

**Coordinated Mediterranean Pollution Monitoring and  
Research Programme**

**MID-TERM REVIEW OF THE JOINT  
WHO/UNEP COORDINATED PILOT PROJECT  
ON COASTAL WATER QUALITY CONTROL  
IN THE MEDITERRANEAN  
(MED VII)**



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**WORLD HEALTH ORGANIZATION**

**Regional Office for Europe  
Copenhagen, 1977**

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MID-TERM REVIEW OF THE JOINT  
WHO/UNEP COORDINATED PILOT PROJECT  
ON COASTAL WATER QUALITY CONTROL  
IN THE MEDITERRANEAN  
(MED VII)

Report of a Meeting of Principal Investigators  
of Collaborating Laboratories, jointly convened  
by WHO and UNEP

Rome, 30 May - 1 June 1977

ADDENDUM

Page 10, Annex II

The following text should be inserted after the summary report of the UNDP/WHO Project on Environmental Pollution Control, Athens:

Environmental Engineering Laboratories,  
Technion - Israel Institute of Technology,  
Haifa, Israel.

Summary Report on Coastal Water Quality Control Work in the Mediterranean Sea carried out by the Environmental Engineering Laboratories in Haifa

In the field of marine pollution, the research activities in the Environmental Engineering Laboratories were directed mainly at monitoring sewage outfalls and studying the presence, activity and survival of various indicators and pathogenic bacteria (*Salmonella*, *Vibrio cholerae*) in the marine environment as compared to *E. coli* bacteriophages and human enteric viruses. The results obtained showed that *E. coli* bacteriophages were reacting to environmental conditions in a way similar to that of enteric viruses and were definitely more resistant than coliform bacteria.

In the MED VII research programme it is proposed to study the fate of bacteria (indicator and pathogenic), *E. coli* bacteriophages and human enteric viruses in the sea, in the vicinity of two wastewater outfalls. One is at the mouth of the Kishon river and the second opposite the Tirat Hacarmel community.

The study will be carried out at five sampling points, two in the Kishon river area, two in the Tirat Hacarmel area and one, the control point, north of the T.H. outfall. Frequency of sampling will be once a month.

The fate of the following organisms will be studied: *E. coli* and bacteriophages, coliform bacteria, faecal streptococci, *Salmonella*, human enteric viruses.

Since fish living and growing in polluted water may harbour and concentrate bacteria as well as viruses, and therefore constitute a public health hazard, it is proposed to study the recovery of the above-mentioned organisms from various organs of fish living in the vicinity of the outfalls.

It is proposed also to study the recovery of the above-mentioned organisms in the sediments as compared to the water samples taken from the same sampling points.

Based on a summary prepared by

Dr N. Buras

Principal Investigator

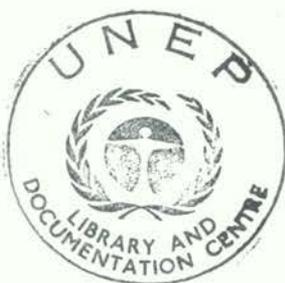
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#### Note

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## 1. INTRODUCTION

The Joint WHO/UNEP Coordinated Pilot Project on Coastal Water Quality Control in the Mediterranean (MED VII) is part of the UNEP Coordinated Mediterranean Pollution Monitoring and Research Programme and specifically relates to the other six joint FAO/GFCM/UNEP, IOC/WMO/UNEP and IOC/UNEP pilot projects.

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

The pilot project is being implemented in close collaboration with UNEP. Following the preparatory phase, an operational document was developed at the WHO/UNEP Expert Consultation on Coastal Water Quality Control Programme (EHE/76.1, Geneva, 15-19 December 1975), which document constitutes its programmatic basis and initiated the operational phase II of the pilot project.

The present mid-term review meeting was organized by WHO and UNEP in collaboration with the Institute of Health in Rome, which has been nominated as the Regional Activity Centre for MED VII. Its main objective was to review the work already carried out and to assess the results obtained during the past phase of MED VII. It also commented on the draft report of the Study Group meeting on Guidelines for Monitoring Public Health Aspects of Coastal Water Quality, Rovinj, 23-25 February 1977, and on the draft report of the Expert Consultation on Health Criteria and Epidemiology of Health Risks related to Beach and Coastal Pollution, Athens, 1-4 March 1977.

During the mid-term review meeting the participants were informed of the progress made in the preparation of the Workshop on Coastal Water Pollution Control, planned for 27 June - 1 July 1977 in Athens.

The meeting also discussed the future orientation of work in the framework of the present operational document (EHE/76.1) and made recommendations for the improvement and acceleration of the pilot project. Recommendations were also made on the content and form of an eventual follow-up action for MED VII, once the pilot project phase is over.

The report of the meeting constitutes an input to the consolidated mid-term review meeting for all seven UNEP Coordinated Mediterranean Pollution Monitoring and Research Programmes (18-22 July 1977).

The principal investigators of the collaborating institutes which have been nominated by their governments to take part in the above WHO/UNEP pilot project and have signed or negotiated agreements with WHO, were invited to participate in the meeting. In addition, the following international organizations and agencies were invited to send representatives: FAO, IAEA, IOC, UNESCO and WMO.

### 1. Opening of the meeting

The meeting took place at the Institute of Health (Regional Activity Centre) in Rome, from 30 May to 1 June 1977.

It was attended by 24 principal investigators or their alternates from eight Mediterranean countries, and by a representative of FAO. A list of participants is given in Annex IV.

Dr L.A. Kaprio, Regional Director of the WHO Regional Office for Europe, opened the meeting and welcomed the participants on behalf of the Organization. Referring to the work undertaken by WHO in the field of water pollution control and more specifically in marine pollution, he stressed the importance of the problem and of the present project. He further emphasized the readiness of WHO to assist Member States in the coordination and implementation of practical solutions which would bring about an abatement of pollution and promote health and well-being in the Mediterranean area. He took the opportunity to express the Organization's great appreciation of the assistance and collaboration of the Institute of Health.

Dr S. Kečkeš, Programme Coordinator of the Mediterranean Pollution Monitoring and Research Programme (MED POL), greeted the participants on behalf of the Executive Director of UNEP, thanked the Institute of Health, Rome, and the Government of Italy for hosting the meeting and expressed UNEP's hope that the collaboration established among the research centres participating in MED VII, WHO and UNEP, would bear its first visible fruits at the meeting.

Professor F. Pocchiari, Director-General of the Institute of Health, then addressed the participants. Outlining the responsibilities and the work of the Institute, he expressed its readiness to assist the promotion and implementation of the MED VII project. As provided for in the project document, his Institute had been nominated as Regional Activity Centre and, in that capacity, it would collaborate with and assist WHO and all the laboratories participating in the project.

## 2. Election of officers

Professor F. Pocchiari was elected Chairman of the meeting and Professor H.I. Shuval and Professor E. Ulug were elected Vice-Chairmen. Dr L. Spiteri and Dr L. Volterra were nominated Rapporteurs.

## 3. Adoption of the agenda

The provisional agenda was adopted by the meeting without change (see Annex I).

## 4. Introductory statements and general discussion

### 4.1 Development of the Mediterranean Action Plan

Dr S. Kečkes' reviewed the components of the Action Plan adopted by the governments of the Mediterranean countries at the Intergovernmental Meeting on the Protection of the Mediterranean Sea (Barcelona, January/February 1975) and the progress achieved in its implementation. He stressed that the assessment of the present level of pollutants in the Mediterranean and of their impact on the marine environment and human health, which would be carried out through the MED POL pilot projects, was an integral part of the Action Plan. It served as the scientific basis for technical, administrative and legislative actions which might be undertaken by the governments of the region to improve the quality of the Mediterranean environment.

The following were indicated by Dr Kečkes' as the tasks of the meeting:

- (1) to review the results of the first phase of MED VII;
- (2) to prepare a report which would contribute to the assessment of pollution of the Mediterranean;
- (3) to clarify methodological questions and thus to improve the implementation of the second phase of MED VII, using the operational document (EHE/76.1) as the framework of that project.

The results presented at the meeting would be integrated with those obtained from similar review meetings on the other pilot projects of MED POL and submitted to an intergovernmental meeting of the Mediterranean countries (Monaco, 28 November - 6 December 1977) as part of the report on the state of pollution in the Mediterranean region.

### 4.2 Development of the MED VII project

Mr Ponghis presented the document "Development of the MED VII project up to the end of May 1977", referring to the operational document (EHE/76.1) which constituted the basis for the implementation of the project. He outlined briefly the immediate objectives of the project and reviewed the relevant activities undertaken to meet those objectives.

In the field of monitoring of selected areas, he mentioned that, regarding the establishment of a network of collaborating institutes, only 7 countries had until recently nominated 18 collaborating institutes. Those numbers had increased to 9 countries and 28 institutes by the end of May. Although a number of agreements were almost finalized, no final agreement between WHO and the respective collaborating institutes had been signed, owing to various delays and the lack of certain data.

He also referred to the Guidelines for Monitoring Public Health Aspects of Coastal Water Quality (Rovinj, 23-25 February 1977), which were to be reviewed by the present meeting, as well as the report of an Expert Consultation on Health Criteria and Epidemiology of Health Risks related to Beach and Coastal Pollution (Athens, 1-4 March 1977).

Data on the scope and objectives of the proposed Workshop on Coastal Water Pollution Control to be held in Athens (27 June - 1 July 1977), which constituted part of the present project, were brought to the attention of the participants.

Turning to the objectives concerning equipment and training assistance, Mr Ponghis mentioned that the requests received for equipment exceeded the existing possibilities of the project. On

the other hand, training requests were rather limited and some revision of proposed activities in that respect might be justified. Finally, he enumerated the publications relevant to the project which were intended to assist in its implementation.

#### 4.3 General discussion

In discussing the general statements presented by the secretariat, the participants raised a number of points related to the content and direction of the research and monitoring work to be undertaken.

In particular, the question of the effects of the discharge of organic material of land-based wastes was raised and the concept of waste assimilation capacity was discussed. It was recognized that although the overall absorbing capacity of the Mediterranean in that respect might appear almost unlimited such was not the case for specific parts of it such as the Adriatic and other semi-enclosed areas. Moreover, the fate of the organic waste and the nature of its constitution were not easily determined; related research was imperative and should not be limited to coastal areas.

Many participants expressed their views on the importance of viruses as a potential risk to health, both during recreational exposure and as a result of seafood consumption. Various methods for detecting viruses and measuring their levels were discussed and it was felt that an extension of the present project to include such studies was fully justified. Very little was yet known about the fate of bacteria and viruses and their possible accumulation in concentration areas other than the water itself, e.g., in organic material or sediments, and extensive studies should also be undertaken in that field.

### 5. Review of work and results obtained during the past phase of MED VII

#### 5.1 Monitoring of selected coastal areas

The participants were invited to make a short summary of the various activities they were undertaking in the field of coastal marine pollution in general and not limit themselves to an account of the specific work performed under the present project. A summary of the activities of each of the collaborating institutes is given as Annex II; a review of the state of pollution on the Italian coast (summer, 1976), prepared by the Regional Activity Centre, is presented in Annex III.

Of the general points made by the participants, the following might be mentioned in particular.

Although the activities provided for by MED VII are already being formally undertaken by only a few laboratories, almost all the laboratories are conducting intensive bacteriological surveillance of coastal waters and some are already following the procedures and methods advocated in the operational document (EHE/76.1).

A considerable number of laboratories are at present conducting analytical studies on the detection of viruses in water, sediments and shellfish. The participants considered it desirable that fish also be included in the proposed work of MED VII; it was agreed that such activities, though not obligatory, constituted a worthwhile part of the programme.

Several points on sampling time, sample treatment and various specific analytical issues related to bacteria and viruses were discussed.

Disappointment was expressed that so few countries had nominated participating institutions and that only 8 laboratories from out of 18 Mediterranean countries were represented at the meeting. It was recommended that efforts be made to increase the number of institutes participating in the project, particular attention being paid to countries which had not yet nominated any.

#### 5.2 Methods and techniques used in the implementation of MED VII

In principle, basic guidelines on parameters and monitoring procedures are given in the operational document (EHE/76.1), which describes the principles and operational details of the pilot project.

In order to ensure uniformity of sampling and analysis in the monitoring areas and to harmonize procedures with those accepted for the other pilot projects, a document on Guidelines for Monitoring Public Health Aspects of Coastal Water Quality was presented at the meeting. Discussions were focused on the microbiological examination procedures given in Chapter 10 of that document, dealing with the mandatory bacteriological tasks, i.e., total coliform, faecal coliform and faecal streptococci counts.

Some participants queried the usefulness of total coliform counts, considering their known limitations. It was concluded, however, that the test continued to be of importance since most of the countries still included that parameter in their legislation as basic for determining the sanitary quality of marine water. Moreover, it was mentioned that total coliform counts provided some useful information, particularly for comparative purposes.

The operational document states that the membrane method is the selected one for use by all laboratories participating in the project, and there was a general consensus that that method offered many advantages, both in simplicity and accuracy. It was pointed out by a number of participants that the additional costs were minor and were far outweighed by the advantages.

However, some participants stated that in their countries the MPN method was legally prescribed and therefore the laboratories faced some difficulties in applying two methods. Nevertheless, in a number of laboratories (e.g., in Israel, Greece and Yugoslavia) both methods were used in view of the great advantages of the membrane method and the comparatively limited additional cost that it involved. It was expected that both methods would be used for a transitional period until the legal aspects of the problem could be resolved.

The meeting recommended that WHO should officially approach the interested countries where the MPN method was required by law and advise them that the membrane method should also be accepted as a legal test, or that it should at least have the same standing as the MPN procedure. An example of such an adaptation of legislation is the Directive of the Council of the European Communities on the quality of bathing waters, dated 8 December 1975, in which both the membrane method and the MPN method are fully accepted. It was agreed that, as far as the MED VII project was concerned, only the membrane method was regarded as compulsory for the participating laboratories.

The participants recognized the great benefit that the standardization of media and filters would produce for comparability of results and for the purchase of the relevant media for all the laboratories. A subgroup formed to examine the matter made the following recommendations.

1. The same m-FC medium should be used for both coliform counts and faecal coliform counts. The suggested incubation temperature is  $35^{\circ} \pm 0.5^{\circ}$  C for the total coliform count and  $44.5^{\circ} \pm 0.2^{\circ}$  C (incubation in water bath) for the faecal coliform count.
2. Liquid m-FC, as opposed to agar, should be used (Difco M-FC Broth Base (No.0883) and rosolic acid; the rosolic acid is to be freshly prepared.
3. The HA millipore filter (0.45 u, 47 mm) should be given preference.
4. M. enterococcus agar (Difco) should be used for faecal streptococci at an incubation temperature of  $35^{\circ} \pm 0.5^{\circ}$  C.

Criticism was voiced by a few of the participants on the part concerning meteorological and hydrographical observations, described in Chapter 8 of the Guidelines for Monitoring Public Health Aspects of Coastal Water Quality. They considered that current and draft measurements were not adequately covered by the above document. Moreover, they felt that the required marine measurements could not usually be undertaken by public health laboratories that did not have the necessary equipment or facilities. The importance of this point is enhanced in view of the fact that these parameters are included in the compulsory part of the work as set out in the pilot project.

While the above remarks were to some extent justified, it was agreed that the inclusion of physical, hydrographic parameters was of great importance in assessing and interpreting the results of microbiological tests. Therefore the guidelines were intended to provide the minimum data on those physical parameters required for the above assessment and interpretation. However, it was considered that in general the parameters referred to would be provided by other national institutions equipped and staffed for that purpose. Those institutions were expected to follow the guidelines provided by the relevant UNEP/IOC-assisted project MED VI. Only in the absence of that information would the provisions of Chapter 8 of the Guidelines for Monitoring Public Health Aspects of Coastal Water Quality be applied. Moreover, relevant provision, mentioning the above in a summarized form, would be included in the Chapter 8 under review.

Reservations were expressed by a number of participants about some methods concerning the optional parameters in the monitoring work. It was explained that those methods were not compulsory but were given as a guide. It was expected that in due time, and in the light of the experience of the participating laboratories, a revision of those methods could be proposed.

### 5.3 Assistance and training for the participating laboratories

The general provisions in this project include the development of short courses and in-service training for scientific staff participating in the project. The requests received so far from the laboratories have been very limited and a revision of the initial plans would be justified.

From the discussion it was clear that in-service training and the exchange of fellows between laboratories was the type of training preferred. A number of laboratories were also ready to accept fellows for in-service training. The possibility of sending consultants to provide on-the-spot assistance at the request of interested laboratories was mentioned.

From the number of requests received for equipment and expendable material, it was evident that the demand of the laboratories was considerably in excess of the budgetary possibilities. It was confirmed that any request for assistance could be considered only within the budgetary component provided under the MED POL programme.

However, in view of the possibility of some funds being saved from the training component of the project, an augmentation of the equipment component might be foreseen. An additional increase in the provision of expendable supplies could be achieved by standardizing the material required by the participating laboratories. That would allow purchases to be made centrally by project MED VII and thus result in some savings, thereby increasing the amount of supplies that could be provided.

### 5.4 Criteria, guidelines and standards for coastal recreational waters and beaches

The specific part of the draft report of the Expert Consultation on Health Criteria and Epidemiology of Health Risks related to Beach and Coastal Pollution (Athens, 1-4 March 1977) dealing with criteria was brought to the attention of the participants.

The interim criteria proposed in Chapter 10 of that document were discussed and compared with national and intercountry guidelines or standards applied in the relevant countries.

The meeting accepted the conclusion of the Expert Consultation on Interim Criteria that "highly satisfactory bathing areas should show E. coli counts of consistently less than 100 per 100 ml and, to be considered acceptable, bathing waters should not give counts consistently greater than 1000 E. coli per 100 ml", i.e., "no more than 10 per cent of at least ten samples collected during the bathing season should exceed 1000 E. coli per 100 ml".

However, it was noted that some countries applied stricter standards than the one suggested. That did not in any way conflict with the above recommended interim criteria, since the latter should be considered as the minimum requirement.

The participants were of the opinion that additional criteria should be applied for physical, chemical and aesthetic characteristics of coastal bathing waters. In that connexion, reference was made to the draft document on health criteria for the quality of coastal bathing waters (E. Mood & B. Moore). The meeting also believed that there was a need to establish criteria for shellfish-growing waters and possibly for coastal fishing areas as well.

Concern was expressed that existing standards might not adequately exclude the risk of viral infection, since enteroviruses had been shown to survive for much longer periods in the sea than coliforms.

### 5.5 Epidemiology of health risks related to the pollution of coastal waters

The participants were acquainted with the epidemic episode of cholera which occurred in 1973 in Italy as a consequence of El Tor vibrio cholera being introduced from abroad and spread through the consumption of infected shellfish. Expressing their great concern in that connexion they recommended that special attention be paid to the risk of transmission of cholera by polluted bathing waters, since tourists who were cholera carriers could easily enter any of the Mediterranean countries, and such a situation could lead to the spread of vibrio cholerae through contaminated marine waters.

### 5.6 Principles for coastal water pollution control

The planned Workshop on Coastal Water Pollution Control, Athens, 27 June - 1 July 1977, was brought to the attention of the meeting. Additional data were included in the documentation for the meeting. The meeting recognized the need for a practical solution to the problem of municipal waste disposal in coastal areas and of marine pollution.

## 6. Data exchange, processing and reporting

The possibility of direct contact between the laboratories and WHO was brought to the attention of the participants. While WHO and UNEP would reserve the right to interpret the data submitted by participants in MED VII, all data submitted would be considered as restricted in their original form unless specific approval for their general release was given by the laboratory concerned.

The recording, storage and processing of data were thoroughly discussed. It was considered important to develop a standard format for reporting data which would be followed by all the laboratories and would make possible the use of computers in the future. All individual tests should be recorded in full on a separate form.

It was also considered useful to maintain comparability if possible, not only within the project but also between the different parts of the MED POL programme as far as was feasible.

The Institute of Health, Rome, as Regional Activity Centre, was requested by the meeting to develop, in consultation with the interested laboratories and WHO, a uniform data reporting and processing programme for both the obligatory and the optional parts of the project. Participating institutions should be given training in the use of the standard reporting procedure, together with advice on the data processing and analysis possibilities.

## 7. Future orientation of MED VII and recommendations

The participants had a far-ranging discussion on these items of the agenda and made the following recommendations.

- (1) In view of the fact that only nine of the 18 countries have so far nominated laboratories, efforts should be made to increase the number of institutions participating in the project, particular attention being paid to countries which have not yet nominated their participants.
- (2) The mandatory part of the monitoring programme, as outlined in EHE/76.1, should be carried out with strict adherence to the methodology described in the Guidelines for Monitoring Public Health Aspects of Coastal Water Quality.
- (3) The development of methods for the assessment and principles for the control of coastal water pollution is considered to be one of the prime tasks of project MED VII and activities under this project component should therefore be intensified considerably.
- (4) Environmental engineering research on technological solutions for land-based waste disposal problems common to Mediterranean countries should be supported and coordinated with efforts initiated under the present project.
- (5) The forthcoming workshop on coastal water pollution control is regarded as an important starting-point, leading to continuing activity by interested scientific institutions which would collaborate on the development of relevant control principles and technologies.
- (6) Original data submitted by participants in the project to WHO and to meetings of the institutes collaborating in MED VII should be treated as restricted and should be used further only in connexion with appropriate interpretation.
- (7) Savings should be transferred from unspent training funds to the purchase of equipment.
- (8) Guidelines and principles for assessing the quality of recreational beaches should be developed as part of MED VII activities.
- (9) In order to ensure full comparability of the data obtained and the most adequate geographic coverage, efficient coordination should be exercised at the national level, at the level of MED VII, and between MED VII and the other relevant components of the Mediterranean Action Plan.
- (10) The strengthening of coordination between the different components of the Mediterranean Action Plan contributing to the solution of coastal pollution control problems is regarded as essential. In particular, results of projects on coastal pollution control (MED VII), on the impact of pollutants on ecosystems (MED V) and on land-based sources of pollution (MED X), should be mutually utilized to further the development of the Protocol on Land-based Sources of Pollution.
- (11) Uniform, computer-compatible data reporting forms and systems should be developed by the Regional Activity Centre (RAC) in collaboration with the participating laboratories and WHO, and used by all

participants in MED VII in order to enable the full and comprehensive utilization of data collected through this and other MED POL projects. An appropriate training activity should be developed by the RAC to introduce this reporting system.

(12) Basic and applied research programmes supporting the monitoring programme should be considered part of MED VII and ways should be found to promote them. Some research studies regarded as important are given in this report, e.g., on water and sediment interaction, the use of bacteriophages as pollution indicators, and pathogenic bacteria and animal viruses.

(13) The public health implications of the eutrophication of coastal waters caused by land-based discharges should be studied as part of MED VII, while MED V should review the magnitude and extent of the problem as well as its impact on the ecological balance.

(14) Epidemiological studies should be initiated in a number of Mediterranean countries and carried out according to the uniform methodology recommended in the report of the Expert Consultation on Health Criteria and Epidemiology of Health Risks related to Beach and Coastal Pollution (Athens, 1-4 March 1977), and ways should be found to support them.

(15) In addition to shellfish, fish should also be monitored for microbiological quality.

(16) The use of standard media for the monitoring programme is strongly recommended and the suggestion of the subgroup (see section 5.2) is specifically endorsed.

AGENDA

1. Opening of the meeting
2. Election of Chairman, Vice-Chairman and Rapporteurs
3. Adoption of the agenda
4. Introductory statements and general discussion
  - 4.1 Development of the Mediterranean Action Plan
  - 4.2 Development of the MED VII project
  - 4.3 General discussion
5. Review of work and results obtained during the past phase of MED VII
  - 5.1 Monitoring of selected coastal areas
  - 5.2 Methods and techniques used in the implementation of MED VII
  - 5.3 Assistance and training for the participating laboratories
  - 5.4 Criteria, guidelines and standards for coastal recreational waters and beaches
  - 5.5 Epidemiology of health risks related to the pollution of coastal waters
  - 5.6 Principles for coastal water pollution control
6. Future orientation of MED VII
7. Data exchange, processing and reporting
8. Recommendations
9. Other matters
10. Adoption of the report and closure of the meeting

Laboratory of Hygiene,  
Medical School,  
University of Thessaloniki,  
Greece.

Summary Report on Coastal Water Quality Control Work in the Mediterranean carried out by the Laboratory of Hygiene

Past work

For the last 10 years, the laboratory has done work on coastal water and shellfish-pollution measuring the following parameters:

Coliforms; E.Coli; enterococci; salinity; temperature; turbidity; dissolved oxygen; BOD<sub>5</sub>; nitrates; nitrites; heavy metals (Hg, Cd); hydrocarbons; Vibrio; Salmonella.

Present work

The above work is continuing. In addition, at three stations in the recreational area the laboratory is participating in the activities proposed within the framework of the MED VII pilot project.

Future work

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

Based on a summary prepared by  
Professor T. Edipides  
Principal Investigator

Sanitary Laboratory of Athens,  
Ministry of Social Services,  
Athens, Greece.

Summary Report on Coastal Water Quality Control Work in the Mediterranean carried out by the Sanitary Laboratory

The following programme is being initiated:

Monitoring programme concerning shellfish, covering (a) water in culture area, (b) sediments, (c) shellfish.

The parameters which will be measured for the above monitoring areas are: total coliforms, faecal coliforms and faecal streptococci.

In addition, other parameters will be monitored related to epidemiological conditions, such as Salmonella and Vibrio (cholerae, NAG, parahaemolyticus).

Based on a summary prepared by  
Dr M. Thalassimou-Tzatzani  
Principal Investigator

Project Laboratory,  
Ministry of Social Services,  
UNDP/WHO Project on Environmental Pollution Control,  
Athens, Greece.

Summary Report on Coastal Water Quality Control Work in the Mediterranean Sea carried out by the Project Laboratory, Athens

Past work

The Project Laboratory has established a sampling programme around the Attica Peninsula (area of Greater Athens) and the Saronikos Islands.

Data for 1975 and 1976 for faecal coliforms analysed (multiple tube method used).

Present work

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

Parameters measured:

Coastal sea-water: temperature, salinity, dissolved solids, turbidity, total coliforms, faecal coliforms (*E.coli*), faecal streptococci (enterococci); sediment: organic carbon, chlorophylls, particle size analysis, fungi *C. albicans*.

2. Epidemiological-microbiological study of the health risks related to beach and coastal pollution:

A preliminary survey is being implemented at selected sites to determine water quality indicators with a view to evaluating the feasibility of conducting an epidemiological study in coastal areas of Metropolitan Athens.

3. A laboratory study of bacterial die-off or disappearance rate in Saronikos Gulf is being carried out.

4. A study of microfauna and periphyton of coastal areas is aimed at assessing the existing situation and the identification of pollution and their possible evaluation.

Based on a summary prepared by

S. Sotiracopoulou

Principal Investigator

Ministry of Health,  
Tel-Aviv District Health Office,  
Tel-Aviv, Israel.

Summary Report on Coastal Water Quality Control Work in the Mediterranean Sea carried out by the District Health Office in Tel-Aviv

The Ministry of Health initiated coastal water monitoring in 1950 and established internal guidelines for coastal water quality at 2400 total coliform organisms/100 ml.

The length of the Mediterranean coastline is about 180 km. In 1976 the Ministry of the Interior, on the recommendation of the Ministry of Health, approved 65 public bathing beaches along the Mediterranean; four were closed during the season because of visible signs of pollution and bacterial counts higher than that recommended by the Ministry of Health.

The total number of sea-water samples collected during 1976 was 1213 from 47 monitoring stations: 251 during the winter and 462 during the summer (April to September). In addition to total coliform tests on all samples, 900 samples were also tested for faecal coli.

Based on a summary prepared by

Naftali Cohen, M.P.H.,

Principal Investigator

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

Summary Report on Coastal Water Quality Control Work in the Mediterranean carried out by the Environmental Health Laboratory

1. Analysis of coastal water quality data for Tel-Aviv region - 1963-1976

The Ministry of Health has assigned the task of statistical analysis of 14 years of bacteriological monitoring of the bathing-waters of the Tel-Aviv area beaches to the Environmental Health Laboratory, which handles approximately 10 000 bacteriological test results and the environmental data collected at the 17 sampling stations. It has been determined that coliform counts are highest in winter months. This is probably associated with lower die-away rates obtained in colder weather and during periods of lower light intensity. Coliform counts also increase with increasing wave height. The coefficient of correlation between total coliforms and E.coli is 0.91. The results of parallel total coliform and E.Coli tests at various beaches also indicate that the guideline currently used in Israel of 2400 coliforms/100 ml is roughly equivalent to a E.coli guideline of 1000/100 ml, with agreement in 86% of the cases.

2. Factors effecting the die-away of coliforms and enteric viruses in coastal waters

Following studies on die-away of coliforms and enteric viruses, new studies to determine the insitu die-away rate of enteric viruses in the sea in the vicinity of the sewage outfall near Tel-Aviv are being planned utilizing new sensitive methods for detecting a few viruses in sea water samples of 100-500 l. Also, a study to compare the three standard bacterial tests with enteric virus concentrations at beaches is being planned using these same methods.

3. Epidemiological study on the disease rates among bathers and non-bathers at beaches of varying levels of bacterial pollution

An epidemiological study of disease rates among bathers and non-bathers at beaches of varying levels of bacterial pollution in the Tel-Aviv area is being planned along the lines recommended by the WHO Expert Consultation on Health Criteria and Epidemiology of Health Risks Related to Beach and Coastal Pollution, Athens, 1-4 March 1977.

4. Training

It is planned to offer a specialized training course in new techniques for concentrating and detecting viruses in sea-water for scientists participating in the MED VII project. The programme could also include training in methods for detecting microbial aerosols created by sea spray from polluted coastal areas. Training possibilities on an individual basis can also be arranged.

Based on a summary prepared by  
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Summary Report on Coastal Water Quality Control Work in the Mediterranean carried out by the Laboratory of the Health Department

Samples of sea-water are analysed bacteriologically by the multiple tube dilution method and the results are expressed as Most Probable Number of Organisms (MPN) per 100 ml. These samples are submitted routinely by the health inspectors for examination. When the level of E.coli exceeds 1000 per 100 ml or coliforms are in excess of 1800 per 100 ml bathing is prohibited.

Three main areas will be monitored within the framework of project MED VII: Mellena Bay, San Luciano and Renella. The monitoring will be carried out according to the mandatory part of the operational document using the membrane filtration method.

Based on a summary prepared by  
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Summary Report on Coastal Water Quality Control Work in the Mediterranean carried out by the NRC Water Research Institute, Rome

The Water Research Institute has undertaken a research programme at the mouth of the Tiber to ascertain the degrees of dispersion and diffusion of polluting agents carried by the Tiber, the waters of which have been qualitatively and quantitatively studied in recent years.

The programme is working along two convergent and interdependent lines. On the one hand, the fluodynamic, meteomarine conditions are studied, and on the other the main parameters of quality and their effects on various ecosystems are monitored. It is hoped that it will be possible eventually to create a hydrodynamic model in which some conservative parameters also converge.

The Institute has been working on this study for about a year. With regard to the parameters measured those related to microbiological pollution and those connected with eutrophication are given the same importance.

In addition to phosphorous and nitrogen salts, soluble silicates are also measured. As to the problem of eutrophication, algae tests are also carried out in order to detect the controlling element.

At the same time other types of research are being undertaken, in the hope that they will be useful for the objectives of MED VII. They concern the detection of inorganic and organic toxic elements chosen for their high degree of toxicity. Inorganic cadmium and mercury and organic polychlorobiphenyls (PCB) and hexachlobenzene (HCB), which are typical representatives of the chloro-organic classes, are included in the tests.

During the first year, about 20 monitoring and sampling sites were established in the area immediately facing the mouth of the Tiber.

As the first part of the programme, surface samples only were taken once or twice each month, but during the coming year vertical distribution will also be taken into account.

Based on a summary prepared by  
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Summary Report on Coastal Water Quality Control Work in the Mediterranean carried out by the Institute of Health (Regional Activity Centre)

The zone chosen for the MED VII project study is the sandy municipal beach of Castel Porziano (about 2 km long). This is located on the Tyrrhenian Sea between the Rome and Torvaianica beaches. The beach is bounded by two canals.

Sampling points are situated at a distance of about 400 m from each other along the beach. Two other sampling stations are located in the two canals in order to evaluate their pollution load.

In the above-mentioned area the mandatory part of the programme is carried out. The detection of Salmonella and of anti-coli and anti-Salmonella bacteriophages will be carried out as optional analyses.

The work began in the first days of May 1977, following the methodology for the MED VII project.

Based on a summary prepared by  
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Summary Report on Coastal Water Quality Control Work in the Mediterranean Sea carried out at the University of Genoa

The Institute of Hygiene of the University of Genoa has a long tradition in the study of coastal water quality. Detailed studies on the hygienic conditions of coastal waters, with particular regard to the situation in the Ligurian Sea, were extensively reviewed in 1965 and 1972. The hygienic conditions of the coastal waters near Leghorn, were also investigated two years ago. A survey was also carried out in coastal waters around Elba by performing bacteriological analysis in situ.

In the field of microbiological monitoring of sea-water, an apparatus has been designed for the cumulative sampling of water over a pre-established period. In particular, the problem of the virological monitoring of sea-water in relation to the bacteriological parameters of pollution has been examined. By using the selected polyelectrolyte method, virological monitoring was carried out on samples of coastal water with various levels of bacteriological pollution. Additional investigations were carried out to study the problem of virus accumulation and release in clastic sediments of coastal waters.

Recently, some modern aspects of chemical pollution have been explored, particularly the detection of heavy metals in sea water and in hydric fauna involved in the alimentary chain, as well as in filtering organisms. A series of studies was concerned with the detection of microelements in shellfish (Mytilus galloprovincialis) and in crustaceans (Meganocytiphones norvegica) collected in the Ligurian Sea.

The Institute of Hygiene has also carried out a number of studies in selected monitoring areas in the Mediterranean Sea to try to find areas where both chemical and biological pollution approached zero. So far, the Institute has failed to detect such an ideal situation.

Epidemiological surveys have been initiated in an attempt to determine a possible association between sea-bathing and a number of diseases. Two groups of school-children (10-12 years old) were investigated with the help of questionnaires. One group spent their summer holidays at the seaside and the other in the mountains. A statistical study of the two groups based on the completed questionnaires is now in progress

Based on a summary prepared by  
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Summary Report on Coastal Water Quality Control Work in the Mediterranean carried out by the Institute

A survey of the sanitary condition of recreational beaches in four areas (Zadar, Split, Ston and Dubrovnik) along the Adriatic coast was initiated and has been systematically carried out since November 1976. At 25 coastal stations (10-15 m from the shore), standard microbiological parameters (faecal and total coliforms, faecal streptococcus and heterotrophs) and accompanying physical and chemical parameters are measured in sediments and sea-water. By May 1977 three baseline measurements had been made at all stations, and the frequency of sampling is to be increased during the bathing season.

In one area (Ston) additional sampling of Mytilus galloprovincialis and Ostrea edulis is performed using standard microbiological procedures.

The results obtained so far indicate that all the analysed recreational waters are within the limits of sanitary tolerance, but the sites near the harbour (which are not used for recreational activities) are heavily affected by faecal pollution.

Based on a summary prepared by  
Slavko Sobot  
Principal Investigator

Annex II

Institute of Hydrobiology and Fisheries,  
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Summary Report on Coastal Water Quality Control Work in the Mediterranean carried out at the University of Messina

The coastal areas studied during the last years are as follows:

1974: Saline-Augusta open waters, four cruises. 1975: Augusta coastal zone, three cruises; Stretto coastal zone, three cruises. 1976: Stretto, two cruises; Milazzo, two cruises. 1977: Stretto, one cruise; Milazzo, one cruise; Augusta coastal zone, two cruises.

Planned for 1977

Milazzo, two cruises; Patti, one cruise; Vibo Valentia, one cruise; Augusta coastal zone, two cruises; Augusta open waters, two cruises; Capo Passero, three cruises.

Parameters

The following parameters are measured in the above studies:

temperature; salinity (titrometric); oxygen; oxygen saturation; pH; total alkalinity; specific alkalinity; seston 80°C and 800°C gravimetric; ammonia; nitrites; nitrates; phosphates; sulfates; BOD<sub>5</sub>; oils/greases; total charge of heterotrophic water; total coliforms (M-Endo-MF; MF on absorbent pads 36°C (Difco); faecal coliforms (M-Endo-MF; MF on absorbent pads, 44°C (Difco); Petroleum bacteria (qualitative for crude oil and quantitative for diesel; total charge of heterotrophied sediments.

Based on a summary prepared by

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Summary Report on Coastal Water Quality Control Work in the Mediterranean carried out by the Environmental Engineering Department

The selected pilot project area for coastal water quality control Antalya Konya Alti beach, is one of the places where the greatest tourism potential is expected. The project is supported by the Turkish Scientific and Technical Research Council, the Ministry of Tourism, the Ministry of Health and Social Welfare, the Ministry of Agriculture and the General Directorate of Water-derived Resources.

The checklist of Pilot Project Activity (ICP/CEP 209) is signed by the collaborating centre (METU, Environmental Engineering Department) as the coordinating institute for the above-mentioned public services.

Monitoring will include the water phase, sediments, plankton and shellfish.

Meteorological and hydrographic conditions of the area will be available from other studies carried out in the selected pilot project areas.

Based on a summary prepared by

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Summary Report on Coastal Water Quality Control Work in the Mediterranean carried out by the Sanitary Engineering Research and Study Centre

Specific MED VII analytical activities have not yet started because of organizational difficulties. However, numerous activities have taken place with a view to the development of the future analytical programme and in the more general field of coastal water quality control.

Analytical methods have been reviewed and discussed with specialist microbiologists and analytical chemists. A critical review of the Draft Guidelines for Monitoring Public Health Aspects of Coastal Water Quality will follow.

Criteria, guidelines and standards for coastal recreational waters and beaches have been discussed at several meetings as well as at the national level. A review of the criteria adopted by the EEC has been developed, mainly with reference to the present criteria adopted by the Italian authorities.

The possibility of collaborating on the research programme with the Zoological Station of Naples has been discussed with the Director, Professor A. Monroy, and it is expected that an agreement will be reached soon. A joint activity is planned for August to monitor the Bay of Naples. A specialist from the University of Newcastle upon Tyne has been invited to the Zoological Station of Naples to carry out bacteriological monitoring of the Bay for the second year. The methodological lines of MED VII will be followed.

Concerning the general problem of coastal water quality control, a strategy for coastal management has been developed which, it is hoped, will bring the problems within reach of solution.

Based on a summary prepared by  
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Summary Report on Coastal Water Quality Control Work in the Mediterranean carried out by the Centre for Marine Research

The Bay of Rijeka in the Northern Adriatic is an area in which the quality of recreational waters has been systematically investigated since June 1976.

The operational document for the WHO/UNEP Pilot Project on Coastal Water Quality Control served as the general guideline for planning and execution of the work.

Eight representative coastal stations (10-15 m from the shoreline) were selected at Rijeka, Volosko and Opatija. Two additional open sea stations, 500 m from the shoreline, are used as reference stations.

The parameters monitored at all stations are: total coliforms, faecal coliforms, faecal streptococci, dissolved oxygen, BOD (5 days), pH, salinity, temperature, atmospheric conditions. At the two open sea stations, nutrients, primary productivity and currents are also determined.

No attempt has been made to generalize the findings or to correlate the obtained data with the hydrographic conditions and existing land-based sources of pollution because of the high variability of the results obtained so far. This will be done when more data are collected.

Based on a summary prepared by  
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Trieste, Italy.

Summary Report on Coastal Water Quality Control Work in the Mediterranean carried out by the Institute of Hygiene

The Institute of Hygiene has been working on problems of marine pollution for about 10 years, research activities being coordinated within the framework of the National Research Council.

The first part of the study was aimed at obtaining a pollution map of the North Adriatic from Trieste to Ravenna.

Further research on a sampling zone including the Marano lagoon, which is highly polluted, and the adjacent area of sea, was aimed at the study and comparison of microbiological parameters (E.coli, total bacterial load at 34°), physical parameters, biochemical, temperature, OD., BOD detergents, chlorides, orthophosphates, polyphosphates, ammonia, etc. and at attempting to define the validity of their utilization in marine pollution research and in the study of the diffusion of pollutants.

The Institute also developed a method for laboratory sampling and measurement of total hydrocarbon. Using this standardized method, which was verified in other laboratories, it was possible to estimate the total surface hydrocarbon pollution in the North Adriatic.

In collaboration with the National Research Council, the Institute developed methods for metal detection (Cd, Co, Cv, Cm, etc.). Using those methods, samples of sea-water, sediments, shellfish and some types of fish were successfully analysed, indicating the utility of using biological material (particularly shellfish) as indices of metal pollution.

Methodological research is under way for the detection of enteric pathogens such as Salmonella and viruses.

The Institute is prepared to collaborate in the following research under the MED VII project.

- (1) methodological evaluation of microbiological, chemical and biochemical tests;
- (2) determination of polluted areas by microbiological tests (E. coli, Streptococci faecalis enteropathogens (bacteria and viruses));
- (3) pollution by metals and hydrocarbon.

The experience obtained confirms that it is necessary to use a great number of parameters in research on marine pollution. Collaboration between the various groups working in the North Adriatic is to be hoped for. For example, some agreements have already been reached with the Marine Biological Station in Portoroz, Yugoslavia.

Based on a summary prepared by

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Summary Report on Coastal Water Quality Control Work in the Mediterranean carried out by the Marine Biological Station

Regular monitoring was carried out along a 17 km stretch of the Slovenian littoral of the Gulf of Trieste, which is densely populated and highly developed from the point of view of tourism. The effects of pollution and its extent were assessed by monitoring complex parameters (physico-chemical, bioproductivity, biocoenotic, bioassay, sedimentological, etc.) including bacterial parameters. During 1971-75 sampling took place, mostly at monthly intervals, at 34 stations along the above coastal area for bacteriological examinations.

Obligatory total heterotrophs grown on nutrient agar at 37° C and faecal coliforms on "Teagitol 7" medium at 44.5° C, obtained by membrane filtration, were counted. Indicatively, at selected stations and seasons, faecal streptococci and clostridium perfringens were examined. The data obtained during the five-year period were evaluated statistically and the following sanitary standards were recommended to the responsible authorities for application in an updating of the legislation:

Shellfish culture waters: max. 10 faecal coliforms/100 ml

Highly satisfactory bathing-waters: max. 50 faecal coliforms/100 ml

Tolerable bathing-waters: max. 800 faecal coliforms/100 ml.

Beginning in 1975, regular bacteriological examinations have been made of mussels (Mytilus galloprovincialis) from the polluted port of Piran, of natural populations in clean waters of Savudrija, and in cultivation plants in Strurijan for comparison purposes. The parameters measured are faecal coliforms (by the multitube method) and pathogens, Salmonella, Vibrio, Proteus, Shigella, etc. (by relevant methods.)

For the purpose of the MED VII Project, it is planned to undertake the following studies:

- (1) monitoring of the whole coastal sea as described above, including the obligatory part of the MED VII programme. (The above study is to be coordinated with the investigations proposed by the Institute of Hygiene, Trieste, in order to include the whole area of the Gulf of Trieste);
- (2) advanced and expanded examinations of mussels as described above;
- (3) research on the fate, behaviour, accumulation and disappearance of symbiotic and pathogenic enteric micro-organisms in experimental lagoons which will be artificially polluted by typical domestic sewage.

In addition, in-service training facilities will be provided.

Based on a summary prepared by

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Summary Report on Coastal Water Quality Control Work in the Mediterranean carried out by the Monaco Scientific Centre

The Laboratory of Microbiology and Studies of Marine Pollution, a department of the Monaco Scientific Centre, has been working since November 1966 on coastal water quality control.

Samples of sea-water are collected along the coast (3 km long) at 10 stations, once a week, at the surface and at a depth of 3 m for examination for coliform, E.coli, Streptococcus faecalis and Salmonella, by the method of membrane filtration.

During the bathing season from May to October, water is collected in the beach area at 20 supplementary points.

Within the framework of "Programme Ramoge", studies of nutrients (Technicon), heavy metals (spectrophotometry) and physical parameters have been added.

Studies on currents and winds, and on factors of dispersion and diffusion of pollution have also been carried out.

Based on a summary prepared by

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Summary Report on Coastal Water Quality Control Work in the Mediterranean carried out by the Marine Research Centre

It was not possible to accomplish much actual research during the past year (1975-76) for obvious political reasons. However, action is now under way to upgrade the Centre's capability and to reassess the prospects for full participation.

In Lebanon there are a number of institutions undertaking studies along the lines of the MED VII project. One of these is the newly established Marine Research Centre, which was officially nominated by the Government to participate in the above project. Currently, different institutes use different methodologies, and not all collected data are readily available or published. Parameters routinely measured include counts for E.coli, Streptococcus faecalis, total coliform, BOD, O<sub>2</sub>, S<sup>o</sup>/oo, T<sup>o</sup> C, and pH.

By its participation in MED VII, the Centre aims at the adoption of a common and accepted methodology throughout the Mediterranean area; it will also advise the relevant authorities on bacteriological standards.

Based on a summary prepared by

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Regional Activity Centre for Project Med VII,  
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Viale Regina Elena,  
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State of Pollution on the Italian Coast

The Institute of Health, Rome, invited the provincial laboratories of hygiene and preventive medicine of all the coastal towns to send in the results of analyses carried out during the summer of 1976.

The Italian standard for sea-water used for recreational and bathing purposes is 100 faecal coliforms/100 ml. As a general rule, 20% of the analyses must not exceed this value. The MPN method is followed.

The entire coast of each province was considered for a statistical estimate of the percentage of the analyses which exceed the limit value. From Table 1 it will be seen that in the summer of 1976 some provinces had a high percentage of colimetric analyses exceeding the limit value, but in each zone there were beaches with low colimetric indices. It should be noted that the summer of 1976 was characterized by heavy rains, low temperatures and frequent squalls. In Table 2 the percentage of samples in each of 15 colimetric groups is shown. Out of a total of 4445 analyses, 81.2% were within the standard limit, while only 6.64 exceeded the value of 1000 faecal coliforms/100 ml.

In appraising the above analysis of frequency of distribution of the colimetric values, it should be taken into consideration that the basic data utilized present some deficiencies as far as uniformity of coverage, frequency of sampling and availability of relevant details are concerned.

Based on a summary prepared by

M. Boeddu, L. Villa and L. Volterra

Table 1

PERCENTAGE OF SAMPLES CONTAINING MORE THAN 100 FAECAL  
COLIFORMS/100 ML, BY PROVINCE

Province	Percentage of samples containing more than 100 faecal coliforms/100 ml
Imperia	18.11
La Spezia	0.00
Massa Carrara	38.12
Lucca	13.61
Leghorn	3.97
Grosseto	35.48
Rome	4.94
Latina	8.64
Naples	16.46
Salerno	26.17
Catanzaro	18.19
Cosenza	17.80
Reggio Calabria	0.00
Taranto	5.00
Lecce	0.00
Brindisi	24.52
Bari	12.04
Foggia	10.53
Pescara	10.88
Teramo	5.28
Ascoli Piceno	9.52
Macerata	49.75
Ancona	0.00
Pesaro	14.00
Forli	2.93
Ravenna	10.61
Venice	31.42
Udine	25.00
Trieste	29.41
Catania	4.21
Syracuse	0.00
Ragusa	28.18
Caltanissetta	16.60
Trapani	0.00
Palermo	7.00
Cagliari e Oristano	0.91
Sassari	6.00
Agrigento	2.85

Table 2FREQUENCY OF DISTRIBUTION OF COLIMETRIC VALUES ACCORDING TO  
15 COLIMETRIC CATEGORIES

Colimetric categories	Percentage of samples in a given category
0	24.25
1-10	19.37
11-20	10.10
21-50	18.06
51-80	5.75
81-100	3.66
101-120	0.74
121-150	2.04
151-200	1.28
201-300	3.10
301-400	1.08
401-500	0.79
501-700	1.48
701-1000	1.39
> 1000	6.64

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