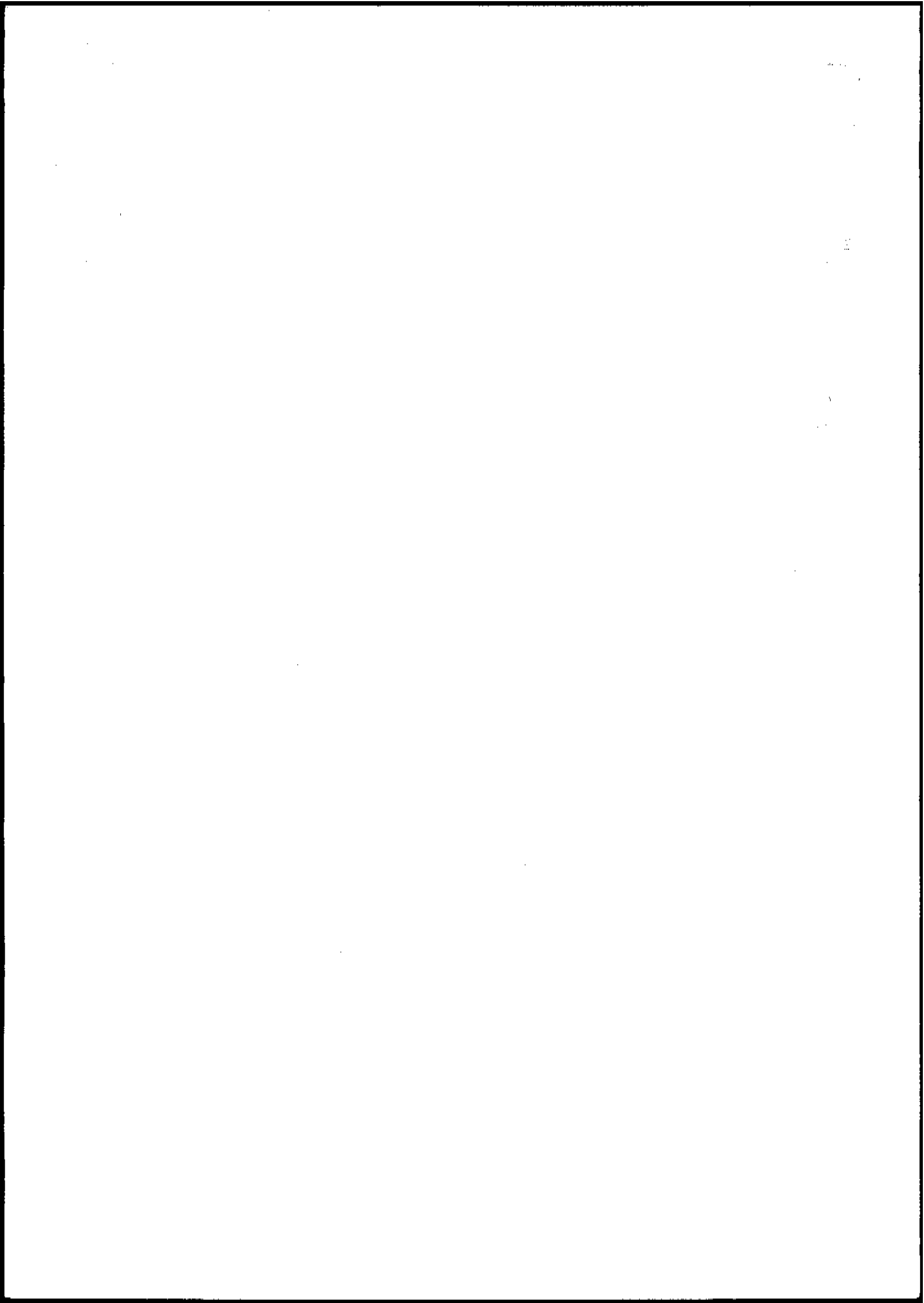
PROVISIONAL LIST OF DOCUMENTS

Working documents

- | | |
|-------------------|---|
| ICP/CEH 001 m06/1 | Provisional list of documents |
| ICP/CEH 001 m06/2 | Scope and purpose |
| ICP/CEH 001 m06/3 | Provisional Agenda |
| ICP/CEH 001 m06/4 | Provisional programme |
| ICP/CEH 001 m06/5 | Provisional list of participants |
| ICP/CEH 001 m06/6 | Thalassogenic infections - Health effects associated with microbial contamination of marine bathing waters and shellfish-growing areas. A critical review, by Professor H.I. Shuval |
| ICP/CEH 001 m06/7 | Draft proposal for Mediterranean regional epidemiological studies correlating coastal water and shellfish quality with health effects, by Dr L.J. Saliba |
| ICP/CEH 001 m06/8 | Draft protocol for epidemiological studies correlating coastal water quality and health effects. by Dr B. Fattal |

Reference documents

- | | |
|----------------|--|
| ICP/RCE 206(5) | WHO/UNEP - Health criteria and epidemiological studies related to coastal water pollution. Report of a group of experts jointly convened by WHO and UNEP, Athens, 1 - 4 March 1977. WHO Regional office for Europe, Copenhagen, 1977 |
| UNEP/WG.118/3 | UNEP/FAO/WHO/UNESCO/IOC/WMO/IAEA - Progress report on the implementation of the long-term programme for pollution monitoring and research (MED POL Phase II) (1983 - 1985). United Nations Environmental Programme, Athens, 1985 |
| UNEP/WG.118/6 | Assessment of the present state of microbial pollution in the Mediterranean sea and proposed control measures. United Nations Environmental Programme, Athens, 1985 |





3149

WHO/UNEP Consultation meeting
on the correlation between coastal
water quality and health effects

Follonica, 21 - 25 October 1985



ICP/CEH 001 m06/2
2917I
9 August 1985
ORIGINAL: English

Italy

SCOPE AND PURPOSE

*Water pollution - ed. of
Mediterranean countries*

The first phase of the Joint Coordinated Mediterranean Pollution Monitoring and Research Programme (MED POL Phase I), conducted between 1976 and 1981 within the overall framework of the UNEP-sponsored Mediterranean Action Plan, included a pilot project on Coastal Water Quality Control (MED POL VII), jointly coordinated by WHO and UNEP. During the course of this pilot project, interim environmental quality criteria were proposed for coastal recreational waters, shellfish-growing waters and shellfish in the Mediterranean region.

The research component of the Long-term Programme for Pollution Monitoring and Research in the Mediterranean Sea (MED POL Phase II), designed to cover the period 1981-1990, contains as one of its approved activities, the performance of epidemiological studies related to the confirmation or revision of the proposed environmental quality criteria.

Research projects within this activity were initiated in 1982. Similar work on the correlation of bathing and/or shellfish-growing waters with health effects on swimmers and/or shellfish consumers respectively has been performed both within and outside the Mediterranean region, though mainly on a fragmentary basis.

The present meeting, which is being jointly convened by WHO and UNEP within the framework of the MED POL Phase II, is being held at Follonica, Italy, with the collaboration of the Istituto di Mutagenesi e Differenziamento, Centro Nazionale delle Ricerche (CNR) with the following objectives:

- to review the results of accomplished and ongoing epidemiological studies in the subject-area, with particular emphasis on their achievements and their shortcomings;
- to formulate a proposal for collaborative regional epidemiological studies which could be carried out in the Mediterranean;
- to formulate draft guidelines for the above studies;
- to review results obtained to date from the relevant aspects of the MED POL Phase II monitoring programme insofar as these relate to the proposed epidemiological studies;
- to make appropriate recommendations

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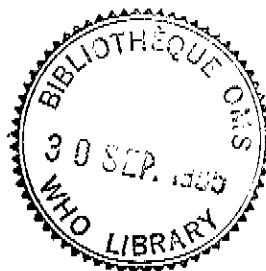
ORGANISATION MONDIALE DE LA SANTÉ
BUREAU RÉGIONAL DE L'EUROPE

WELTGESUNDHEITSORGANISATION
REGIONALBÜRO FÜR EUROPA

ВСЕМИРНАЯ ОРГАНИЗАЦИЯ ЗДРАВООХРАНЕНИЯ
ЕВРОПЕЙСКОЕ РЕГИОНАЛЬНОЕ БЮРО

WHO/UNEP Consultation meeting
on the correlation between coastal
water quality and health effects

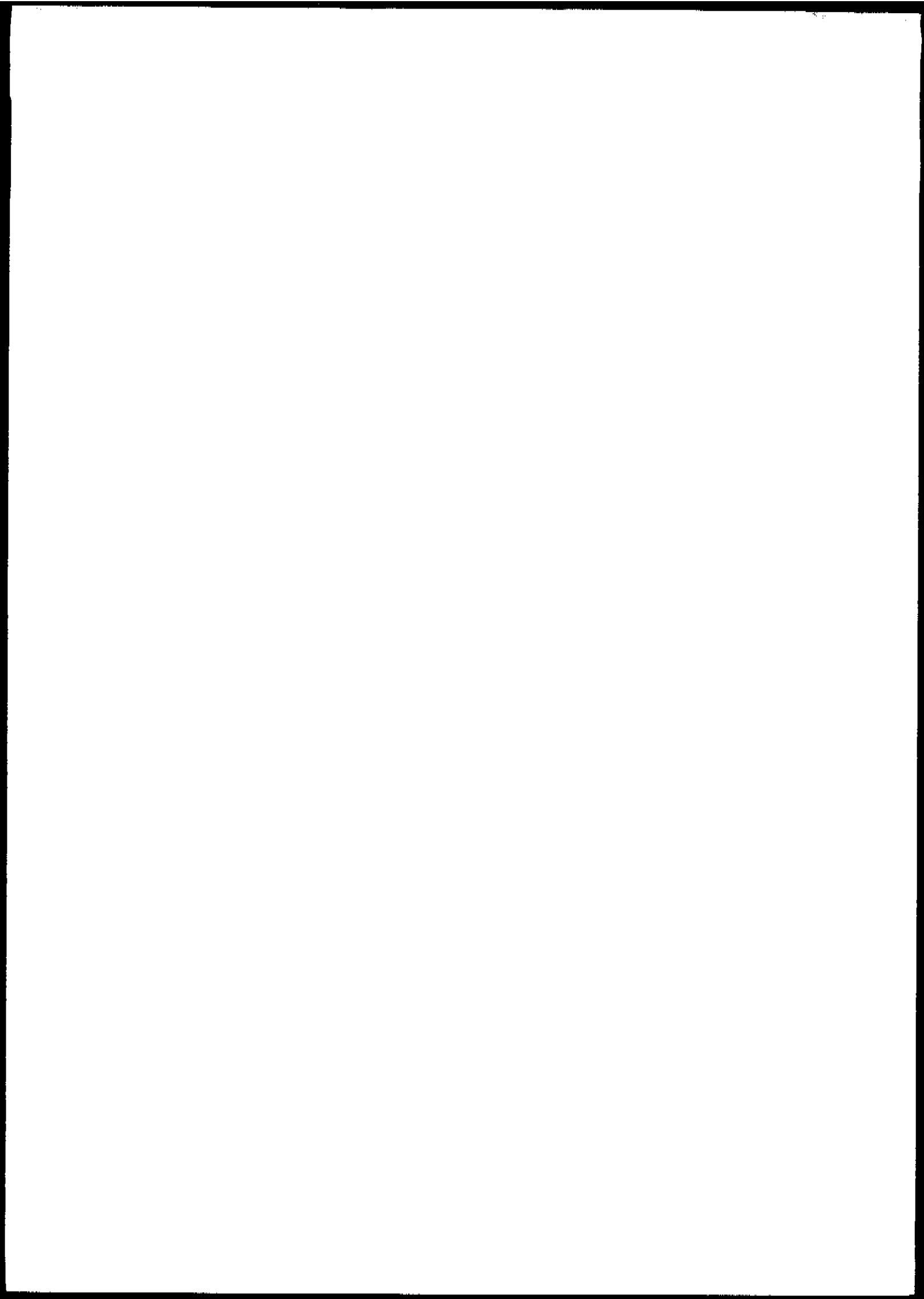
Follonica, 21 - 25 October 1985



ICP/CEH 001 m06/3
2917I
9 August 1985
ORIGINAL: English

PROVISIONAL AGENDA

1. Opening of the Workshop
2. Scope and Purpose
3. Election of Officers
4. Adoption of the Agenda
5. Organization of the Meeting
6. Review of accomplished and ongoing epidemiological studies correlating the quality of coastal recreational waters, shellfish-growing waters and shellfish, with health effects
7. Review of draft proposal for epidemiological studies in the Mediterranean region, including guidelines for such studies
8. Review of current studies of monitoring of coastal recreational waters, shellfish-growing waters and shellfish in the Mediterranean
9. Future action and recommendations
10. Other matters
11. Adoption of the draft report
12. Closure of the Meeting





WHO/UNEP Consultation meeting
on the correlation between coastal
water quality and health effects

Follonica, 21-25 October 1985



ICP/CEH 001 m06/4
90621
30 September 1985
ORIGINAL: ENGLISH

PROVISIONAL PROGRAMME

Monday, 21 October 1985

- 09.00 - 10.00 Registration of participants
- 10.00 - 10.45 Opening of the meeting (agenda item 1)
- Scope and purpose (agenda item 2)
- 11.00 - 12.30 Election of officers (agenda item 3)
- Adoption of the agenda (agenda item 4)
- Organization of the meeting (agenda item 5)
- Review of accomplished and ongoing epidemiological studies correlating the quality of coastal recreational waters, shellfish-growing waters and shellfish, with health effects (agenda item 6)
- 14.30 - 17.30 Review of accomplished and ongoing epidemiological studies correlating the quality of coastal recreational waters, shellfish-growing waters and shellfish, with health effects (agenda item 6, continued)

Tuesday, 22 October 1985

- 09.30 - 12.30 Review of accomplished and ongoing epidemiological studies correlating the quality of coastal recreational waters, shell-fish growing waters and shellfish, with health effects (agenda item 6, continued)
- 14.30 - 17.30 Review of draft proposal for epidemiological studies in the Mediterranean region, including guidelines for such studies (agenda item 7)

Wednesday, 23 October 1985

- 09.30 - 12.30 Review of draft proposal for epidemiological studies in the Mediterranean region, including guidelines for such studies (agenda item 7, continued)
- 14.30 - 17.30 Review of draft proposal for epidemiological studies in the Mediterranean region, including guidelines for such studies (agenda item 7, continued)

Coffee: 10.45 - 11.00 / 16.00 - 16.15

Thursday, 24 October 1985

09.30 - 12.30 Review of current studies of monitoring of coastal recreational waters, shellfish-growing waters and shellfish in the Mediterranean region (agenda item 8)

 Future action and recommendations (agenda item 9)

 Other matters (agenda item 10)

14.30 - 17.30 Working groups

Friday, 25 October 1985

09.30 - 12.30 Adoption of the report (agenda item 11)

14.30 - 17.15 Adoption of the report (agenda item 11, continued)

17.15 - 17.30 Closure of the meeting (agenda item 12)