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REPORT OF THE CONSULTATION MEETING FOR THE FINALIZATION AND APPROVAL OF CRITERIA AND STANDARDS FOR BATHING WATERS ALONG WITH BEACH PROFILES (Athens, 8-9 November 2010)

In cooperation with

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United Nations Environment Programme

CONSULTATION MEETING FOR THE FINALIZATION AND APPROVAL OF CRITERIA AND STANDARDS FOR BATHING WATERS ALONG WITH BEACH PROFILES

Report on a joint WHO/UNEP Meeting

Athens, Greece
8-9 November 2010

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ABSTRACT

Microbiological contamination of coastal recreational waters by sewage discharges is one of the main public health concerns in Mediterranean countries. WHO and the United Nations Environment Programme within the framework of the MED POL programme Phase IV, held a country designated consultation meeting of experts in Athens, Greece, from 8-9 November 2010, to approve the bathing quality criteria and standards for the monitoring of these waters. Experts from 20 countries reviewed recent advances in monitoring microbial pollution, taking into consideration the WHO guidelines and the European Commission (EC) directive on this topic. The participants also considered the proposed methodology for developing beach profiles. The participants unanimously agreed on criteria and standards following modifications of the proposal made during the Consultation. The agreed criteria and standards take into consideration the WHO guidelines and are in conformity with the new EC directive. Finally, the participants agreed to submit the criteria and standards for approval to the next MED POL Focal Points meeting and further on to the Contracting Parties meeting.

Keywords

ENVIRONMENTAL MONITORING – standards
SEAWATER
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WATER POLLUTION
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WHO Regional Office for Europe, Copenhagen

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Foreword

The Contracting Parties to the Barcelona Convention adopted common criteria and standards for coastal recreational waters at interim in 1985, with a view to update them when new more evidence would be provided. A new proposal was prepared ten years later, but as at the same time there was a proposal of a European Council Directive on the same subject in evolution, it was decided to postpone any decision and to wait until the new Directive would be operational. This was meant to avoid any duplication of efforts regarding microbiological analyses and elaboration of data in case of different criteria and standards as four of the Contracting Parties belonged to the EU and the EU itself is a Contracting Party. In the meantime, WHO has developed new "Guidelines for Safe Recreational-water Environments" launched in 2003 and the EU has abandoned their old proposal and started a new one linked to the WHO Guidelines. A new EC Directive was adopted by the European Parliament in 2006, and in line with it, the Mediterranean countries have proposed criteria and standards that comply with the WHO guidelines and the EC Directive, so as to agree on regulations that will provide the same background.

1. Opening of the Meeting

The meeting took place at the premises of the Coordinating Unit for the Mediterranean Action Plan, Athens, Greece from 8 to 9 November 2010. It was attended by twenty government-designated experts (ALB, ALG, CRO, CYP, EGY, EU, GRE, ISR, LEB, MAL, MON, MNT, MOR, SLOV, SPA, TUN and TUR), a temporary advisor, the Coordinator of UNEP/MED POL Programme and the Project Officer of WHO/EURO in the MED POL Programme. A list of participants is attached as Annex I to this report.

In officially opening the Meeting, Mr. F. Saverio Civili, MED POL Coordinator, greeted the participants and gave a brief description of the objectives of the MED POL Programme by highlighting the importance of the Protocol for the Protection of the Mediterranean sea from land-based sources and activities. He also referred to the MED POL Phase IV programme and its operational document, as the key tool to decrease the level of pollution in the Mediterranean and to apply the sustainable development principles. He referred to the work performed so far in the field of bathing waters within the MED POL context and the need to adopt new criteria and standards for all the Mediterranean countries, with the aim to apply common criteria and standards for both EU and non EU countries. He also referred to the issue of Marine Litter in the Mediterranean which is also related to beach quality.

2. Scope and Purpose of the Meeting

The sanitation status in the Mediterranean region varies form country to country, as do the standards and their enforcement. Taking into consideration that the Mediterranean sea continues to attract every year an ever increasing number of international and local tourists that among their activities use the sea for recreational purposes, the issue of the microbiological pollution is of particular importance. Although the general situation has improved considerably in several parts of the region through the establishment of sewage treatment plants and the construction of submarine outfall structures, the matter is still of major concern in a number of areas and the quality of recreational waters needs regular monitoring.

Within the framework of the Long-term Programme of Pollution Monitoring and Research in the Mediterranean Sea (MED POL Phase I) the development of national marine pollution monitoring programmes was commenced in 1982. Microbiological monitoring of coastal recreational and shellfish waters formed an important component of such

programmes and still continues to be of outmost importance for the Mediterranean countries due to their contribution to the tourism industry of the region.

In 1985 the Contracting Parties to the Barcelona Convention adopted common criteria and standards for coastal recreational waters at interim, with a view to update them when new more evidence would be provided. In the following years, WHO has developed new "Guidelines for Safe Recreational Water Environments" launched in 2003, a new EC Directive was adopted by the European Parliament in 2006, linked to the WHO Guidelines, while the countries agreed on a common methodology and standards for coastal waters.

Every Mediterranean country now has an operational monitoring programme, but financial constraints have limited the development of such programmes in a number of countries. In order to assist countries in monitoring programmes, a methodology that allows the evaluation of the health risks in coastal areas, related to sanitation has been developed by WHO. This methodology is a helpful tool to assist countries in implementing monitoring programmes for the safe use of the coastal areas and along with the European Directive form a solid basis for the development and establishment of Mediterranean guidelines for bathing waters.

The objectives of the present consultation, which is being jointly convened by WHO and UNEP within the framework of MED POL Phase IV, include:

- Review of WHO's Guidelines for Safe Recreational Water Environments along with the EC Directive on the subject with emphasis on the criteria and standards along with water quality profiles;

- Evaluation of the pilot and national projects on water quality profiles;

- Application of the methodology for the evaluation of health risks in coastal areas;

- Recommendations for the adoption by the Contracting Parties to the Barcelona Convention, of the criteria and standards for bathing waters along with beach profiles;

- Recommendations for future activities including capacity building.

3. Election of Officers

Mr Charles Bonnici (Malta) was elected Chairperson, Mr Messaoud Tebani (Algeria) and Prof. Maria Figueras (Spain) Vice Chairpersons. Dr. George Kamizoulis acted as Secretary to the Meeting.

4. Adoption of the Agenda and organization of the meeting

The meeting unanimously agreed on the adoption of the Agenda as proposed, including some amendments. The adopted Agenda is attached as Annex II. The amendments included a new subject in the Agenda, following Dr. Kamizoulis suggestion. The new subject entitled “Marine Litter” was accepted for discussion at the end of the proposed Agenda items, since it is directly linked with bathing waters and beach profiles. Following the work already done on this issue and in view of its introduction to the EU descriptors of the Marine Framework Directive, it was considered essential to include information on this topic. During the meeting and the discussion that followed, the participants agreed to modify the agenda by including two new items which the participants considered as being important. These were: (a) Results of the WHO/MED POL Intercalibration exercise of 2009 and (b) Presentation of the results of the EPIBATH project on *E. coli* indicator.

5. Brief history of the preparation of the proposed criteria and standards

Dr. Kamizoulis briefed the meeting on the history of criteria and standards for bathing waters, including those proposed for the Mediterranean region. The development of criteria and standards for coastal recreational water quality is normally dependent on the interpretation of results of comprehensive and well-conducted studies aiming at the correlation of the microbiological quality of sweater and the observed health effects on exposed population groups, and establishing a clear dose-response relationship, thus allowing the definition by the competent authorities of a level of acceptable risk in terms of water quality.

The National Technical Advisory Committee to the U.S. Federal Water Pollution Control Administration developed in 1968 a national faecal coliform guideline of 200 MPN/100 ml for fresh and marine waters by applying a factor of safety – where water quality should be better than that which would cause a health effect.

In 1974, WHO convened a Working Group of European experts on Guides and Criteria for Recreational Quality Beaches and Coastal Waters, in Bilthoven, Netherlands, which "agreed that the recommended upper limits for indicator organisms should be expressed in broad terms of orders of magnitude rather than rigidly stated specific numbers. Highly satisfactory bathing areas should, however, show *E.coli* counts consistently less than 100 per 100 ml and in order to be considered acceptable, bathing waters should not give counts greater than 1000 E.*coli* per 100ml".

In 1976, the U.S. Environmental Protection Agency (USEPA) proposed a guideline based on a minimum of not less than five samples taken over not more than 30-day period. The faecal coliform content of primary contact recreational waters shall not exceed a log mean of 200/100 ml, nor more than 10% of total samples during any 30-day period, shall exceed 400/100 ml.

In 1976 also, the European Economic Community published its Quality Requirements (microbiological) for Bathing Waters (Directive 76/160/EEC). Subsequent U.S. studies confirmed the superiority of enterococci as an indicator organism and Cabelli developed in 1983 a linear relationship between mean enterococcus density/100 ml and swimming associated rate for gastrointestinal symptoms per 1000 persons.

In 1983, the WHO/EURO Project Office of the Coordinating Unit for the Mediterranean Action Plan proposed that the Mediterranean governments adopt criteria for coastal recreational waters. These criteria could use as a basis the 1974 Bilthoven conclusions extrapolated to Mediterranean conditions using the results of the WHO organized pilot project on coastal water quality control within the framework of the UNEP-sponsored MED POL program (carried out between 1976 and 1981). The criteria were based on concentrations of both faecal coliform concentration limits (100 per 100 ml in at least 50% of the samples, 1000 per 100 ml in at least 90%; minimum of 10 samples).

In 1985 the Contracting parties to the Barcelona Convention adopted the WHO/EURO (MED POL) criteria as "interim bathing water criteria and standards" which, today 25 years later, are still applied. In 1986 the USEPA adopted a new control criterion for marine waters: enterococci, which were not to exceed 35/100 ml.

In 1994 the European Commission initiated the preparation of a new Directive for bathing water quality that could replace the one of 1976 (76/160/EEC), and re-launched a later version in 1998, which was concluded in 2006 with the issuing of the EC Bathing Water Directive 2006/7/EC. The WHO Guidelines for safe recreational water environments were completed and published in 2003. The latter have been updated in 2009 including results of new epidemiological studies and new information on methods, indicators and on the

application of the Hazard Analysis Critical Control Points (HACCP) to evaluate and manage the risk at bathing areas (WHO/SDE/WSH/04.09).

The Mediterranean guidelines for bathing waters were formulated in 2007 based on the WHO guidelines for "Safe Recreational Water Environments" and on the EC Directive for "Bathing Waters". The proposal was made in an effort to provide updated criteria and standards that can be used in the Mediterranean countries and to harmonize their legislation in order to provide homogenous data. In addition, in 2009, the guidelines were coupled with the instructions for the preparation of water quality profiles. Finally, in 2009, a proposal to the USEPA (Journal of Water and Health, Vol 7, Nr 1, March 2009) was to include in the new national criteria the sanitary investigation component, so as to provide a mechanism to consider the relative risks associated with contamination from different sources in diverse waters.

6. Presentation of the WHO guidelines on safe recreational water environments

Before arriving to the objective of the meeting, i.e. the finalization and adoption of the proposed guidelines, it was considered that a review of the WHO guidelines would be necessary, for the better understanding of the proposed Mediterranean guidelines. In this regard, Dr. Kamizoulis gave an overview of the guidelines which are currently in use by countries that apply the WHO guidelines.

He started by explaining that regulatory schemes for the microbial quality of recreational water have been largely based on percentage compliance with faecal index organisms counts. According to the new WHO guidelines, constraints on these approaches include the following:

- Management actions are retrospective and can only be deployed after human exposure to the hazard.
- In many situations, the risk to health is primarily from human excreta, yet the traditional indices of faecal pollution are also derived from other sources. The response to non-compliance, however, typically concentrates on sewage treatment or outfall management.
- There is poor inter-laboratory comparability of microbiological data.
- Beaches are classified as either safe or unsafe, although there is in fact a gradient of type, severity and frequency of health effects with increasing faecal pollution of human and animal origin.

These limitations can largely be overcome by a monitoring scheme that combines microbial testing with broader data collection regarding sources and transmission of pollution. There are two outcomes from such an approach. One is a recreational water environment classification based on long-term analysis of data, and the other is immediate actions to reduce exposure, which can be applied from hour to hour or from day to day.

A WHO expert consultation in 1999 formulated a harmonized approach to assessment of risk and risk management for microbial hazards across drinking, recreational and reused waters. The "Annapolis protocol" by WHO in 1999 represents an adaptation of the harmonized approach to recreational waters. The protocol has been tested in various countries resulting in the development of the WHO Guidelines for recreational waters in 2003. In these Guidelines the Chapter 4, "Faecal pollution and water quality" summarized the results of the "Annapolis protocol" and underlines that water safety is best described by a combination of sanitary inspection and microbial quality assessment.

The two principal components for assessing faecal contamination of recreational waters are:

- Assessment of the evidence for the degree of influence of faecal material (i.e. derivation of a sanitary inspection category),
- Counts of suitable faecal index bacteria (a microbial water quality assessment).

Guidelines and standards for microbial water quality were originally developed to prevent the occurrence of outbreaks and disease. Numerous epidemiological studies have shown a causal relationship between gastrointestinal symptoms and recreational water quality as measured by index bacteria numbers. Quantitative epidemiological studies published in recent years enable the estimation of the degree of health impact of any given range of water quality. In 19 out of 22 studies examined in a review paper by Pruss in 1998, the rate of certain symptoms or symptom groups was significantly related to the count of faecal index bacteria in recreational waters. According to Kay *et al.* in 2001, the most useful data were provided by the randomized controlled trials in the U.K.. These studies give the most accurate measure of exposure, water quality and illness compared with observational studies. These trials therefore form the key studies for the derivation of the WHO guideline values for recreational waters.

In order to apply several regulations, a number of indicators are used and particularly among those commonly used for health related issues are the microorganisms. These should ideally: have a healthy basis; have adequate information available with which to derive guideline values; be sufficient stable in water samples; have a standard method for analysis; be low cost to test; make low demands on staff training, and require basic equipment that is readily available.

The microorganisms commonly used in regulations include the following:

- Intestinal enterococci: meet all the requirements
- *Escherichia coli:* intrinsically suitable for fresh waters
- Total coliforms: are inadequate (not specific to faecal material)
- Thermotolerant coliforms: are unsuitable as regulatory parameters (non adequate studies – non faecally derived organisms)
- *Salmonellae:* limited biological plausibility (low infectivity –relatively low numbers in sewage – rapid inactivation in waters)
- Enteroviruses: direct health significance varies from negligible to very high (costly to essay – require specialized methods – their numbers are variable and not related to human outcome).

In the WHO Guidelines on “Safe Recreational Water Environments” there is a very interesting sub-chapter related to "Faecal Pollution and Water Quality", that provides the necessary information on the Faecal streptococci containing two genera, namely *Enterococcus* and Streptococcus, while, the predominant species in polluted aquatic environments are: *Enterococcus faecalis*, *Enterococcus faecium* and *Enterococcus durans*, e all included under the term Enterococci.

The criteria for Enterococci are the following: (a) growth at 10ºC and 45ºC, (b) resistance to 60ºC for 30 min, (c) growth at pH 9.6 and at 6,5% NaCl and (d) ability to reduce 0,1% methylene blue. Finally, since the most common environmental species fulfill these criteria, in practice the terms (i) Faecal streptococci, (ii) Enterococci, (iii) Intestinal enterococci and (iv) the enterococcus group, may refer to the same bacteria. On the other hand, the Intestinal Enterococci is defined by ISO as the appropriate subgroup to monitor: bacteria capable at aerobic growth at 44ºC and hydrolysing 4-methylumbelliferyl-β-D-

glucosite in the presence of: thallium acetate, nalidixic acid and 2,3,5 triphenyl tetrazolium chloride.

The guideline values for microbial water quality are derived form the key studies described above. The values are expressed in terms of the 95th percentile of number of intestinal enterococci per 100 mL and represent readily understood levels of risk based on the exposure conditions of the key studies. The table below indicates the relationship of the estimated risk of exposure to the 95th percentile values of Intestinal Enterococci.

95th Percentile value of Intestinal Enterococci/100 ml (rounded values)	Basis of derivation	Estimated risk per exposure
≤40 A	This range is below the No Observed Adverse Effect Level (NOAEL) in most epidemiological studies	<1% GI illness risk <0.3% Acute Febrile Respiratory Illness (AFRI) risk
41-200 B	The 200/100 ml value is above the threshold of illness transmission reported in most epidemiological studies	1-5% GI illness risk 0.3-1.9% AFRI risk
201-500 C	This range represents a substantial elevation if the probability of all adverse health outcomes for which dose-response data area available	5-10% GI illness risk 1.9-3.9% AFRI risk
>500 D	Above this level, there may be a significant risk of high levels of minor illness transmission	>10% GI illness risk >3.9% AFRI risk

AFRI= acute febrile respiratory iones; GI= gastroenteritis

The three most important sources of human faecal contamination of recreational water environments for public health purposes are typically sewage, riverine discharges and contamination by bathers. The types and numbers of pathogens in sewage will differ depending on the incidence of disease and carrier states in the contributing human and animal populations and the seasonality of infections.

Moreover, it should be highlighted that the assessment of recreational water quality is interpreted or modified in the light of regional and/or local factors. Such factors include the nature and seriousness of local endemic illness, population behaviour, exposure patterns, as well as socio-cultural, economic, environmental and technical aspects. To assist in the formulation of a well evidenced decision the sanitary inspection provides an additional tool.

The sanitary inspection should aim to identify all sources of faecal pollution. Information to be collected should cover at least the following:

(a) Sewage outfalls, sewage overflows, storm water discharges (presence/absence, type of sewage treatment, effectiveness of outfall type), (b) riverine discharges

(presence/absence, type of sewage treatment, population size from which sewage originates, river flow in the bathing season), (c) bather shedding (bather density in the swimming season, dilution /mixing of water), and (d) additional information (rainfall, wind, tides and currents, coastal geography).

The outcome of the sanitary inspection and the microbial quality assessment is a five-level classification for recreational water environments – very good, good, fair, poor and very poor. In addition there is a follow up category were there is potential discrepancy between the results of the microbial water quality assessment and the sanitary inspection.

Initial classification of recreational waters is achieved by combining the sanitary inspection category and the microbial quality assessment using a matrix such as that shown in the table below. The cut-off guide values (40, 200, 500) are expressed in terms of 95 percentiles of counts of intestinal enterococci per 100 ml and represent levels of risk based on the exposure conditions of key epidemiological studies. When the site inspection and water quality inspection result in a potentially incongruent categorization, further assessment will be required. This will include reassessing the sanitary inspection and additional analysis of water quality. In some cases provisional classification (where no data or incomplete data are available) or reclassification may occur.

Classification matrix for faecal pollution of recreational water environments

	Microbial Water Quality Assessment Category 95th percentile intestinal enterococci/100 ml				
	A <40	**B** 41-200	**C** 201-500	**D** >500	**Exceptional circumstances****
Sanitary Inspection Category* Very low	Very good	Very good	Follow up	Follow up	Action
Low	Very good	Good	Fair	Follow up	
Moderate	Good	Good	Fair	Poor	
High	Good	Fair	Poor	Very poor	
Very High	Follow up	Fair	Poor	Very poor	
Exceptional circumstances**	Action				

* "very low" = very low susceptibility to faecal influence

** Exceptional circumstances relate to known periods of higher risk, such as during an outbreak with a pathogen that may be waterborne, sewer rupture in the recreational water catchment, etc. Under such circumstances, the classification matrix may not fairly represent risk/safety.

Finally the guidelines make reference to the management, being an important tool for maintaining and improving the water quality of the recreational areas. There are two main elements of management action: classification of recreational water locations and short-term information that reflects changes in conditions. In order to support safety in recreational water environments the responsible management authorities should establish a program for evaluating existing hazards. Threats may include physical accidents, microbiological parameters, cyanobacteria and algae blooms.

Good quality public information in near real time about the recreational water environment is considered as particularly important. The use of modern technology is highly recommended (television, internet) as well as fencing, signposting and removal of beach facilities (public toilets, showers) in the event of poor microbial water quality.

Pollution prevention and remediation measures should be available for water quality improvement. This includes direct point source abatement. Intermittent pollution abatement and catchments pollution abatement are some of the measures to be taken.

The recommended monitoring schedule according to the risk category identified by sanitary inspection is the following:

Risk category identified by sanitary inspection	Microbial water quality assessment	Sanitary inspection
Very low	Minimum of 5 samples per year	Annual
Low	Minimum of 5 samples per year	Annual
Moderate	Annual low-level sampling 4 samples x 5 occasions during swimming season Annual verification of management effectiveness Additional sampling if abnormal results obtained	Annual
High	Annual low-level sampling 4 samples x 5 occasions during swimming season Annual verification of management effectiveness Additional sampling if abnormal results obtained	Annual
Very High	Minimum of 5 samples per year (swimming strongly discouraged)	Annual

The detailed WHO Guidelines can be downloaded from the following site: http://www.who.int/water_sanitation_health/bathing/en

7. Presentation of the EC Directive on Bathing Waters

In order to arrive to the establishment of the Mediterranean criteria and standards, besides the WHO Guidelines, a wide presentation of the evolution of the EC Directive was made by Dr. Kamizoulis.

In reviewing the Directive he stated presenting the old EC Directive (76/160/EEC), in which bathing areas have been classified as safe or unsafe on the basis of percentiles of 12 samples monitored during the previous bathing season, using 3 bacterial indicators: total coliforms, faecal coliforms and (optionally) faecal streptococci. Pathogens such as *Salmonella* and enteric viruses should be monitored when necessary.

Member States should respect a "normal" monitoring frequency, of one sample per 15 days, or a "reduced" monitoring frequency of one sample per month. The "reduced" monitoring frequency can be used when the water quality is good and there are enough samples.

The assessment of the water quality is established through mandatory monitoring of total coliforms, faecal coliforms and of three physical parameters and optionally for faecal streptococci.

In the new Directive (2006/7/C) concerning the management of bathing water quality and replacing Directive 76/160/EEC, the bathing water is defined as “1) Water where bathing is traditionally practiced by a large number of bathers or is promoted by the competent authorities, and 2) where bathing is not prohibited or advised against for the full

duration of three consecutive years". Swimming pools and spa pool waters for therapeutic purposes and artificially created and separated from surface waters are not covered by the Directive. The Directive covers both sea water and fresh water.

This Directive lays down provisions for:

(a) The monitoring and classification of bating waters quality
(b) The management of bathing waters quality
(c) The provisions of information to the public on bathing water quality

The above-mentioned document includes the following issues:

(a) Establishing and maintaining a bathing water profile: This is basically a description of the physical, geographical and hydrological characteristics of the bathing water, the identification and evaluation of all potential sources of contamination and an assessment of the risks to the bather's health.

(b) Establishing a monitoring calendar: Monitoring should be started before the start of each bathing season with a frequency based on historical data of the previous years.

(c) Monitoring the bathing water: Member states should monitor waters for intestinal enterococci and *E.coli.* Standard rules for handling and transporting samples for microbiological analyses should be followed. It is recommended that the samples be analyzed on the same working day. If this is not possible for practical reasons, the samples must be processed within a maximum of 24 hours provided that the samples are stored in the dark and as closed as possible to 4ºC.

(d) Assessing bathing water quality: This shall be established on the basis of water quality data sets consisting of at least 15 samples obtained during the preceding 3 o 4 bathing seasons.

(e) Classifying the bathing water: Bathing waters are classified in 4 categories depending on the concentration of bacterial indicators and using a 95 and 90 percentile evaluation, as follows. Member states should ensure that all bathing waters are at least of "sufficient" quality.

	A	B	C	D	E	F
	Parameter	Excellent quality	Good quality	Sufficient	Poor	Reference methods of analysis
1	Intestinal Enerococci (cfu/100mL)	100*	200*	185**	>185**	ISO 7899-1 or ISO 7899-2
2	Escherichia coli (cfu/100 mL)	250*	500*	500**	>500**	ISO 9308-3 or ISO 9308-1

* 95th Percentile point of the data probability density function is derived from the following equation: upper 95^{Th}percentile = antilog (μ + 1,65 σ); ** 90th Percentile = antilog (μ + 1,282 σ), μ = Calculated arithmetic mean of the log10 values, σ = Calculated standard deviation of the log10 values.

The bathing water monitoring activities are to be implemented as follows:

1. One sample is to be taken shortly before the start of each bathing season. Taking account of this extra sample and subject to paragraph 2, no fewer than four samples are to be taken and analysed per bathing season.
2. However, only three samples need to be taken and analysed per bathing season in the case of a bathing water that either:
   (a) has a bathing season not exceeding 8 weeks; or
   (b) is situated in a region subject to special geographical constraints.
3. Sampling dates are to be distributed throughout the bathing season, with the interval between sampling dates never exceeding one month.
4. In the event of short-term pollution, one additional sample is to be taken to confirm that the incident has ended. This sample is not to be part of the set of bathing water quality data. If necessary to replace a disregarded sample, an additional sample is to be taken 7 days after the end of the short-term pollution.

The Member States should prepare bathing water profiles that will include:

- the description of the bathing water itself: expanse and physical environment, frequentation by bathers in time and space, leading to formal choice about bathing season duration, limits of the bathing water and location of the representative monitoring point-, and equipments for receiving public.

- a general description of the waterbody itself (in accordance with the WFD), inside which the bathing water is a “protected area”, and a general description of the neighbouring waters receiving point or diffuse discharges, from urban or rural activities, able to influence the quality of the bathing waters.

In addition the bathing water profile should provide information on the monitoring point that shall be indicated on a map showing the bathing water in an appropriate scale. It seems to be useful to combine the indication of the monitoring point with the delineation of the bathing water itself. Additionally, the point has to be indicated by its coordinates and their frame of reference, that is followed by the practical approach to the management of beaches.

In order to give information on the particular sharing of responsibilities between national and local authorities it seems to be useful to describe this issue in form of a text.

Accordingly, the competent authority for designation of the bathing water should be indicated. It should also be indicated how to get in contact with the competent authority. A telephone number and an e-mail address are required at least. For the public, a unique phone number and e-mail address at regional revel could be provided.

Then the presentation continued with the description of a template that summarises the information that must be considered when preparing the quality profiles. By studying well the template, it was evident that all information required by the Mediterranean guidelines related to the water profiles was included within, reassuring the countries that there will be no duplication of efforts, as both the Med guidelines and the EC Directive contain the same information required.

8. Presentation of the proposed and agreed Mediterranean Guidelines for bathing waters and water quality profiles

The recommendations for harmonization of the proposed guidelines and the methodology were presented. These were made along with the draft proposal based on WHO Guidelines in 2007, and were used for arriving to the final guidelines to be mentioned later on. The recommendations of the meeting held in 2007 in Athens, were the following regarding the criteria listed below and the bathing water profiles:

- The criteria for the classification given under the terms of sanitary inspection also require harmonisation because there is a high degree of subjectivity.

- If the meeting decides not to include classification criteria the problem of trying to avoid the subjectivity mentioned above will be solved by itself.

- Or, the following general rules should be applied:

  i) For bathing waters that have previously recorded elevated microorganism levels on any occasion, the rating should be at least low.
  ii) If there are potential sources of contamination identified, only bathing waters with no history of faecal contamination can have a negligible rating.
  iii) A risk of None can only be ascribed when there are no faecal sources and no history of contamination.
  iv) The unknown category is for bathing waters that have a history with some faecal contamination, but for which there is currently no explanation.

<u>Overall Risk Rating</u>

The overall risk rating should reflect the potential for faecal contamination of the bathing water. Usually, bathing waters should be rated according to their highest individual risk rating, given that bathing water quality is usually associated with one or at most two significant sources of faecal contamination. Any variation from this, leading to potential downgrading of the overall risk, would have to be accompanied by documented evidence for a reduced combined rating.

- A clear involvement of local authorities is needed for taking measures to prevent use of bathing areas of poor water quality. More detailed information of action taken during short-term pollution incidents and the identity and contact details of bodies responsible for taking such action is necessary across all countries.

- There is a need for standardising the method used for calculating the percentile. The probability density function with the formula to calculate the percentile provided in the new EU Directive (2006/7/EC) could be the common approach.

- The influence of the microbiological methods on the final results will also require harmonisation.

As a result, the below template was presented that included all the recommendations made in light of the already discussed and agreed criteria and standards.

AGREED CRITERIA AND STANDARDS FOR BATHING WATERS IN MEDITERRANEAN COUNTRIES

Microbial Water Quality Assessment Category
(based on intestinal enterococci (cfu/100 mL)

Category	**A**	**B**	**C**	***D***
Limit values	<100*	101-200*	185**	>185**(1)
Water quality	Excellent quality	Good quality	Sufficient	Poor quality/ Immediate Action

Minimum sampling frequency: at least one per month and not less than four in a bathing period including an initial one prior to the bathing period.

* 95th percentile intestinal enterococci/100 mL (applying the formula 95th Percentile = antilog (μ + 1,65 σ)

** 90th percentile intestinal enterococci/100 mL(90th Percentile= antilog (μ + 1,282 σ), μ=calculated arithmetic mean of the log10 values; σ= calculated standard deviation of the log10 values)

(1) For single sample immediate action should be carried out once the count for intestinal enterococci exceeds 500 cfu/100mL

- Reference method of analysis: ISO 7899-1 based on membrane filtration technique or any other approved technique
- Transitional period 5 years (starting by 1st January 2008)

Preparation of beach profiles (bathing water profiles)

- The beach profiles should be prepared following a standardized format so as to provide readily information that will be included in all countries beach profiles; a questionnaire like the one below and accepted by the participants should be filled in for all beach profiles.

- In addition a map (or a drawing) has to be included indicating the distance of the points that are worth to be mentioned including eventual sources of pollution etc. For the classification purposes, all the microbiological analyses for the last three years (bathing seasons) should be included.

PROPOSED QUESTIONNAIRE TO COLLECT DATA FOR THE BEACH PROFILE

GENERAL BATHING WATER PROFILE

General Information

Name of beach and bathing area:…….....……..

Location:.....Location on the map (grid reference):…...…

Latitude:…….. Longitude:……..

Length.....m wide.. .....m depth... .....m gradient.....cm

Average area …….m^2

Type of bathing area:
□ open □ confined □ natural □ lake □ estuarine □ marine

Type of bathing area: □ sand □ rocky □ pebble □grass other….....

Public facilities: No. of: Toilets..... Showers..... Litter bins.....

Maintenance of Public facilities: Toilets……Showers……Litter bins……

Is there in place any information system indicating water quality? □Yes □No

Are methods in place to warn the people of danger? □No
□Yes: □Flags □megaphones □ Digital panels □ other….....

Accessibility: □Road □Path □No access. Is there an adequate parking area?
□Yes □No

Beach usage: □ swimming □ sailing □ motor sports other….....……

Number of bathers at peak usage (e.g. Sunday)….....…….....

Are dogs or other animals present at the beach? □Yes Type..... Number..... □No
Water colour: □Transparent □No transparent □ brown green □reddish

Are there any algae present? □Yes Type..... Amount..... □No

Does the beach look clean? □Yes □No Specify type of dirt.....

Characteristics of surrounding area: (more than one category can be used)
□ urban □ residential □ industrial □ agricultural □ dunes
□ river mouth □ hills & mountains □ grassland other.....

Potential sources of contamination to be specified
□ Wastewater discharges □ River or stream discharge □ Other discharges
□ Other sources

Average water temperature: (during season) max/min.....

Prevailing wind (N/S/E/W):.....…….…….....

Prevailing current (N/S/E/W):…….....

Tidal amplitude:……..…….…….....

Distance between mean high and low water:…….....

Beach manager or contact in case of pollution incident:

Phone: ..... Mobile phone: …….. Fax: .....
e-mail: ……..

Address:.....

Organisation:.....

Management team at the bathing area
-.....
-.....
-.....
-.....

Laboratory where the water is analyzed: ……

Distance from beach to laboratory ……. km

Time of transport of samples ……min.

Discussion

Following the presentation of the Mediterranean guidelines, the meeting was asked to make comments on the contents of the guidelines. It was noted by the participants that in case of contamination and when the microbial quality of the seawater is poor, then immediate action should be taken, as for example when the Intestinal Enterococci count exceeds 500 cfu/100ml. This difference from the EU Directive, provides satisfactory ground for facing situations of accidental contamination that need to be resolved as soon as possible, to avoid any health risks to swimmers. It was agreed by all participants that this provision was very helpful and provides the essential guidance for immediate action and possible measures.

It was also mentioned by a participant that the quality and the risks that may arise from the beach sand were not dealt with in the guidelines, although bacteria, fungi, parasites and viruses have all been isolated from beach sand. The answer to this, was that the capacity of pathogens in beach sand to infect beach users remains undemonstrated according to the WHO guidelines for safe recreational water environments. Moreover, the real extend of their threat to public health is unknown. On the other hand, in order to avoid any health risks for the beach users, preventive measures such as education campaigns and management actions (guidance to use clean towels on the beach, good personal hygiene, prohibition of animals, regular mechanical cleaning), are important precautionary measures.

Another issue touched by a participant was referred to the laboratories that perform the microbiological analysis and their accreditation. It was clarified to the participants that accreditation is a matter of national legislation, however, in regular intervals an intercalibration exercise organized by WHO/MEDPOL provides useful information on the capacity of the individual laboratories to perform microbiological analyses. Actually, the last inercalibration exercise was held in 2009 and was coordinated by Prof. A. Mavridou. She kindly offered to present to the participants the results of a national intercalibration exercise regarding the detection of *E. coli* and the methodology followed, on the next day of the meeting.

A major point was made regarding the selection of only one indicator (intestinal enterococci) instead of two (with the addition of *E. coli*), that are included in the EC Directive. The answer given was that for marine waters, only intestinal enterococci (faecal streptococci) showed a dose–response relationship for both gastrointestinal illness and AFRI and that *E. coli* is intrinsically suitable for fresh waters but not for marine water according to WHO Guidelines (2003). The reason for using two indicators for the EU countries derives from the fact that the Directive is valid for both sea water and fresh water. Furthermore ISO methods for *E.coli* are not fully reliable and may produce many false positives. Prof. M. Figueras has dealt with the matter within the EPIBATHE project and she offered herself to present the results of this study to the participants on the next day.

Both proposals by Prof. Mavridou and Prof. Figueras were accepted by the participants with pleasure.

9. Presentation and evaluation of national case studies on bathing waters quality profile - Conclusions

A number of case studies on bathing waters quality profiles in Albania and Greece were presented to the participants (Annex III). The participants commented on each one of them by highlighting the major points needing further explanation or modification. Among them were the following:

- explanation to be provided on the positioning of the monitoring point, to be easily understood that it is a well representative point
- all points of interest should be indicated on the map, including potential sources of pollution (rivers, streams, marinas, tourist establishments, wastewater treatment plants, submarine outfalls, etc.)
- it is advisable to include information on the depth and length of the discharge submarine outfalls (whenever they exist), and provide enough proof for their potential or no effect to the bathers
- when there are more than one sampling points in one beach, it is advisable to evaluate the quality of the waters for the area that corresponds to each sampling point
- the preparation of water quality beach profiles should take into consideration the comments listed before, and all the points that are included in the template that accompanies the Mediterranean guidelines, as it was amended by the meeting (see Agenda item 14).

10. Discussion on the proposed criteria and standards to be adopted

Following the presentation of the draft criteria and standards which were prepared during the past meetings, a lively discussion revealed the need for further corrections to facilitate the application of the guidelines. At the end, it was unanimously agreed that the guidelines to be adopted by the Contracting parties should be those included in Agenda item 14, under conclusions and recommendations.

11. Health risks in coastal Mediterranean areas related to sanitation and seawater quality profiles

An effective way was presented on how to take preliminary measures in coastal areas, so as to avoid any risks to public health, by preparing an evaluation of health risks in coastal Mediterranean areas.

The method suggests that during a sanitary inspection, information should be gathered on a number of issues related to the bathing area, as follows:

a. Sewage outfalls, combined sewer overflow and storm water discharges. It is essential to know if there are sewage outfalls, their position in relation with the sampling point and if they are piped, their length, if they are properly calculated and how they are constructed. In the case of the presence of a sewage outfall, surface or submarine, information on the human faecal load that ends up into the sea and that can affect the quality of the coastal/bathing waters is necessary.

Stormwater discharges and combined sewer overflow which is the discharge of a combination of storm water and domestic waste as a result of the sewer capacity being exceeded during heavy storms have the capacity to affect the shoreline in cases of intense rainwater, however, the faecal pollution load is less contaminated, as it is diluted with the rainwater and occurs only in the rainy seasons.

Regarding sewage discharges or outfalls the following cases can be distinguished: (i) the discharge is directly onto the beach (above low water level in tidal areas), (ii) the discharge is through "short" outfalls into the water, but sewage-polluted water is likely to contaminate the recreational water area, and (iii) the discharge is through "long" outfalls, where the sewage is diluted and dispersed and the design criteria for the outfall should ensure that sewage does not pollute recreational water areas.

However, it should be taken into consideration that the processes of dispersion, dilution, sedimentation and pathogen's inactivation (through sunlight, predation, natural die-off, etc.), will lead to a certain degree of safety. Of equal importance is the degree of treatment applied to the wastewater before the discharge.

The bellow table summarizes the relative risk potential to human health through exposure to sewage through outfalls (including storm water run off and combined sewer outfalls).

	Discharge type		
Treatment	**Directly on beach**	**Sort outfall[a]**	**Effective outfall[b]**
None[c]	Very high	High	NA[d]
Preliminary	Very high	High	Low
Primary (including septic tanks)	Very high	High	Low
Secondary	High	High	Low
Secondary plus disinfection[e]	---	---	---
Tertiary	Moderate	Moderate	Very low
Tertiary plus disinfection[e]	---	---	---
Lagoons	High	High	Low

[a]The relative risk is modified by population size. Relative risk is increased for discharges from large populations and decreased for discharges from small populations.
[b]This assumes that the design capacity has not been exceeded and that climatic and oceanic extreme conditions are considered in the design objective (i.e., no sewage on the beach zone).
[c]Includes combined sewer overflows if active during the bathing season (a history of total non-discharge during the bathing season can be treated as "Low").
NA = not applicable
[e]Additional investigations recommended to account for the likely lack of prediction with faecal index organisms

b. Riverine discharges. It is also important to indicate whether there are riverine discharges onto the recreational coastal waters, or not. In the affirmative, an investigation should take place so as to identify if there are sewage discharges into the river, and their type of treatment if any. For a very rough estimation, if appropriate monitoring is difficult to define the pollution loads, the population size from the cities where the sewage originates can provide very useful information. Similar information is also usefull for the sewage outfalls mentioned before.

The below table summarizes the relative risk potential to human health through exposure to sewage through riverine flow and discharge:

	Treatment level				
Population and flow characteristics[a]	**None**	**Primary**	**Secondary**	**Secondary plus disinfection[b]**	**Lagoon**
High population with low river flow	Very high	Very high	High	---	Moderate
Low population with low river flow	Very high	High	Moderate	---	Moderate
Medium population with medium river flow	High	Moderate	Low	---	Low
High population with high river flow	High	Moderate	Low	---	Low
Low population with high river flow	High-	Moderate	Very low	---	Very low

[a] The population factor includes, in principle, all the population upstream from the recreational water environment

[b] Additional investigations recommended to account for the likely lack of prediction with faecal index organisms

c. Bather shedding. The number of bathers that visit the recreational water area during the bathing season is quite important for the estimation of risks to public health. This should always be combined with the geography of the coastal area that may influence the renovation or dilution at the bathing area (i.e. close bay or confined beach versus and open beach).

The bellow table summarizes the relative risk potential to human health through exposure to sewage from bathers:

Bather shedding	**Category**
High bather density, high dilution	Low
Low bather density, high dilution	Very low
High bather density, low dilution	Moderate
Low bather density, low dilution	Low

d. A number of additional issues should be considered when preparing health risks evaluation. This information is related to the duration and quantity of the eventual rainfalls; the speed and direction of the wind; the tides if applicable and the currents in the area under consideration, as well as the water release in special cases as for example in dam-controlled rivers. The coastal physiography will also add valuable information in the estimation of the risk potential.

The above described elements for the evaluation of health risks, emphasize the faecal contamination that is originated by humans. However, although of lesser importance, the faecal contamination from other sources should be regarded. Therefore, drainage from areas of animal pasture must be indicated, along with eventual intensive livestock rearing. The presence of gulls shows a faecal contamination originated by the faeces of these birds and not from human origin. Finally if the beach is also used by dogs or horses, eventual contamination is also to be considered. However, this practice should be totally discouraged or prohibited during the bathing season.

12. Presentation of a national Intercalibration Exercise in 2009 for the detection of *E. coli*

The issue of the method used for the detection of E.coli is addressed by many laboratories as the current reference method using membrane filtration indicated in the E.U. Directive creates a number of problems. Ten laboratories in Greece compared the performance of the reference method TTC Tergitol 7 Agar (with the additional test of β-glucuronidase production) with five alternative methods. The samples were prepared by spiking drinking water with sewage effluent following a standard protocol. Chlorinated and non-chlorinated samples were used. The statistical analysis was based on the mean relative difference of confirmed counts and was performed in line with ISO 17994. The results showed that in total, three of the alternative methods (Chromocult Coliform agar, Membrane Lauryl Sulfate agar and Trypton Bilex-glucuronidase medium) were not different from TTC Tergitol 7 agar (TTC Tergitol 7 agar vs Chromocult Coliform agar, 294 samples, mean RD% 5.55; vs MLSA, 302 samples, mean RD% 1; vs TBX, 297 samples, mean RD% -2.78). The other two alternative methods (Membrane Faecal coliform medium and Colilert 18/ Quantitray) gave significantly higher counts than TTC Tergitol 7 agar (TTC Tergitol 7 agar vs MFc, 303 samples, mean RD% 8.81; vs Colilert-18/ Quantitray, 76 samples, mean RD% 18.91). In other words, the alternative methods generated performance that was as reliable as, or even better than, the reference method. This study will help laboratories in Greece overcome culture and counting problems deriving from the EU reference method for E.coli counts in water samples.

The study has been published (Mavridou *et al.*, 2010), "Equivalency testing of TTC Tergitol 7 agar (ISO 9308-1:2000) with 5 culture media for the detection of E. coli in water samples in Greece Wat.Sci.Tech. 61:167-76".

13. Presentation of the results of the EPIBATHE project on *E. coli* indicator

The EPIBATHE Project hade been financed by the EU within VI Frame Work Research Programme as a project to support the new Bathing Water Directive (2006/7/EC), that in its Article 14 (a) indicated that "*The Commission shall, by 2008, submit a report to the European Parliament and to the Council on the results of an appropriate European epidemiological study conducted by the Commission in collaboration with Member States"*. The Project EPIBATHE entitled "Assessment of Human Health Effects Caused by Bathing Waters" began because there was insufficient epidemiological evidence from freshwater riverine (flowing water) studies and little appropriate data from Mediterranean waters. The Project included randomised controlled trial (RCT) epidemiological field studies performed in Hungary and in two Mediterranean bathing areas in Spain. The project involved randomisation of volunteer populations (ca. 2000 in each country) and self-reporting symptoms both pre-exposure and at one and three weeks post-exposure. In parallel to the exposure, water were taken every 20 minutes for the analysis of the indicators of faecal pollution of the EU Directive (*E. coli*, intestinal enterococci with both ISO methods, established at the EU Directive for each indicator in parallel) as well as for coliphages and viruses.

Results of the individual new epidemiological studies conducted in Hungary and Spain did not demonstrate a clear dose response relationship with indicators and no excess risk, confirming that the standards of the new Bathing Water Directive (2006) protect sufficiently public health. EPIBATHE also concluded that:

(i) enterococci remain the most useful indicator organism assessed in predicting disease in marine waters (with *E. coli* offering the most useful freshwater parameter for predicting the risk of illness),

(ii) marine waters produce approximately twice the risk of gastrointestinal disease transmission than fresh water,
(iii) EU thresholds appear reasonable in light of the new combined analysis.

The project evidenced important limitations of the microbiological methods included in the EU Directive for *E. coli* (ISO 9308-1 and 9308-3). The MF (ISO 9308-1) allows two alternative procedures the first is the standard test and uses lactose TTC agar with Tergitol-7 and requires a probabilistic confirmation of the colonies (at least 10). The second is the rapid test that use tryptone soya agar (4-5 h at 36 ± 2°C°C) after which a transplantation of the filter to tryptone bile agar (19-20 h at 44 ± 0.5°C) allows for confirming all the colonies that turn red after the addition of drops of the indole reagent (on the top of the colonies) as *E. coli*. Transplantation can be avoided if both media are included in the same Petri dish and a programmed incubation is used. The rapid test with the latter procedure was the one employed both in Hungary and Spain in the EPIBATHE Project. Results revealed that the ISO 9308-1 method which was designed for drinking water or treated waters is not useful for contaminated marine waters or fresh waters with many interfering microbes. The other method (ISO 9308-3) is a MPN method (designed in a 96 wells format) and enumerates *E. coli* on basis to their capacity to growth at 44 ± 0.5°C in tryptone, salicine triton and of hydrolysing 4-methylumbelliferyl-b-D-glucuronide being the reaction visualized by the emission of fluorescence by the wells in 36-72 h. It is worth mentioning that both the MF and MPN ISO methods can provide results for *E. coli* that can be equal or higher than the results obtained for faecal coliforms, because both methods involve less selective conditions that may favour the recovery of stressed *E.coli*.

While both MF and MPN ISO methods for intestinal enterococci (ISO7899-1 and ISO7899-2) provide quite similar results, this is not the case for *E. coli* where the ISO MPN method (ISO 9308-3) can provided quite higher results (>1 log) than the ISO MF (ISO 9308-1) in marine waters with very low levels of faecal pollution, measured by the mean (and range) of intestinal enterococci of 11 (2-36) cfu/100mL. This is due to enzymatic activity from other non-target bacteria (false positives) at low levels of the targeted bacteria or even by plant extracts and algae including diatoms. However, the MPN methods for intestinal enterococci and *E. coli* had been used for fresh recreational waters in another epidemiological study performed in Germany without finding the false positive reactions for *E. coli* mentioned above and found in the EPIBATHE study. All this data had been included in the WHO Guidelines for Safe Recreational Water Environments Meeting Report (WHO/SDE/WSH/04.09) that updated the 2003 Guidelines.

In the update of the WHO Guidelines it was also emphasized that intestinal enterococci and *E. coli* may not be useful in tropical waters due to potential growth in soils/sediments. In fact molecular methods have proved that *E. coli* can become “naturalized” in the environment and its presence does not necessarily indicate recent faecal pollution. In line of this its was also presented the phenomenon described as “blooms of faecal indicators” that had been attributed to the presence of organic carbon that favour the growth and can be there by preceding rain events, sewage outfalls or green algae, and that are also promoted by the stratification of the water influenced by the wind and water temperatures. In those studies it had been demonstrate that *E.coli* has the capacity to grow in the water and/or sediment at temperatures between 15 and 45 ºC, or that other interfering microbes like *Enterobacter cloacae* and *Citrobacter freundii* can produce this abnormal results.

Another important observation during the EPIBATHE project at a Mediterranean bathing area was the important temporal and spatial variations of water quality influenced by the change on wind sped during the morning (from 11h to 14h) of the trial. This was due to the fact that a faecally polluted rivulet was situated at ca. 150 meters south, and the wind changes moved the plume towards the bathing area. In this situation it was observed that the *in situ* measure of salinity could be an important predictor of this event, because it

inversely correlated with the indicators of faecal pollution (i.e. lower salinity was associated to higher concentration of indicators).

14. Conclusions and recommendations

- The Meeting concluded to approve the Mediterranean criteria and standards with a number of corrections and amendments that were made during the discussions. The final text to be used is the following:

CRITERIA AND STANDARDS FOR BATHING WATERS IN MEDITERRANEAN COUNTRIES

Microbial Water Quality Assessment Category
(based on Intestinal enterococci (cfu/100 mL)

Category	**A**	**B**	**C**	***D***
Limit values	<100*	101-200*	185**	>185**(1)
Water quality	Excellent quality	Good quality	Sufficient	Poor quality/ Immediate Action

Minimum sampling frequency: at least one per month and not less than four in a bathing period including an initial one prior to the start of the bathing period.

* 95th percentile intestinal enterococci/100 mL (applying the formula 95th Percentile = antilog (μ + 1,65 σ)

** 90th percentile intestinal enterococci/100 mL (90th Percentile=antilog (μ + 1,282 σ), μ=calculated arithmetic mean of the log10 values; σ= calculated standard deviation of the log10 values.

(1) For single sample immediate action is recommended to be carried out once the count for IE exceeds 500 cfu/100 mL

- For classification purposes at least 12 sample results are needed spread over 3-4 bathing seasons
- Reference method of analysis: ISO 7899-1 based on membrane filtration technique or any other approved technique
- Transitional period 4 years (starting by 1st January 2012)

PREPARATION OF BEACH PROFILES (BATHING WATER PROFILES)

Beach profiles should be prepared following a standardized format similar to that provided here below, a copy of which should be displayed for public information on the beach.

In addition, a map has to be included with the sampling points, sources of pollution, facilities and any other relevant information. The classification of the beach as described in the table above should also be included.

Standardized format: GENERAL BATHING WATER PROFILE

General Information

Name of beach and bathing area:…….....……..

Location:.....Location on the map (grid reference):…...…

Latitude:…….. Longitude:……..

Length.....m wide.. .....m depth... .....m gradient.....cm

Type of bathing area:
□ open □ confined □ natural □ lake □ estuarine □ marine

Type of bathing area: □ sand □ rocky □ pebble □grass other….....

Public facilities: No. of: Toilets..... Showers..... Litter bins.....

Is there in place any information system indicating water quality? □Yes □No

Are methods in place to warn the people of danger? □No
□Yes: □Flags □megaphones □ Digital panels □ other….....

Accessibility: □Road □Path □No access. Is there an adequate parking area? □Yes □No

Beach usage: □ swimming □ sailing □ motor sports other….....……

Number of bathers at peak usage (e.g. Sunday)….....…….....

Are dogs or other animals present at the beach? □Yes Type..... Number..... □No

Water colour: □Transparent □Not transparent □ brown green □reddish

Are there any algae present? □Yes Type..... Amount..... □No

Does the beach look clean? □Yes □No Specify type of dirt.....

Characteristics of surrounding area: (more than one category can be used)
□ urban □ residential □ industrial □ agricultural □ dunes
□ river mouth □ hills & mountains □ grassland other.....

Potential sources of contamination to be specified
□ Wastewater discharges □ River or stream discharge □ Other discharges
□ Other sources

Average water temperature: (during season) max/min.....

Prevailing wind (N/S/E/W):.....…….....

Prevailing current (N/S/E/W):…….....

Distance between mean high and low water:…….....
Beach manager or contact in case of pollution incident:

Phone: ..... Mobile phone: …….. Fax: .....
e-mail: ……..

Address:.....

Organisation:.....

Management team at the bathing area
-.....
-.....
-.....
-.....

- The Meeting also recommended MED POL to present the above criteria and standards to the MED POL Focal Points meeting in 2011, with a view to be agreed and approved by all countries, and to be further presented for adoption at the meeting of the Contracting Parties to the Barcelona Convention, to be held at the end of 2011.

- In parallel, capacity building activities should be encouraged, including training courses of short duration. Particularly, evaluation and analysis results of bathing waters could also be included, as the interpretation of the results requires experienced and skilful personnel.

- Two countries, namely Lebanon and Turkey, expressed their interest in undertaking pilot studies for the preparation of bathing waters quality profiles, with the assistance of WHO/MED POL.

15. Marine Litter

As the issue of marine litter is quite linked with bathing waters and beach profiles and following a number of activities that are ongoing in the Mediterranean context, starting with the EU countries, a brief overview regarding the activities related to marine litter was introduced.

Marine litter has been an issue of concern in the Mediterranean since 1970.

The Mediterranean countries adopted the Convention for the Protection of the Mediterranean Sea against Pollution (the Barcelona Convention) in 1976. Within the framework of this Convention the Mediterranean countries adopted in 1980 a Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources. In the Protocol the importance of dealing with the problem of marine litter is recognized. In Annex I of the Protocol, marine litter is defined as "Persistent synthetic materials which may float, sink or remain in suspension and which may interfere with any legitimate use of the sea". The Protocol was amended in 1996. Protocol Annex I defines as one of the categories of substances "Litter as any persistent manufactured or processed solid material which is discarded, disposed of, or abandoned in the marine and coastal environment".

UNEP/MAP, jointly with IOC and FAO, recognizing the lack of information on marine and coastal litter in the Mediterranean, convened in 1987 an *ad hoc* meeting on persistent materials (UNEP/IOC/FAO, 1991). The meeting recommended that a pilot survey be initiated in selected Mediterranean areas. The pilot survey was organized in 1988 by UNEP/MAP, in

cooperation with IOC and FAO, with five participating countries: Cyprus, Israel, Italy, Spain and Turkey. Results of the survey were reviewed at the IOC/FAO/UNEP Review Meeting on the persistent synthetic materials pilot survey, which was held in 1989. This pilot survey is considered as a landmark activity for the assessment of coastal and marine litter in the Mediterranean.

A Comprehensive Bibliography on Marine Litter containing 440 references and an Assessment of the State of Pollution of the Mediterranean Sea by Persistent Synthetic Materials, which can Float, Sink or Remain in Suspension were published by UNEP/MAP in 1991 (MAP/UNEP, 1991).

The Eleventh Meeting of the Contracting Parties to the Convention for the Protection of the Mediterranean Sea against Pollution and its Protocols, 1999, asked the Secretariat to begin action on coastal and marine litter and to prepare a relevant assessment. It also decided to include a budget line for the assessment of pollution of the Mediterranean Sea by litter.

Following the decision by the Contracting Parties, a Consultation Meeting on Marine and Coastal Wastes in the Mediterranean was held in 1999 and several documents were prepared. The meeting outlined a project on Marine and Coastal Litter Management, to be implemented in five phases. A general Questionnaire about Litter Management in Coastal Zones of the Mediterranean was sent to Mediterranean countries and the answers were analyzed. The results of the assessment (MAP/UNEP, 2001) showed that the main sources of coastal litter in the region are river runoff, tourist activities and coastal urban centers. This result indicates that it is the inadequate management of coastal solid waste that is responsible for the presence of litter on the beaches, floating in the water and on the sea bed. In addition to the above mentioned results, almost all the Mediterranean countries have policies for the management of coastal solid waste but the enforcement of the policies is weak because of the poor coordination between different national and local administrations dealing with solid waste issues. However, only few countries have policies related specifically to marine litter. Local administration and municipalities are the ultimate responsible for the management of coastal litter in the region. The role of the Ministry of environment is limited to the control aspects.

Based on these facts, MEDPOL built up a strategy to assist coastal local authorities to improve the management of coastal solid waste and prevent the introduction of litter into the marine environment. Along this line, MEDPOL implemented in 2004-2005, with the cooperation of RAMOGE and UNADEP, a pilot project at the Municipality of Tripoli, Lebanon in which direct technical and legal assistance has been provided together with a public awareness campaign (MAP/UNEP, 2004). A national replication strategy has been, as well, developed and agreed upon by all Lebanese coastal municipalities.

In 2003, UNEP/MAP, in cooperation with WHO, prepared Guidelines for Management of Coastal Litter for the Mediterranean Region. These guidelines (MAP/UNEP/MED POL, 2004) were prepared within the framework of the Strategic Action Programme (SAP) for the Mediterranean and are intended to help the responsible authorities, planners and field operators to place their national and regional development strategies within a context, which will allow them to protect the Mediterranean environment as best possible.

The Mediterranean Action Plan of UNEP with the support of the Regional Seas Programme of UNEP in 2006 developed a medium-term public awareness and education campaign on the management of marine litter in the Mediterranean with the overall objective to contribute to the protection of the environment and the sustainable development of the Mediterranean. UNEP/MAP opted to work with partner NGOs of the region, namely the Mediterranean Information Office for Environment, Culture and Sustainable Development (MIO-ECSDE), the Hellenic Marine Environment Protection Association (HELMEPA) and

Clean Up Greece - Environmental Organisation, in the context of a project entitled “Keep the Mediterranean Litter-free Campaign” carried out by the three partner organizations with the support of UNEP/MAP. The outcome of the project was a brochure produced in 11 Mediterranean languages, a series of awareness events and clean-ups and a publication which is a proposal of MIO-ECSDE, HELMEPA and Clean Up Greece to UNEP/MAP for a common regional approach on how to raise awareness and appropriately educate about marine litter with implementation at national and local level (Clean Up Greece/HELMPEPA/MIO-ECSDE, 2007). The latter has been developed for the general public as well as for all other stakeholders such as the maritime industry, the tourism sector, agriculture, regional and national authorities, NGOs, the media, etc.

An assessment on the state of pollution by marine litter in the Mediterranean sea was conducted in 2008 in order to define the magnitude of the problem and update the national institutional framework.

A Regional Strategy for the Sustainable Management of Marine Litter in the Mediterranean, as a follow-up of the previous assessment of the Mediterranean situation was prepared in 2009, which is going to be coupled with a financial evaluation of its implementation (under preparation)

Prof. M. Figueras has dealt with the matter of Marine Litter and she offered herself to present the results to the participants and the proposal was accepted with pleasure. She presented an overview of the Catalan Monitoring Programme for the Prevention and Cleaning of Coastal Areas, developed since 2000 by the Catalan Agency of Water in collaboration with the University Rovira and Virgili. Within this programme developed from June to September one aeroplane supervised the Catalan coast and 11 pelican boats, and 33 beach boats undertook the cleaning of any floating litter in order to prevent its arrival at the bathing areas. The aerial supervision provided information that could guide the boat activities, and also provided important information about the extent of phytoplankton blooms, amount of light oils, lines of scum that float in the sea earlier in the morning and revealed malfunctioning or leaking in long sea outfalls. The main conclusion of the monitoring is that the prevailing encountered and collected marine litter correspond to plastics, human made wood, and rest of plants i.e. reed or stalks, the latter after big storms. All this marine litter originates in land, in agreement with the results presented of the studies performed within MED POL. Furthermore, the impact of fishing activities it has been well evidenced trough the collection of nets, wood fish boxes and collection of dead fish as results of the selection carried out which leads to discard fish that are not commercially useful. This aspect is important because sometimes the quantities of these fish are considerable and those may reach the shoreline where bathers may think that their death is due to contamination.

16. Closure of the meeting

Dr. Kamizoulis thanked the participants for their active participation during the Meeting and for their positive and constructive comments and suggestions on the proposed draft criteria. In formally closing the Meeting, Mr . Bonnici, also thanked the participants and expressed his gratitude to the MEDU office for hosting the meeting in Athens and for their kind hospitality.

ANNEX I

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ANNEX II

AGENDA

1. Opening of the Meeting
2. Scope and Purpose of the Meeting
3. Election of Officers
4. Adoption of the Agenda and organization of the Meeting
5. Brief history of the preparation of the proposed criteria and standards
6. Presentation of the WHO guidelines on safe recreational water environments
7. Presentation of the EC Directive on Bathing Waters
8. Presentation of the proposed and agreed Mediterranean Guidelines for bathing waters and water quality profiles
9. Presentation and evaluation of national case studies on bathing waters quality profile – Conclusions
10. Discussion on the proposed criteria and standards to be adopted
11. Health risks in coastal Mediterranean areas related to sanitation and seawater quality profiles
12. Presentation of a national Intercalibration Exercise in 2009 for the detection of *E. coli*
13. Presentation of the results of the EPIBATHE project on *E. coli* indicator
14. Conclusions and recommendations
15. Marine Litter
16. Closure of the meeting

ANNEX III

CASE STUDIES OF BATHING WATER QUALITY PROFILES FROM GREECE AND ALBANIA

Bathing Profiles for Greek Beaches

According to the new Directive 7/2006/EC and guidelines of WHO

Kamares Beach, Sifnos

March 2010

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General information

1.1 ID and Name of bathing water

- *Bathing water name:* Kamares
- *Bathing water ID:* GR4220180182180101

1.2 River Basin District

- *River Basin District Name:* Aegean Islands
- *River Basin District ID :* GR14

1.3 Water Body

- *Water Body Name Y.Σ:* Sifnos coast
- *Water Body ID :* GR001400010069N
- *Ecological status of waterbody in relation to eutrophication:* Not in danger of eutrophication

1.4 Bathing Profile

- *Name/I.D:* 1
- *Date of last review of BP:* 1st issue 2010

1.5 Monitoring point

- *Coordinates / Frame of reference:* 5287862,63017 X, 1304292,1863 Y/ETRS
- *Description of monitoring point:* Center of the beach

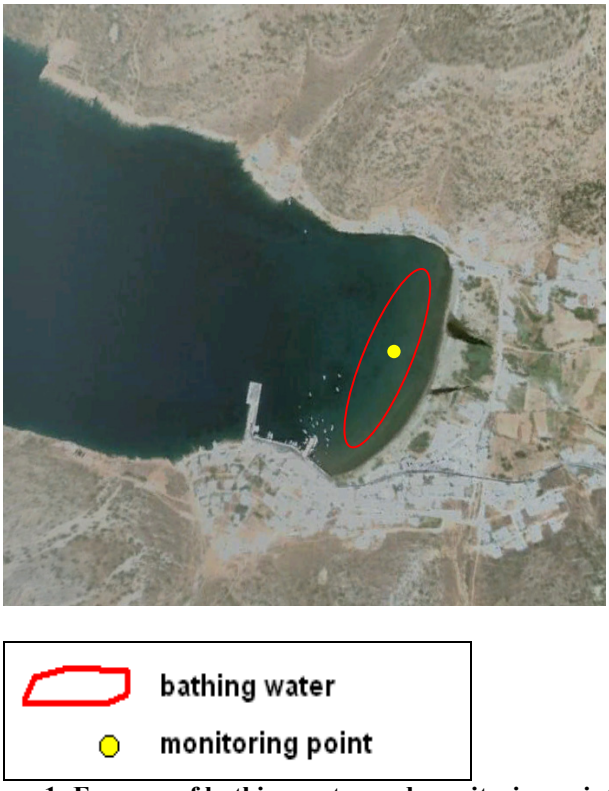

Figure 1: Expanse of bathing water and monitoring point

1.6 Competent authority

- *National competent authority:*Central Water Agency Ministry of Environment
- *Local competent authority:* Sifnos municipality
- *Contact information*: Tel: +3022840 31345, email: info@sifnos.gr

1.7 Localisation

- *State:* Greece
- *Province:* South Aegean
- *Municipality:* Sifnos municipality
- *Secondary municipality:*Apollonia
- *Coastal area:* Kamares- Agia Marina

1.8 Land use

Kamares bay is situated on the north east side of Sifnos island, between the mountains of Agios Simeron (on the northern part) and Profitils Ilias (on the southern part), which is the highest mountain on the island with an altitude of +680.00m. The wider area is residential with intense touristic activity and limited natural vegetation. The main activities in the immediate area include the main port of the island in Kamares which accommodates the main sea travel ferries as well as small fishing and leisure boats, an expanse of irrigated farm land and the settlements of Kamares and Agia Marina on the north and south part of the bay correspondingly. A significant non-professional fishing activity is recorded in the bay of Kamares with small fishing boats. The wider area is included in the list of Protected Areas Natura 2000 (GR4220008), while the island of Sifnos has been characterized as an Area of Natural Beauty. Access to the beach is done via the coastal road.

Figure 2: Activities in Kamares bay (source: Network of Sustainable Islands «DAPHNE»)

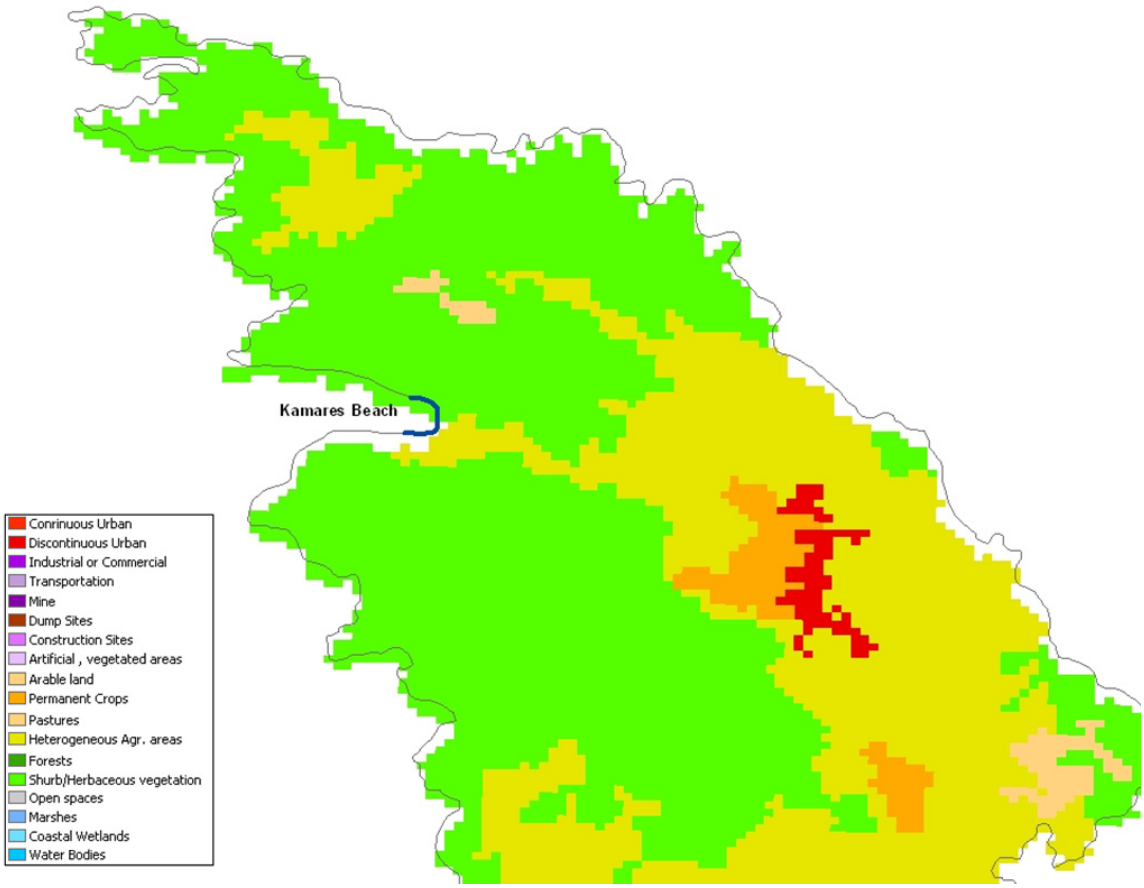

Figure 3: The land-use of the surrounding area of Kamares

2. Physical, geographical, & hydrological characteristics of the bathing water

2.1 Physical - geographical characteristics

- *Type of bathing water*: Coastal Water
- *Description of the beach:* The beach of Kamares is situated between the settlements of Kamares and Agia Marina. The riparian zone and the sea bottom are sandy with a fine golden sand. The riparian zone is natural with scattered plants (almirikia) The length of the beach is approximately 500m and the average beach width is 10m. The orientation of the beach is north west. The depth of the water is small with a smooth inclination of the bottom of the sea. The beach is organized and includes sanitary facilities and toilets, litter bins, ombrellas, and a canteen, all located at the southern part. The beach is cleaned periodically during the bathing season (May - October). The south part of the bay is occupied by the local harbour. Driving, dumping and camping are not allowed on the beach.
- *Maximum number of bathers:* The maximum number of bather is estimated at 1000 bathers/day.

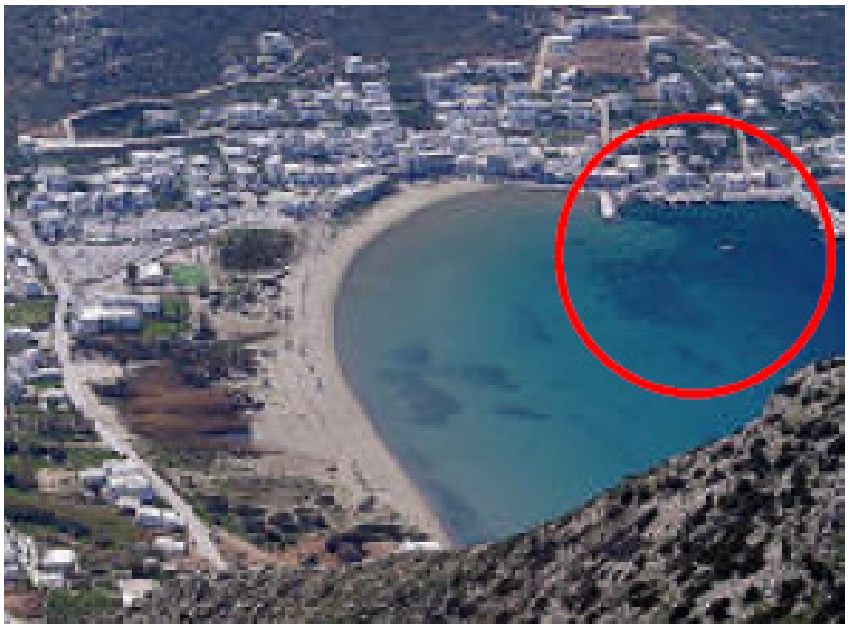

Figure 4: Kamares bay- local harbour

Figure 5: SW part of Kamares Beach

Figure 6: Central part of Kamares beach

2.2 Hydrolocial - metereolocial characteristics

Although the summers in the Aegean islands are long and dry, rainfall in the island of Sifnos tends to be scarce but with great intensity. Table 1 shows the mean monthly precipitation data of the closest meteorological station which is located in the island of Naxos (approximately 60km east of Sifnos) of the past 77 years (1931-2008). The month with the higher precipitation is January, while June and July show the lowest precipitation.

	Jan	Feb	March	April	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
mm	70,5	55,1	47,6	19,1	11,0	5,0	7,5	9,9	13,7	36,6	53,7	69,9

Source: Hellenic National Metereological Service

The following diagram shows the prevailing wind directions. The prevailing wind direction is north, followed by north east and south. The winds are of small of medium intense with the force of 77% of winds to be of lower than 5beaufort. It is noted that Kamares bay, because of it's orientation (NW) is protected by winds, except the winds with a west direction, which occur rarely on the island (1% frequency)of the total wind, and therefore the the sea is usually calm. No intense currents or tide are observed. .

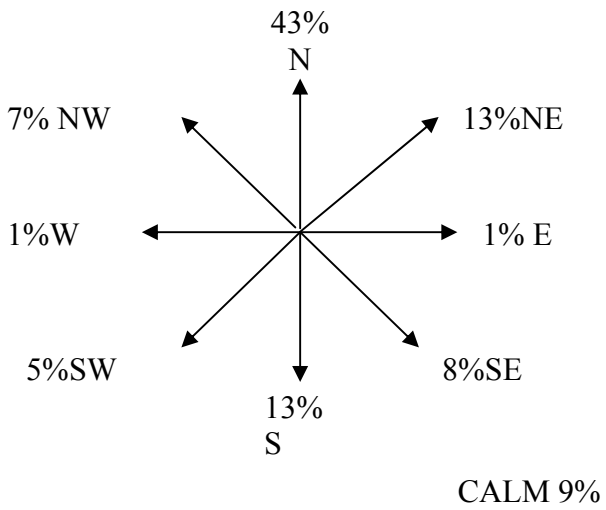

Figure 7: Annual frequency of wind direction

2.3 Chemical characteristics - Beach classification

The classification of the beach has been performed within the frame of Directive 73/160, according to which the microbial water quality for the year 2009 corresponds to the GI category and the physico-chemical quality to the A category. The classification was made based on the results from 6 samples during the period May - October 2009. Kamares beach has been awarded with the 'Blue Flag' ever since 2002.

3. Identification and assessment of causes of pollution

3.1 Point source pollution

After the sanitary inspection, no illegal inlets entering the sea were recorded. The South part of the beach includes some restaurants and coffee shops as well as a camping facility which is served by the local sewage network. Pets are allowed at the beach but their number and frequency of presence does not pose a risk for pollution . No animal faeces were detected on the beach during the inspection.

The Wastewater Treatment Plant of Kamares has been design to accommodate 2500 P.E and serves the whole settlement of Kamares. The treatment includes secondary treatment and disinfection and the treated sewage are disposed in the seas through an underwater pipe. No pollution risk results from the normal operation of the WWTP.

Kamares harbour serves the ferries that approach the west side of the pier at the south part of the bay and the private (leisure) boats that are stationed at a distance of approximately 50m from the bathing area. The major potential pollution source has to do with small releases of sewage effluents from the leisure boats and small fishing boats.

The only industrial plant in the wider area is a desalination unit that has been operating since 2002, using brackish drilling water. The units treats 500-550m^3/d, with reverse osmosis and the use of chemicals, and the produced brine (250m^3/d) is disposed of in the sea. The disposal of brine waste in the sea contains a risk for the sea fauna and flora, therefore it is essential to monitor the quantity discharged as well as the appropriate bioindicators. In case were adverse effects are observed the consideration of alternative solutions (i.e evaporation to dryness and transport to dumping site) should be taken into account.

3.2 Non point source pollution

The major non point source pollution sources include releases from private septic tanks of Agia Marina settlement, on the north part of Kamares bay. The population of Agia Marina according to the National Statictics Service was 49 (2001 sensus). Due to the small size of the settlement there is no risk for sea water pollution from these sources. Other non point sources pollution include the grassland and cultivated areas that are not intense therefore are not considered to be significant.

3.3 Other sources - Sanitary inspection results

During the visual inspection of the beach no pollution of tarry residues, glass, plastic, rubber or any other waste was detected. The water was transparent and clear.

3.4 Assessment of the effect of extreme circumstances

Based on the available meterological data concerning the precipitation and the wind direction , during the bathing season no extreme weather events are recorded. No effects from heavy rain, rough sea or increased stormwater discharges are anticipated.

In case of failure of the WWTP, a short-scale pollution of the sea is expected due to the discharge of untreated urban wastewater, carrying a microbial load of 10^{-7}EColi and nutrient concentrations of the scale of 50 και 12 mg/l for Total Nitrogen and Total Phosphorus correspondingly. Due to the dispersion of the wastewater via the disposal system (underwater pipe and diffusers) and the removal of bacteria by natural effect of UV rays, biological competition, and osmotic shock there is no significant health hazard from the short failure of the plant. No effects are anticipated regarding the presence of microbial pollution, the transparency of the sea or the dissolved oxygene concentration of the bathing water as long as the dispolasl of untreated wastes is limited to a short time frame. All the necessary measures should be taken to resume the correct operation of the plant as fast as possible, under the responsibility of the Municipality Technical Service.

4. Assessment of the potential of eutrophication (proliferation of cyanobacteria , macroalgae, phytoplangton)

The possible nutrient sources include agriculture runoff and runoff from the private septic tanks of Agia Marina settlement. The physical conditions of the beach (small depth of the water and practical absence of winds) are considered to be factors in favor of the phenomenon of eutrophication. The visual observations yielded no algae growth apart from small settlements of poseidonia sea plant, while the increased transparency and clearness fo the water is associated with low phytoplangton concentrations. Historically, the phenomenon of eutrophication has never been recorded in the area. Although data on dissolved oxygene, nutrient or chlorophyl concentrations were not available for Kamares beach, in the whole area of south agean low nutrient concentrations have been recorded therefore, no risk for eutrophication is anticipated.

5. Conclusion

The microbial parameters that were monitored in Kamares beach (TC, FC, FS) and the visual parameters were all below the Guide values of Directive 76/160. The visual inspection yielded no significant pressures and no ‘extreme circumstances’ are anticipated that could lead to the sea water deterioration, based on current data.

Bathing Profiles for Greek Beaches

According to the new Directive 7/2006/EC and guidelines of WHO

Brexisa Beach, Nea Makri

March 2010

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4. ASSESSMENT OF THE POTENTIAL OF EUTROPHICATION (PROLIFERATION OF CYANOBACTERIA , MACROALGAE, PHYTOPLANGTON) 9

General information

1.1 ID and Name of bathing water

- *Bathing water name:* Brexisa beach
- *Bathing water ID:* GR30006501A2170501

1.2 River Basin District

- *River Basin District Name:* Attiki
- *River Basin District ID :* GR06

1.3 Water Body

- *Water Body Name Y.Σ:*Coast of Petalion golf - Rafina
- *Water Body ID :* GR000600010002N
- *Ecological status of waterbody in relation to eutrophication:* Not in danger of eutrophication

1.4 Bathing Profile

- *Name/I.D: 1*
- *Date of last review of BP: 1st issue* 2010

1.5 Monitoring point

- *Coordinates / Frame of reference:* 5204442,228 X, 1412218,77145 Y /ETRS
- *Description of monitoring point:* Center of the beach

Figure 1: Expanse of bathing water and monitoring point

1.6 Competent authority

- *National competent authority:* Central Water Agency Ministry of Environment
- *Local competent authority:* Nea Makri municipality
- *Contact information*: Tel: +3022943 20500, email: info@neamakri.gr

1.7 Localisation

- *State:* Greece
- *Province:* Attiki
- *Municipality:* Nea Makri municipality
- *Coastal area:* Brexisa

1.8 Land use

Brexisa beach is situated at the North Eastern part of Attiki region near the settlement of Nea Makri and is part of the long shoreline that extends from Nea Makri to Schinias bay with a total length of more than 10km. The wider area is residential with wide agriculture areas and limited natural vegetation. It's main land uses include scattered greenhouses, the former American Military Base that used to hold an airport area facility and now houses the fire brigade, public services as well as a sports and cultural center while restaurants, hotels and tavernas are scattered in the shoreline. The area of Brexisa used to be a swamp area up until the middle of the 20th century when it was drained. The area is adjacent to Brexisa archeological place were it takes it's name from.

Since the mid nineties a part of the area of the former American Military Base was used as a dumping site of inert material but after significant complains from residents and user of the area this was stopped.

Other surface waters in the area include the Brexisa wetland and the Rockfeller stream. In 2001, works against stormwater events were made that included the configuration of the former American Military Base trench that ends up at the north side of the beach (Images 1, 2 ,3, 4. During spring and summer there are sea turtles in the stream. Access to the beach is done via the coastal road.

Figure 2: Storm water Trench at the left side of the beach

Figure 3: Stormwater trench outlet in Brexisa beach

Figure 4: Stormwater trench

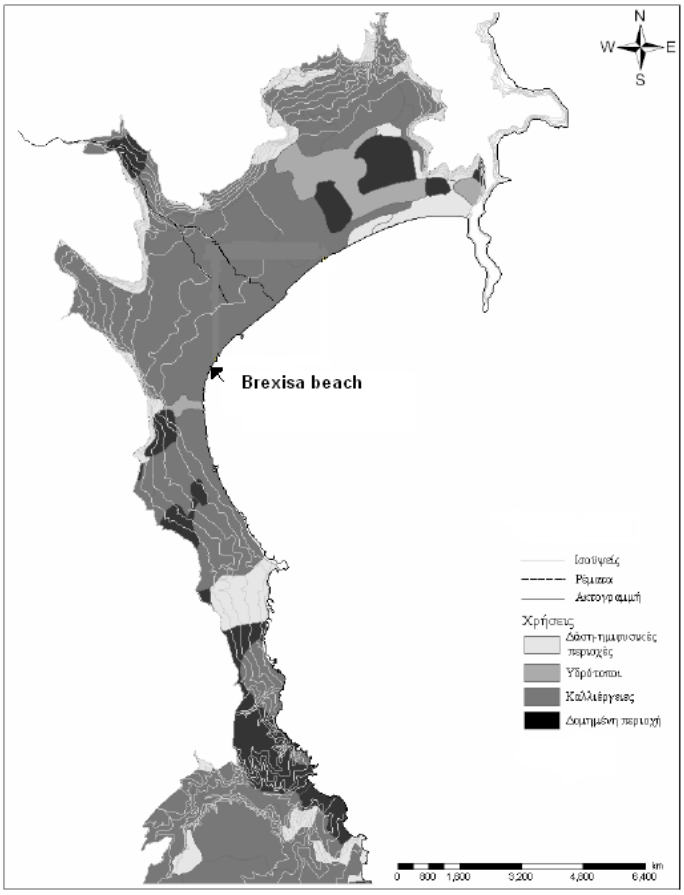


Figure 5: Land Use in the area of Nea Makri and Marathonas source: Hellenic Military Geographical Service

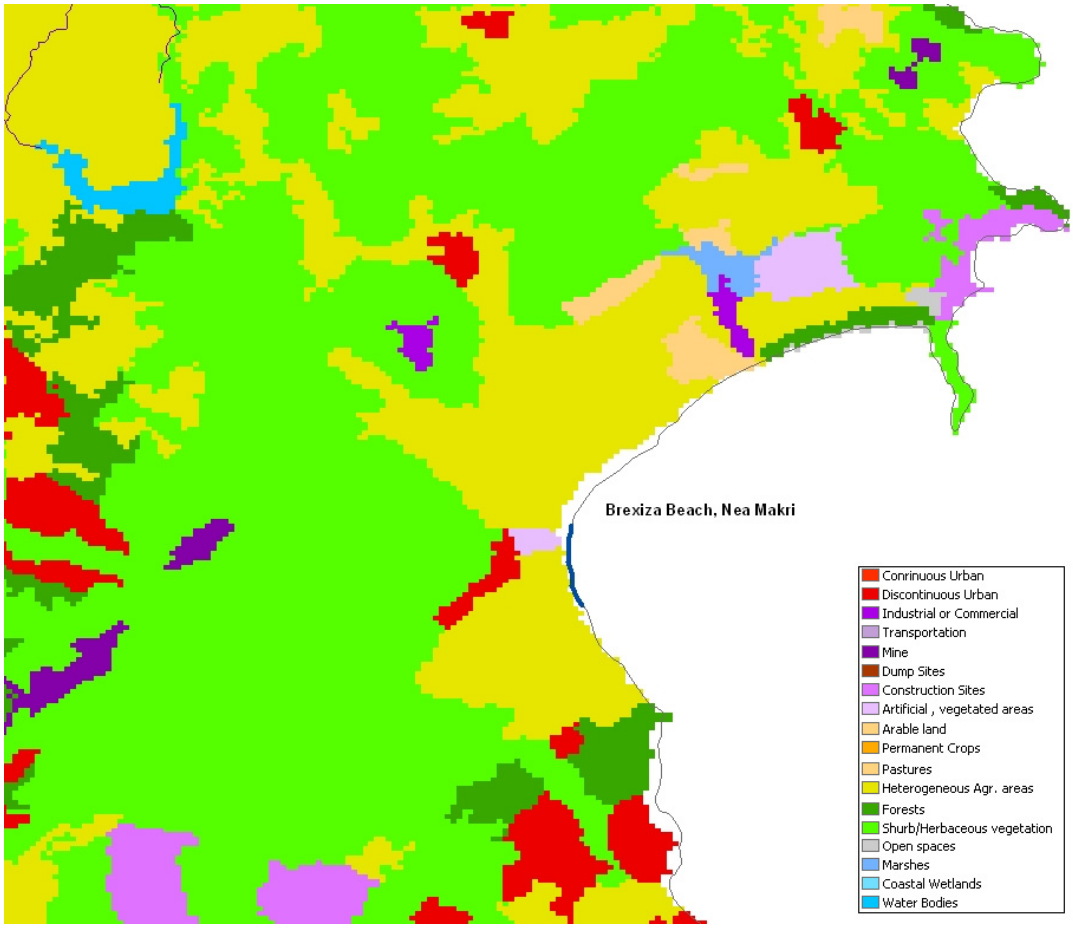


Figure 6: Land Use in the area of Nea Makri and Marathonas, from Corine2000

2. Physical, geographical, & hydrological characteristics of the bathing water

2.1 Physical - geographical characteristics

- *Type of bathing water*: Coastal Water
- *Description of the beach:* The beach of Brexisa is situated near the settlements of Nea Makri The coastal zone is sandy with a fine golden sand while the sea bottom is also sandy with occasionally scattered rocks. The coastal zone is modified, with the planting of pine trees and a wide zone of grass while a pedestrian/cyclist road has been constructed along the beach. The length of the beach is approximately 600m and the average beach width is 30m of sand plus 20m of grass and pine trees. The orientation of the beach is north east. The depth of the water is small with a smooth inclination of the bottom of the sea. The beach is organized and includes sanitary facilities and chemical toilets, litter bins, umbrellas, a canteen and a lifeguard observatory. The beach is cleaned periodically during the bathing season (May - October). Driving, dumping and camping are not allowed on the beach.

- *Maximum number of bathers:* The maximum number of bather is estimated at 1000 bather/day.

Figure 7: Brexiza Beach

2.2 Hydrological - meteorological characteristics

According to the data by the closest meteorological station of the Hellenic National Meteorological Service, in Marathonas for the time frame 1925-1995, the annual precipitation is 567mm, the maximum precipitation being recorded for the month of December while the summer months are usually dry (May-August). Maximum water temperature at the surface is about 26°C during the bathing season and usually does not go under the 17°C within the water column. The prevailing wind direction is north, followed by north east. No intense currents or tide are observed. .

2.3 Chemical characteristics - Beach classification

The classification of the beach has been performed within the frame of Directive 73/160, according to which the microbial water quality for the year 2009 corresponds to the GI category and the physico-chemical quality to the A category. The classification was made based on the results from 17 samples during the period May - October 2009. Brexisa beach has been awarded with the 'Blue Flag' ever since 2001.

3. Identification and assessment of causes of pollution

3.1 Point source pollution

After the sanitary inspection, no illegal inlets entering the sea were recorded within the limits of the bathing area. The main potential point source of pollution is the outlet of the former American Military Base trench at the north side of the beach (Images 1, 2, 3, 4).

Pets are allowed at the beach but their number and frequency of presence does not pose a risk for pollution. No animal feces were detected on the beach during the inspection.

3.2 Non point source pollution

The major non point source pollution sources include releases from private septic tanks of Nea Makri settlement. The population of Nea Makri municipality according to the National Statistics Service was 14809 (2001 census). It is stressed that the whole population of Nea Makri is served by private septic tanks that cause a potential threat to the underwater aquifers as well as Brexisa and the surrounding beaches.

Other non point sources of pollution include the grassland and cultivated areas that are not intense therefore are not considered to be significant.

3.3 Other sources - Sanitary inspection results

During the visual inspection of the beach no pollution of tarry residues, glass, plastic, rubber or any other waste was detected. The water was transparent and clear.

3.4 Assessment of the effect of extreme circumstances

Based on the available meteorological data concerning the precipitation and the wind direction, during the bathing season no extreme weather events are recorded. No effects from heavy rain, rough sea or increased stormwater discharges are anticipated. In an occasion of high precipitation, it is expected that the runoff in the sea will bring pollution into the waters via the stormwater trench outlet.

No effects are anticipated regarding the presence of microbial pollution, the transparency of the sea or the dissolved oxygen concentration of the bathing water as long as the disposal of untreated wastewater is limited to a short time frame. All the necessary measures should be taken to resume the correct operation of the plant as fast as possible, under the responsibility of the Municipality Technical Service.

4. Assessment of the potential of eutrophication (proliferation of cyanobacteria , macroalgae, phytoplangton)

The possible nutrient sources include agriculture runoff and runoff from the private septic tanks of Nea Makri. The physical conditions of the beach (small depth of the water and practical absence of winds) are considered to be factors in favor of the phenomenon of eutrophication. The visual observations yielded no algae growth apart from small settlements of poseidonia sea plant, while the increased transparency and clearness of the water is associated with low phytoplankton concentrations. Historically, the phenomenon of eutrophication has never been recorded in the area. Although data on dissolved oxygen, nutrient or chlorophyll concentrations were not available for Brexisa beach, low risk for eutrophication is anticipated due to the water conditions and beach profile.

5. Conclusion

The microbial parameters that were monitored in Brexisa beach (TC, FC, FS) and the visual parameters were all below the Guide values of Directive 76/160. Two major sources of pollution were identified:

- The private septic tanks that serve the large municipality of Nea Makri and cause o potential threat to the underwater aquifiers as well as to Brexisa and the surrounding beaches.
- The former American military base trench outlet at the north side of the beach that, in case of extreme rain events, can carry significant pollution load in the sea.

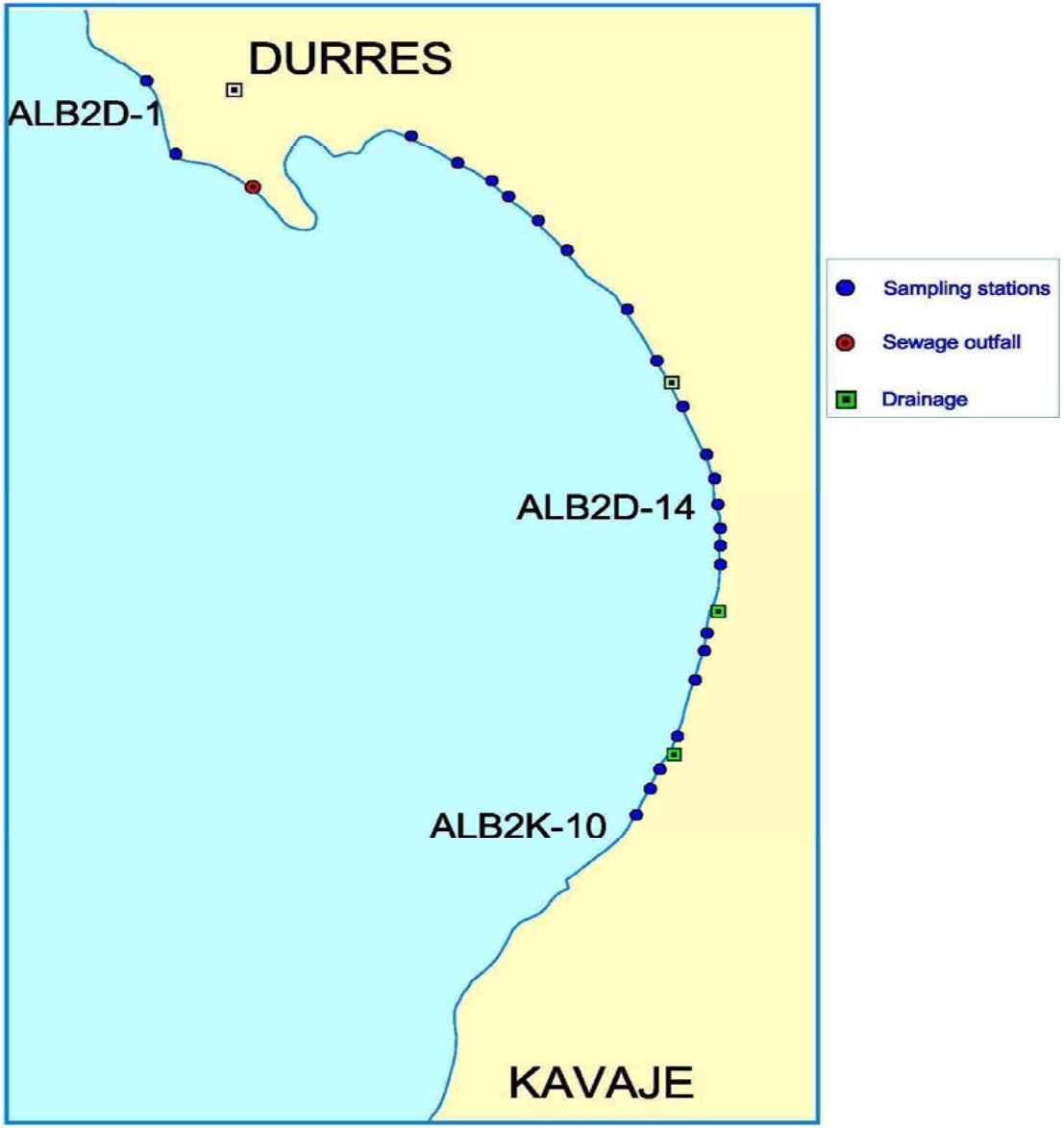
Bathing Profiles for Albanian Beaches

Durresi

Beach

ALBANIA - Durresi, Kavaja Beaches

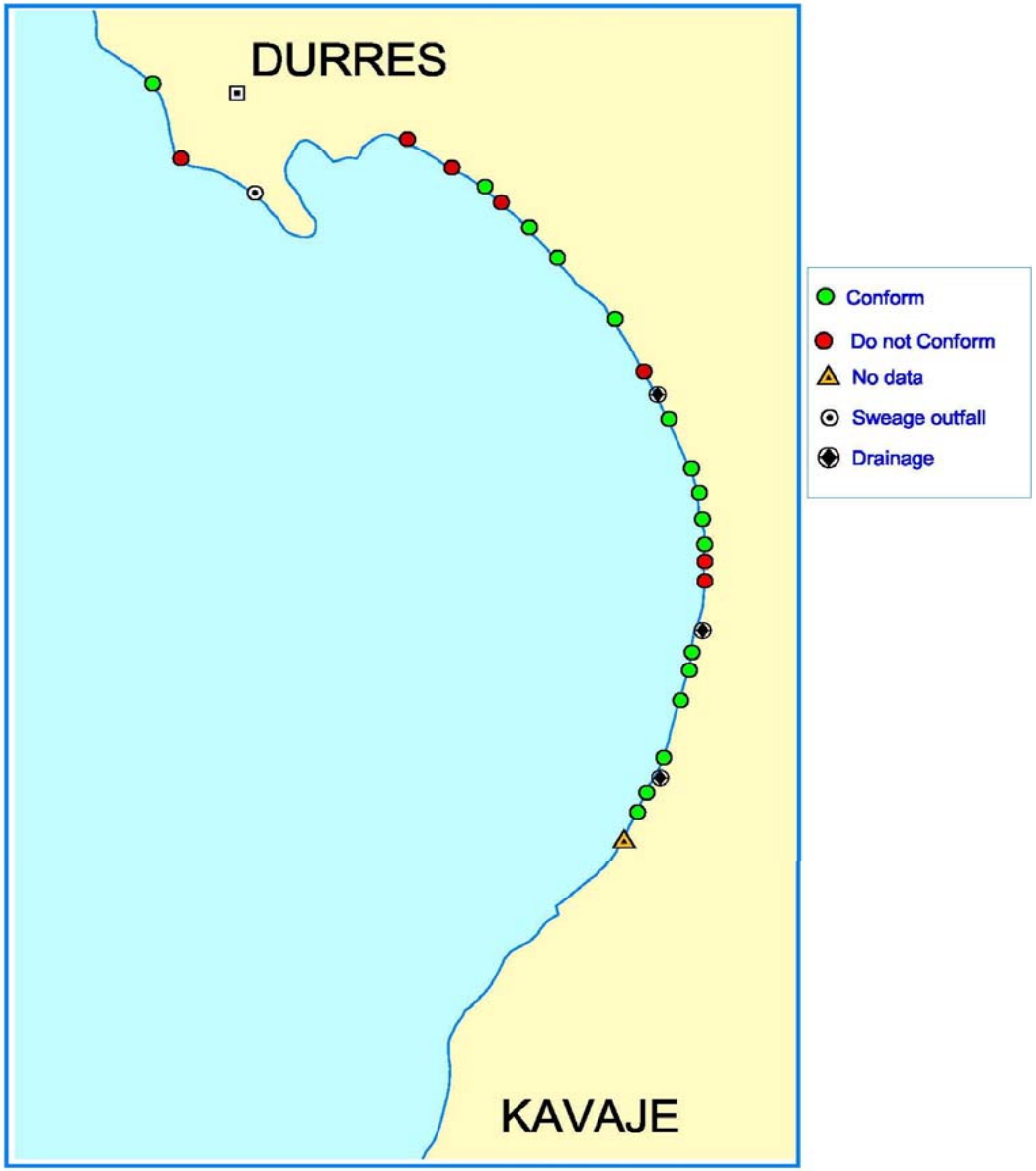
Monitoring Stations of Bathing Water



ALB2D - 14 Stations ALB2K - 9 Stations

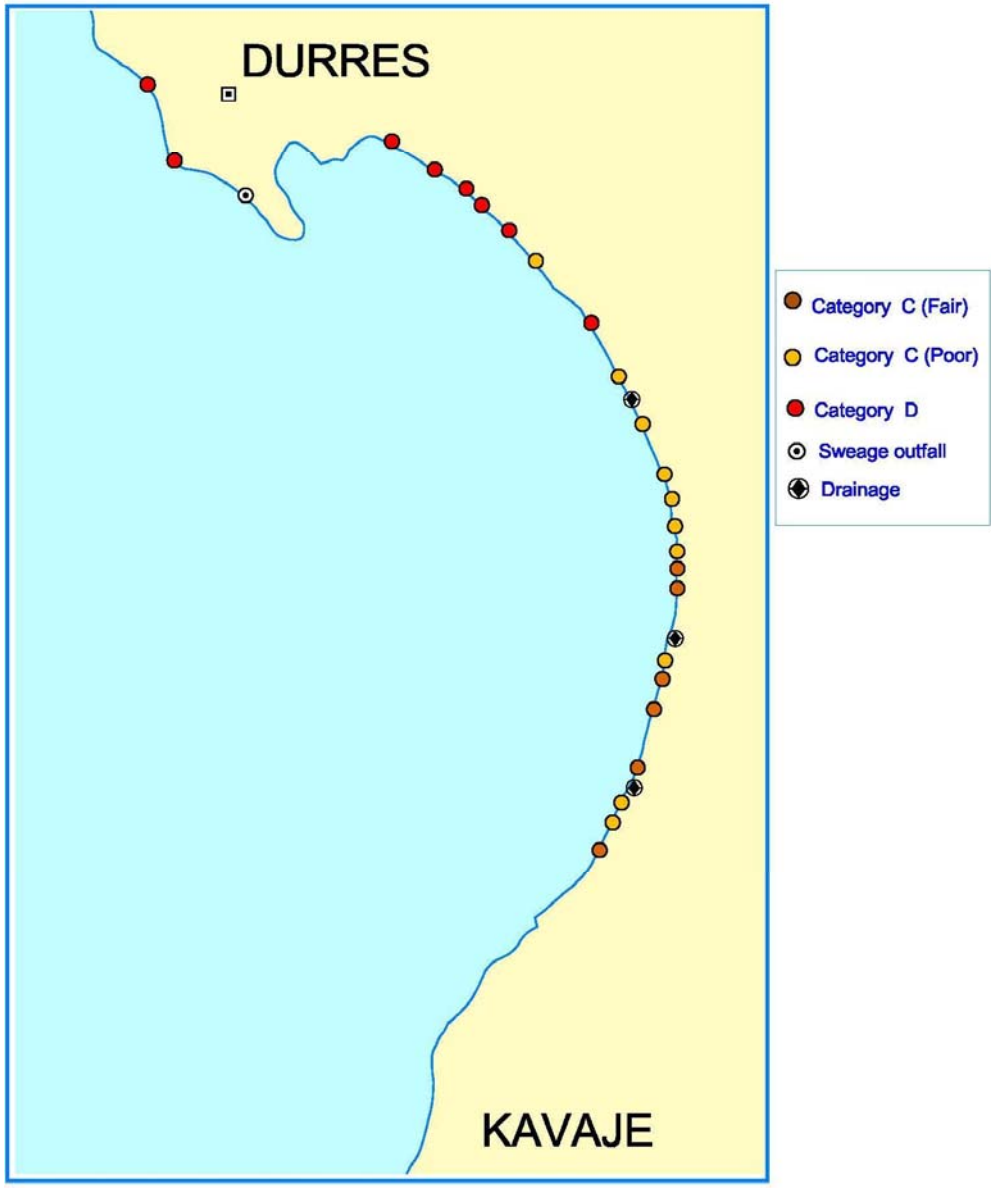
ALBANIA - Durresi, Kavaja Beaches

Microbiological Assesment Quality by WHO/UNEP Interim Quality Criteria



ALBANIA - Durresi, Kavaja Beaches

Microbiological Assesment Quality by 95%-ile



Beach Profile for Coastal Bathing Waters in the Mediterranean

Name of Beach and Bathing Area: Rrushkull Beach, Lalzi Bay -ALBANIA

1. General Information

Location:	From: 41°29’150’’N 19°30’493’’E
	To: 40°29’279’’N 19°30’560’’E
	See Figure Rr 1
Length of whole beach:	2000 m
Width of beach:	From 20-50 m at its widest part.
Type of bathing water:	Marine, relative open bay
Type of beach area:	Sandy beach
Number of bathers:	800 (weekday) to 1500 (holiday peak)
Characteristics of surrounding area:	mixed: rural, agricultural

Rrushkull (Hamallaj) beach is situated in Bay of Lalezi at the north part of Durresi city. The Lalzi Bay with almost 35 km of coast has attracted many projects, aiming developing sea tourism. Except of about 10 km seacost, the other part of the coast is intact and virgin.

There are three main beaches used for bathing and sunbathing in this bay. From north to south of Lalzi Bay there is Shen Pjeter beach (in plain of Draç) the residential village of Lura beach and Rrushkull (Hamallaj) beach at the south part of the bay.

There is Erzeni River and Tarini spring discharges their waters into the sea at south part of this bay near beach of Rrushkulli, forming a width mouth about 2.5 kilometer, near the inner catchments areas of this beach. This river may be a potential risk of pollution for this beach, because their waters are much polluted from the sewage discharges.
The length of Rrushkull (Hamallaj) beach is about 2 km. Parallel with cost line, the surrounded area is dressed of typical Mediterranean bushes and pine forest.

The seacoast is made of long sandy beach. The coastal waters are shallow, receiving water from the rivers and several drainage canals. The water depth increases slowly, with a fine sandy bottom.

The surrounding area is mainly agricultural and rural. There is not infrastructure in this area. There is no proper beach management along this beach. The new road is constructed to link the beach of Rrushkulli (Hamallaj) with national road. There is very limited information signage.

This part of the beach is occupied mostly by private beach clubs, owned by nearby residents. There are a few semi-permanents numbers of kiosks being located in the immediate vicinity of this beach.

Most of the beach is used for daily bathing and sun bathing. Most of the bathing waters are shallow less than 1 to 2m deep. The main part of the sea bottom at bathing area proper is composed of well-sorted fine sand.

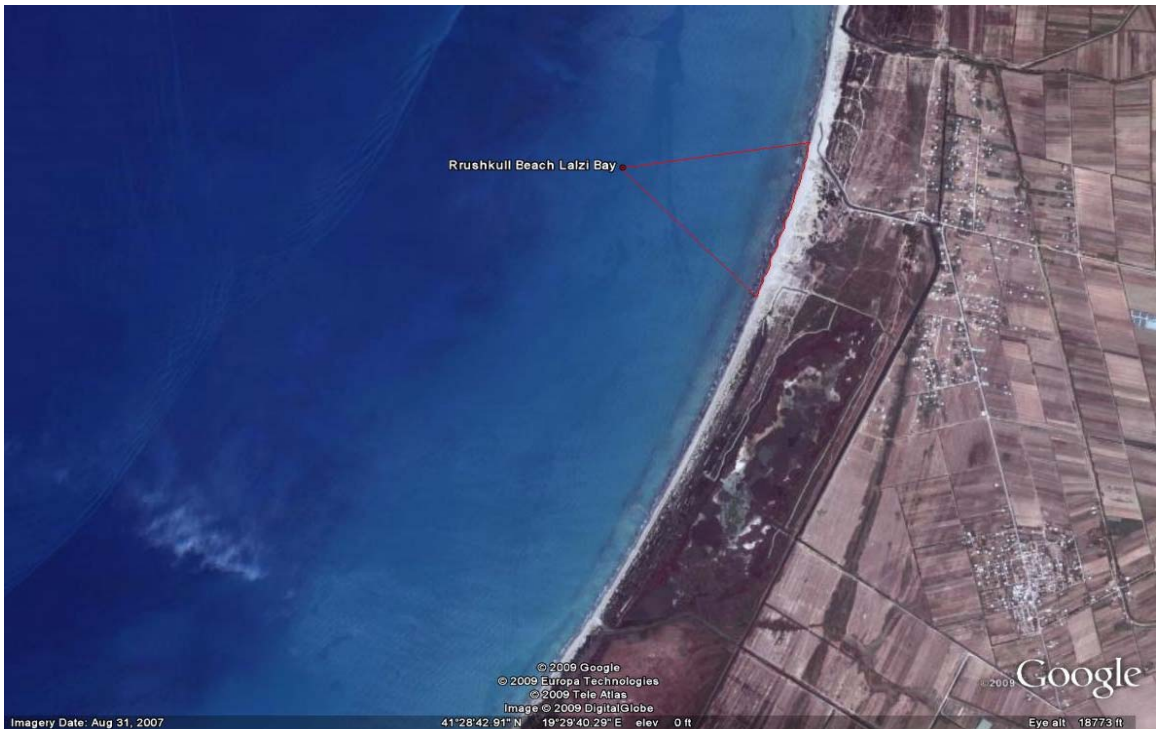


Fig. Rr.1 The aerial view of Rrushkulli Beach, Lalzi Bay

Figure Rr 2: The different view of Rrushkull (Hamallaj) Beach - Lalzi Bay

2. Description of the physical, chemical and hydrological characteristics of the bathing waters

Physico-chemical parameters Not any information is available for water quality parameters in this locality.

Rrushkull (Hamallaj) area is included on the subtropical belt climate. Albania is located at the boundary of two climatic regions: the Mediterranean zone, and Central Europe.

The average annual rainfall in Albania in Durresi region is around 1484 mm; the seasonal patterns are very consistent, with July, sometimes August as the driest month, and November sometimes December, as the wettest one.

The annual average temperature in the Adriatic Sea is around 14. 8° C-16.5 ^{0}C. Winter is relatively short, mild and very wet while summer is long, hot and very dry. The coldest month is January while the hottest month is July. The highest temperature of water during a perennial period had been 29.8°C, while the lowest drops to 7.7° C. the wind direction, generally, is towards North.

The residual current direction is generally towards North also with a mean speed of 0.05-0.2 m/second. The tidal Amplitude is A = 0.30 m. The mean multiyear level between high and low water is 121 cm. The monthly high level is 152 cm, the monthly low level is 83 cm, and the amplitude is 69 cm. There are 3 microbiological monitoring stations in this beach.

3. Sanitary Inspection

Sanitary inspections were undertaken over the period February 2009. The following account is based on such inspections which was carried out, together with the Sanitary Inspectors of Durresi city (Directorate of Public Health) as well as on interviews with the Sanitary Inspectorate of this area.

There are no sewage outfalls within or in the vicinity of Rrushkull (Hamallaj) beach. There are not residences, hotels and buildings on the vicinity of this beach. This part is occupied mostly by private beach clubs owned by nearby residents.
A few semi-permanent kiosks in the vicinity of this beach, supposed to use the septic pits closed to the bathing area, not well constructed.

There is Erzeni River and Tarini spring discharges their waters into the sea at south part, near the inner catchments areas of this beach. The Erzeni River is one of most polluted rivers of Albania because there are many urban sewage wastewaters (untreated) discharges in this river.

This catchments area includes some agricultural fields also. There are no permanent public and private toilets and showers available in the beach. There are not garbage collection at the seashore. The solid wastes are often littered into the forest area.

The beach is not well equipped with solid waste disposal bins, while on the existing ones; do not incorporate any waste separation.

Table 1: Site Inspection Risk Category for Rrushkull (Hamallaj) beach, Lalzi Bay- ALBANIA						
Sewage Discharges		***Present? Y/N***	***Treatment***	***Type of discharge***	***Risk of discharge occurrence during bathing season***	***Category***
	Outfalls	NO				**N/A**
	Overflows from SPS(1)	NO				**N/A**
	Overflows from septic tanks, etc.	possibly (from some boat houses)				**N/A**
	Storm water	YES	No	Storm water	Low	**Low**
		Density	***Expected Rate of Dilution/Dispersion***	***Proportion of boats which may release sewage (2)***		***Category***
	Boating	NO				**N/A**
Riverine Discharges		*Present? Y/N*				**Moderate**
		YES				
Surface Runoff		***Present? Y/N***	***Expected Volume during Bathing Season H/M/L***	***Presence of agricultural land: none/low/ medium/high (3)***	***Presence of animal husbandry: none/low/ medium/high (3)***	***Category***
		YES	Low	Low	No	**Low**
Bather Shedding		***Density of bathers***	***Expected Rate of Dilution/ Dispersion***	***Toilet Facilities None/Inadequate/Adequate***		***Category***
		Medium to Low	Medium	Inadequate		**Low**
Animal inputs (4)		***Dog Ban on Beach Y/N***	***Presence of other animals***	***Density/Frequency of Animals***		***Category***
		NO	NO			**N/A**
OVERALL CATEGORY OF SANITARY INSPECTION						**Low**
(1) = Sewage Pumping Stations						
(2) = these would be larger boats and yachts						
(3) = sources of potential faecal contamination due to manure or animal wastes within the catchment area leading to bay						
(4) = animal inputs other than those due to runoff from agriculture/animal husbandry						
NA = Not applicable						

4. Presentation

The Microbiological Monitoring stations are shown in **Fig. 3 (Rr1, Rr2)** from north to southwest. No any data available.

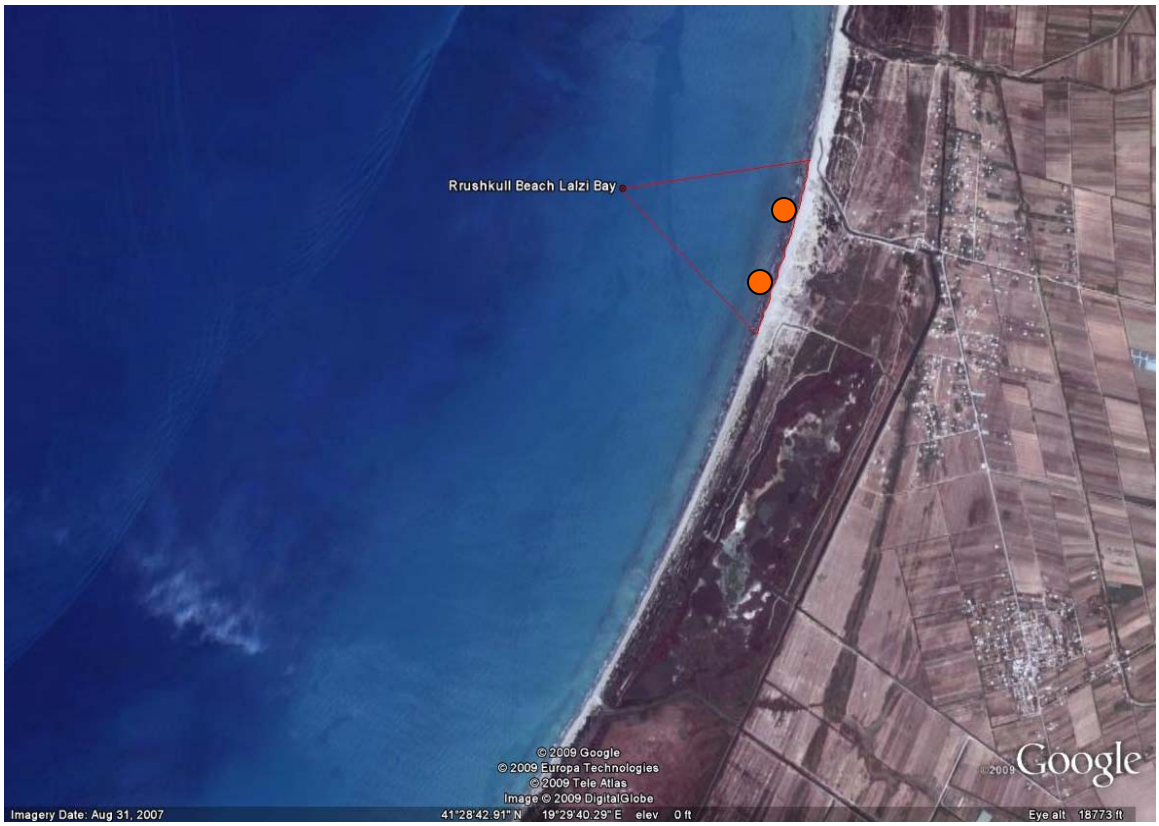


Fig Rr.3 The Microbiological Monitoring stations from north to south **(Rr1, Rr2)**

5. Analysis of historical data for microbial water quality trends

There are not available data on microbial water quality for Rrushkull (Hamallaj) beach.

6. Assessment of the potential for proliferation of cyanobacteria and of eutrophication

No data is available on the phytoplankton composition of the waters in this beach or potential of cyanobacteria and eutrophication.

7. Combined Sanitary and Microbial Water Quality Assessment

Sanitary Inspection Category: LOW
Microbial Assessment Category: No Data

On the basis of the data above, this beach is rated as **GOOD**

The main management issues to be addressed are:

- Improved all infrastructure of the this area

8. References

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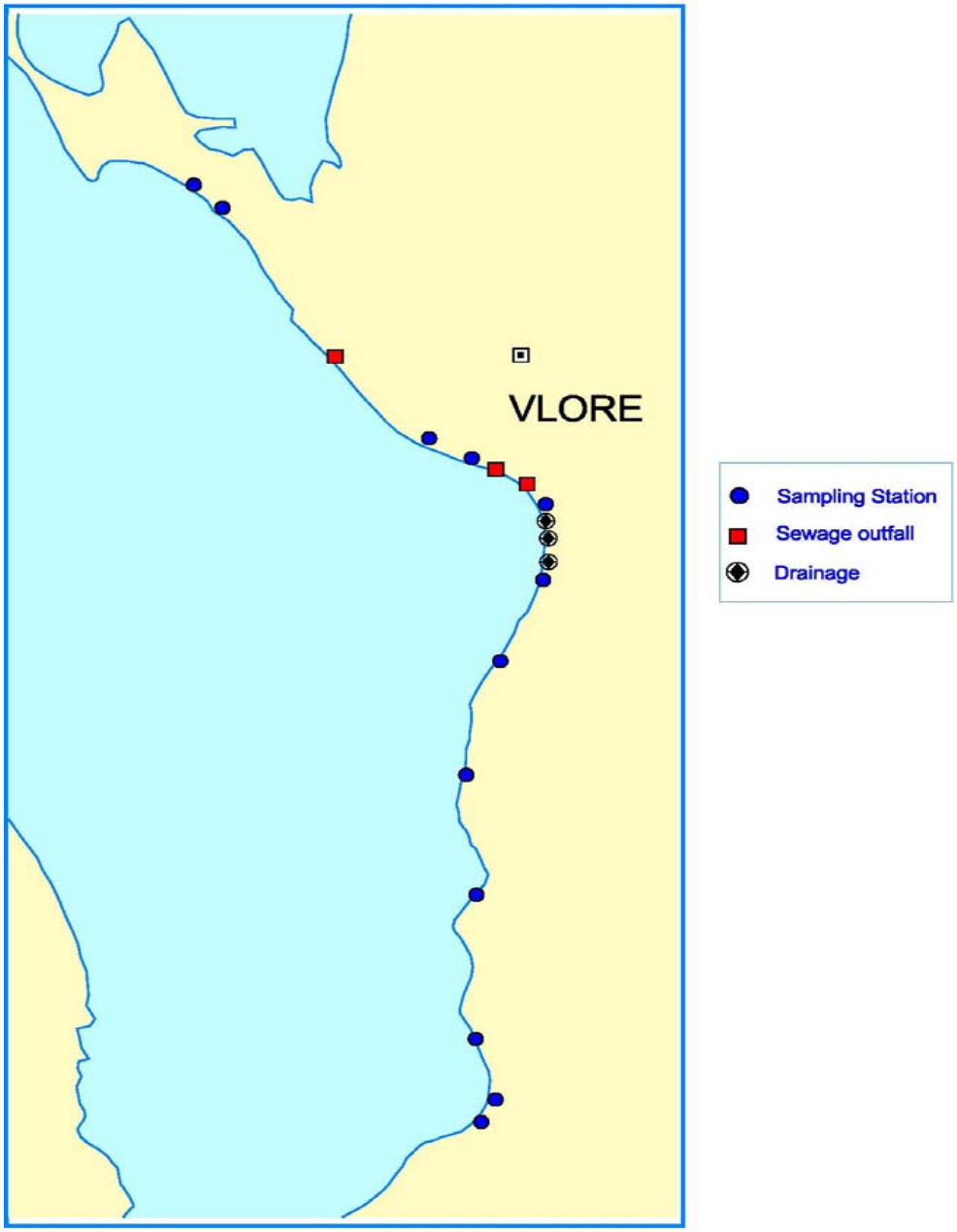
Bathing Profiles for Albanian Beaches

Vlore Beaches

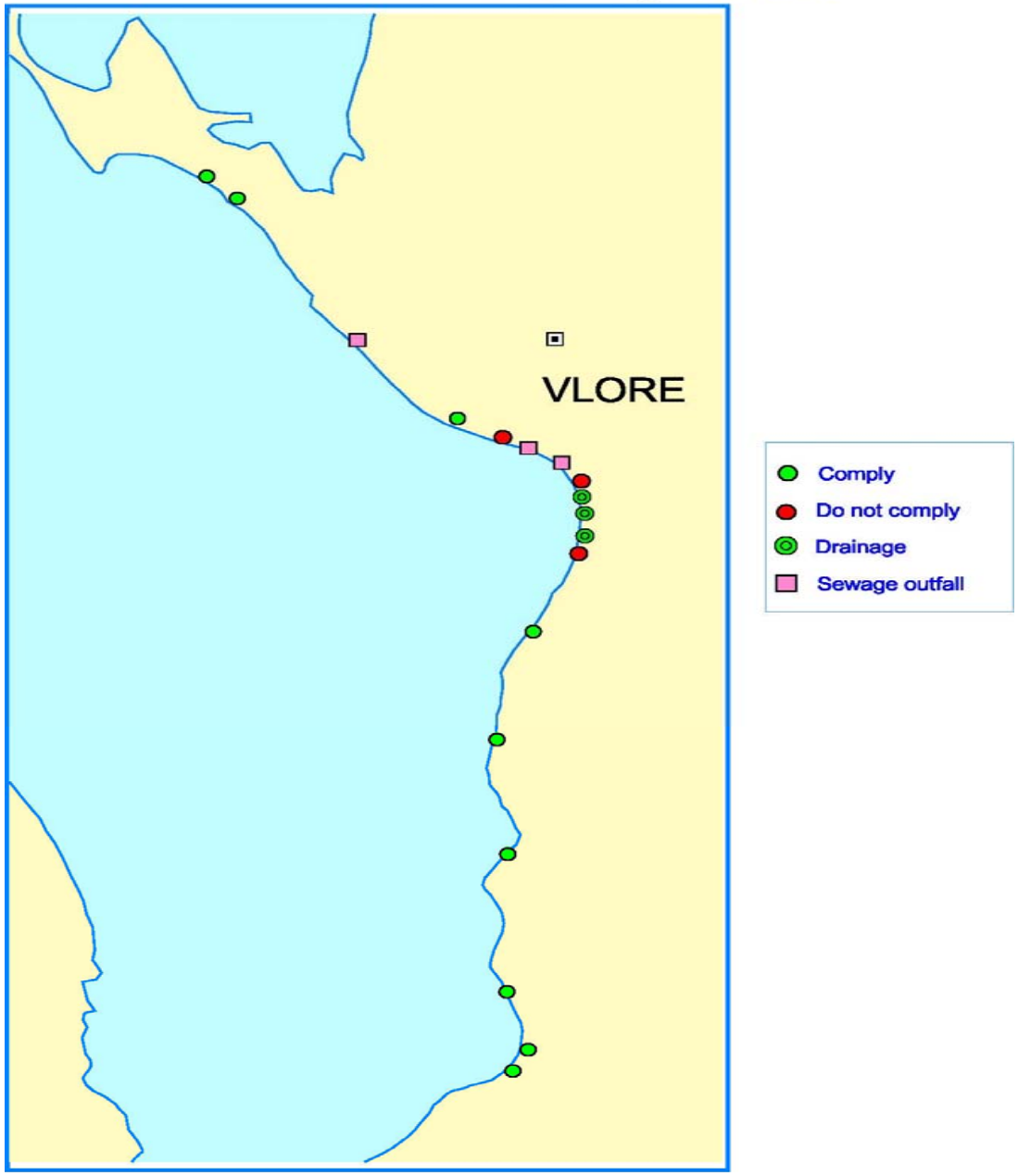
ALBANIA - Vlora Beach

Monitoring Stations of Bathing Water



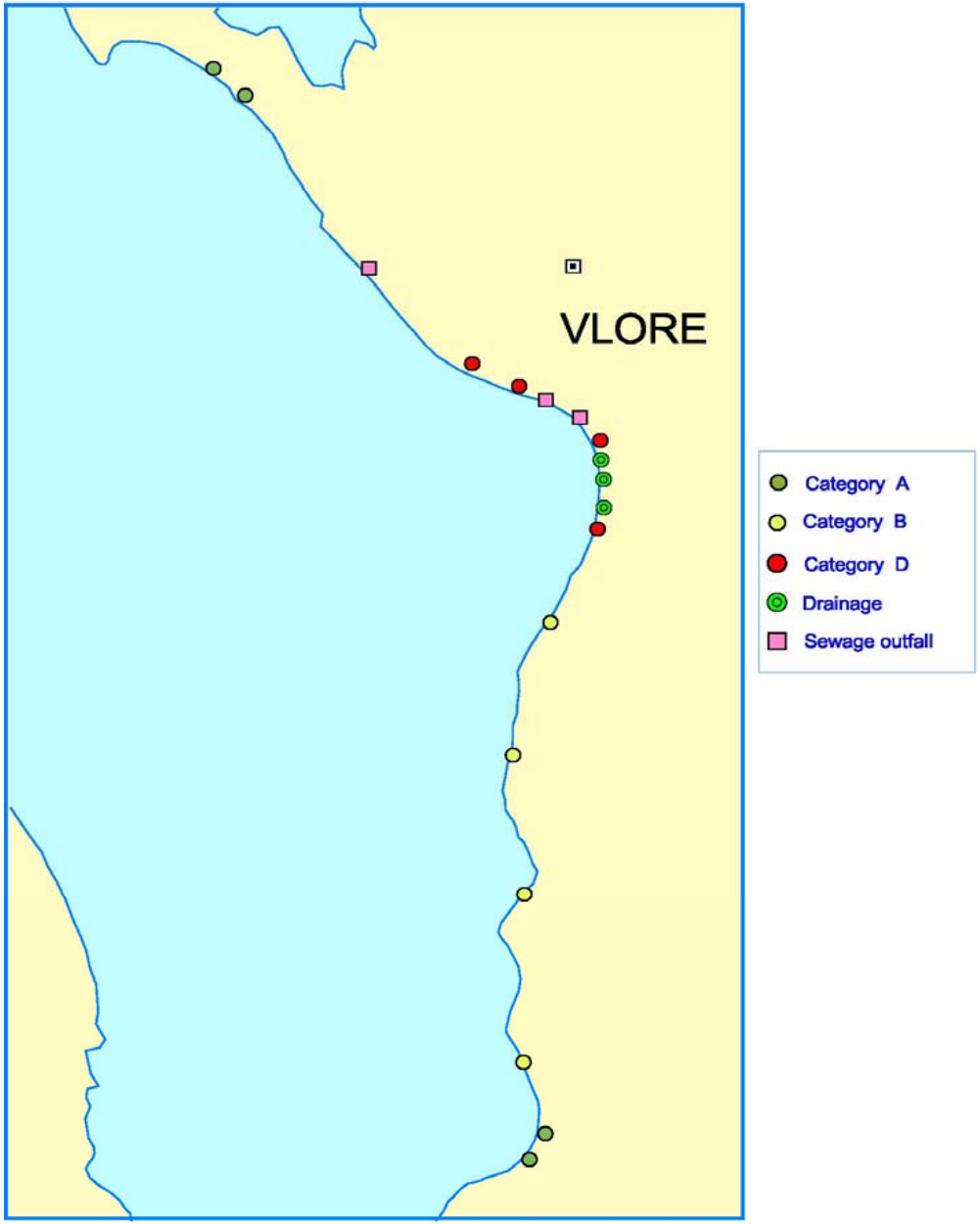
ALBANIA - Vlora Beach

Microbiological Assesment Quality by
WHO/UNEP Interim Quality Criteria



ALBANIA - Vlora Beach

Microbiological Assesment Quality by 95%-ile



Beach Profile for Coastal Bathing Waters in the Mediterranean

Name of Beach and Bathing Area: Dhermiu Beach Dhermiu Bay – Vlore - ALBANIA

1. General Information

Location:	From: 40°08’690’’N 19°37’759’’E
	To: 40°08’397’’N 19°38’498’’E
	See Figure Dh 1
Length of whole beach:	4000 m
Width of beach:	Varies from 100 m at its widest part to 5 m.
Type of bathing water:	Marine, relative open bay
Type of beach area:	Includes rocky, pebble and sandy beaches
Number of bathers:	5000 (weekday) to 10 000 (holiday peak)
Characteristics of surrounding area:	mixed: rural, agricultural and residential

Dhermiu beach is located in the Bay of Dhermiu in south part of Ionian Sea. Dhermiu beach is considered one of the most beautiful beaches in the Albanian Riviera due to its rugged landscape composed of high cliffs dotted by many caves at sea level. The beach itself is composed mainly of small patches of sand and pea stone gravel. The immediate area next to the beach consists of orange and olive plantations.

The beach of Dhermiu is the most popular beach, frequented with Albanian and tourist alike. It is composed by the pebble beaches bisected in many parts by a rocky outcrop, over 4 kilometer length where included the sandy beaches also. Most of the bathing waters are very deep but the sea bottom is visible

There are a number of important hotels being located in the immediate vicinity of this beach and some residential looking seawards. The beach is separated by Dhermiu stream that supposed to have clean water on it. The typical Mediterranean vegetation may be

found around area of the beach and the pine forest of *Pinus halepensis* that occupy most of the hilly slopes north of Dhermiu beach.

There is no proper beach management along this beach. There is very limited information signage. There is not any emergency safety equipment available at the beach.

The southern end of the bay has been developed recently and at the present has the highest concentration of tourist. Beach tourism is the main attraction for the visitors up till now and it takes place mostly within the Bay of Dhermiu.

The surrounding area is mostly rural and agricultural as well as the residential. There is not a parking space at this beach. The new coastal road at the vicinity of this beach is often full of parked vehicles.

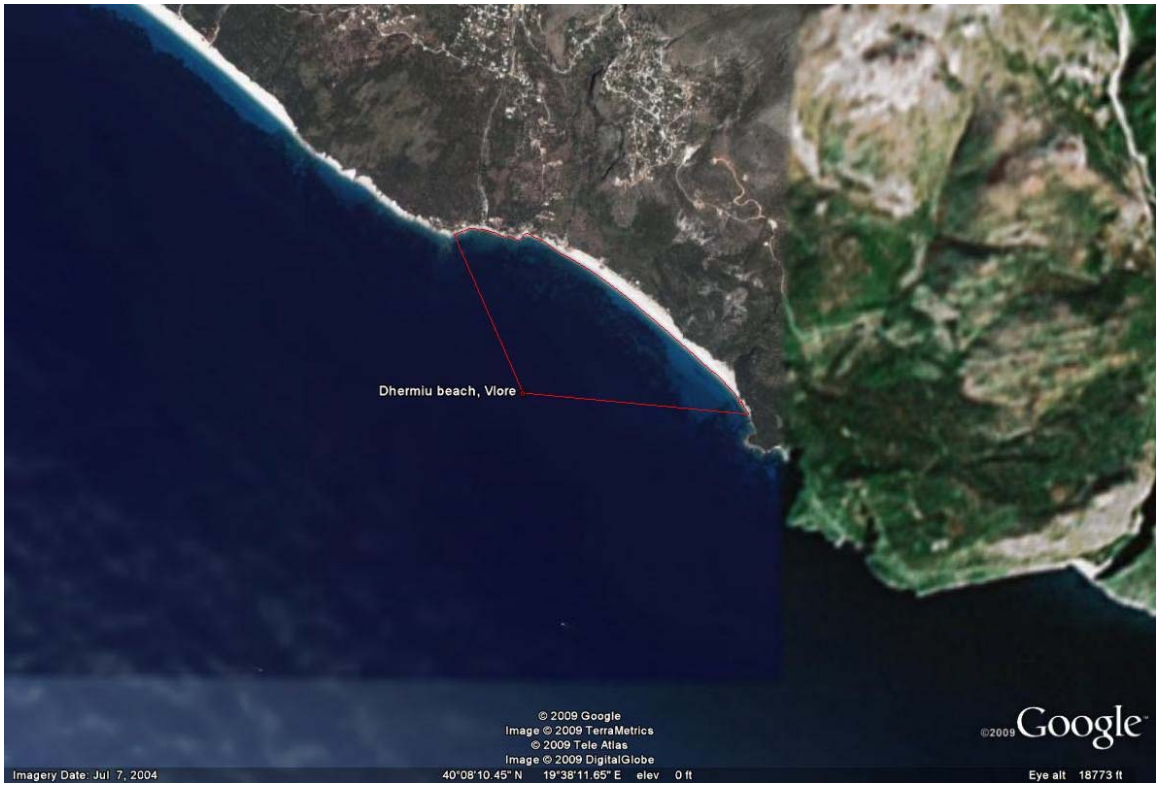


Figure Dh1: The Aerial View of Dhermiu Beach

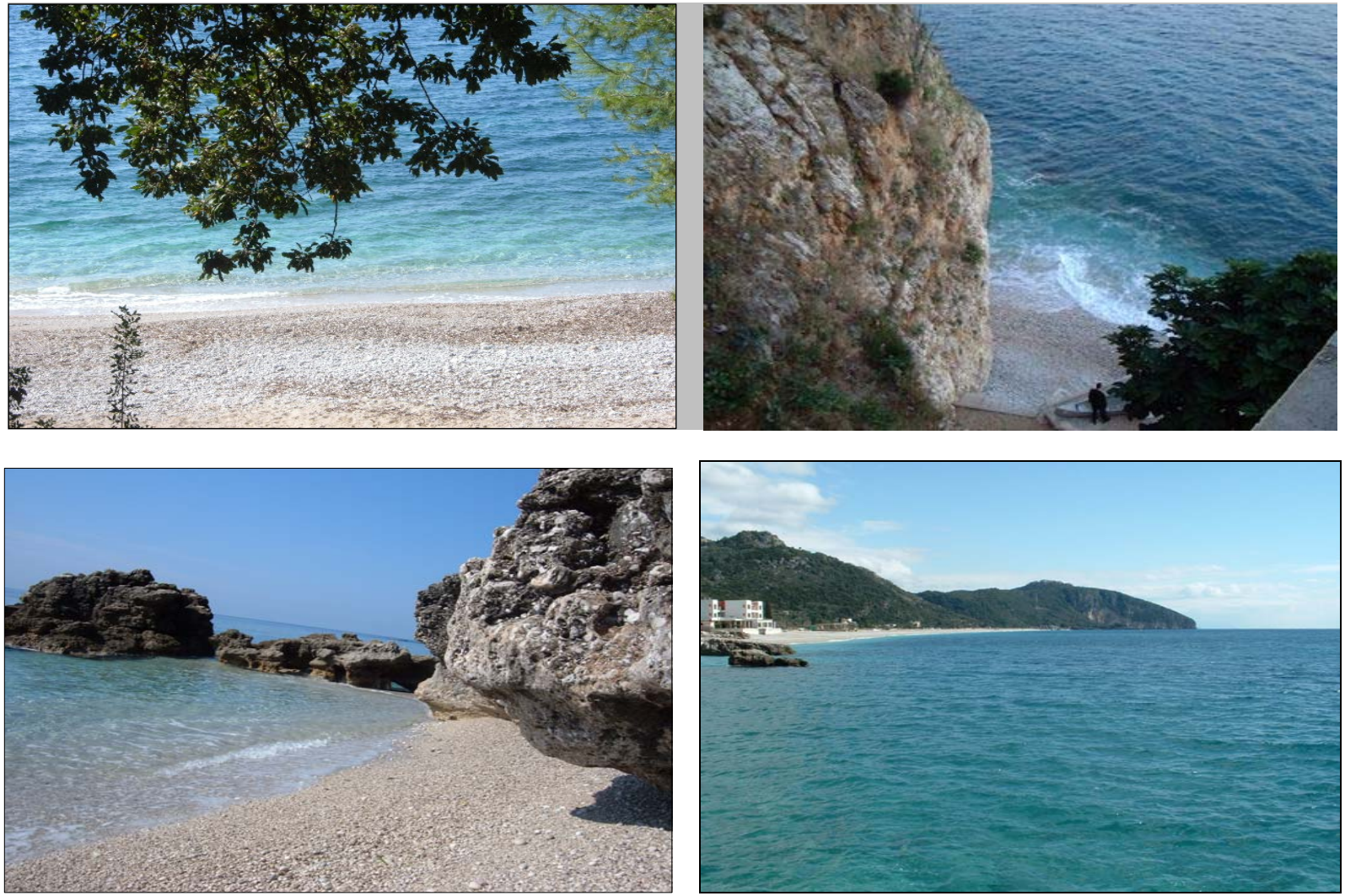
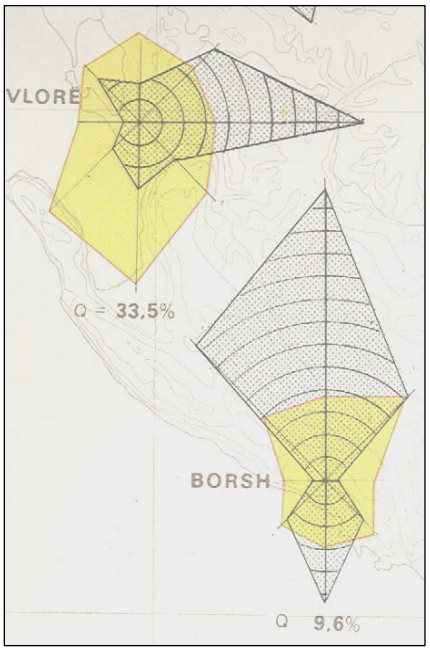


Figure Dh 2: Panoramic views of rocky and pebble beaches of Dhermiu bay

2. Description of the physical, chemical and hydrological characteristics of the bathing waters

Physico-chemical parameters Very limited information is available for water quality parameters in this locality.

The Dhermiu area has a high diversity of vegetation associations typical for the southern coastal part of Albania. Geologically the area belongs to the Ionic geotectonic zone, with a general direction NNW-SSE. The hydro geological conditions of the area are configured from the climate conditions, from the tectonic structure and from the hydrolytic properties of the geological formations.



The southern part of Albania is dominated by a South-North current that is part of Adriatic Surface Water (ASW) circulation. The current is expected to carry the nutrient load to north. Typically surface water circulation is modulated by the dominant winds and shows a southern dominance or the area close to Himara.

Figure 3 Wind rose according to the meteorological station of Borshi area

The climate of the Dhermiu beach is typical Mediterranean, with dry and hot summers, wet and mild winters. The mean annual temperature is 17.6°C. The average annual rainfall in Dhermiu area is about 1500 mm/year, with an important precipitation period in winter (from November to March about 70% of the precipitations)

The annual average temperature in the Ionian coast is about 16-17°C. Winter is relatively short, mild and very wet while summer is long, hot and very dry. The coldest month is January while the hottest month is July.

In the coastal area of Dhermiu the temperature of the surface water is about 19.2^0 C. The highest temperature of water during perennial period has been 29.8°C, while the lowest drops to 7.7° C

3. Sanitary Inspection

Sanitary inspections were undertaken over the period July-August 2008 and February 2009. The following account is based on such inspections as well as on interviews with engineers from the Himara Municipally.

There is not any sewage outfall located in the vicinity of this beach. At the present, most of residential and hotels are using septic pits, or septic tanks that in my filling may be the great potential risk for water pollution.

However, there is a project of Himara Municipality for the construction of the new sewer network of the area. This project was designed to construct the sewerage system in Dhermiu beach and village also. A number of storm water culverts drain the inner catchments areas into the sea.

High output spring is present in the middle part of the beach, with clean water. The beach is not well equipped with a number of solid waste disposal bins. There is no permanent public toilet and private toilets and showers available in the beach.

There is not any information in case of emergency accidents leading to short-term pollution, such as visible sewage overflow in the bay or presence of oil slick.

Table 1: Site Inspection Risk Category for Dhermiu Beach – Dhermiu Bay - ALBANIA						
Sewage Discharges		***Present? Y/N***	***Treatment***	***Type of discharge***	***Risk of discharge occurrence during bathing season***	***Category***
	Outfalls	NO				**N/A**
	Overflows from SPS(1)	NO				**N/A**
	Overflows from septic tanks, etc.	possibly (from some boat houses)				**N/A**
	Storm water	Yes	None	Direct	Low	**Low**
		Density	***Expected Rate of Dilution/Dispersion***	***Proportion of boats which may release sewage (2)***		***Category***
	Boating	NO				**N/A**
Riverine Discharges		*Present? Y/N*				
		YES				**Low**
Surface Runoff		***Present? Y/N***	***Expected Volume during Bathing Season H/M/L***	***Presence of agricultural land: none/low/ medium/high (3)***	***Presence of animal husbandry: none/low/ medium/high (3)***	***Category***
		Yes	Low Volume	Medium	Low	**Low**
Bather Shedding		***Density of bathers***	***Expected Rate of Dilution/ Dispersion***	***Toilet Facilities None/Inadequate/Adequate***		***Category***
		Medium to High	High	Inadequate		**Moderate**
Animal inputs (4)		***Dog Ban on Beach Y/N***	***Presence of other animals***	***Density/Frequency of Animals***		***Category***
		NO	YES	Low		**Low**
OVERALL CATEGORY OF SANITARY INSPECTION						**Low**
(1) = Sewage Pumping Stations						
(2) = these would be larger boats and yachts						
(3) = sources of potential faecal contamination due to manure or animal wastes within the catchments area leading to bay						
(4) = animal inputs other than those due to runoff from agriculture/animal husbandry						
NA = Not applicable						

4. Presentation

The microbiological monitoring stations, are shown in the detailed map **Fig.Dh3**

Figure Dh 3 Microbiological sampling stations

5 Analysis of historical data for microbial water quality

Data on microbial water quality for this site are available as follows:

E. Coli	2005-2008	May-October	every 2 weeks
I. Enterococcus	2005-2008	May-October	every 2 weeks

Data over this time period has been collected from the same three sampling stations (Dh1 to Dh 3). Analysis of such data is summarized in **Table 2.** Data from the individual stations are analyzed separately as indicated in this table.

Table 2: Summary of analysis of microbial data: 2005-2008

	2005 - 2008 (May-October)	**Stations**		
		Dh1	**Dh2**	**Dh3**
E. Coli [(1)]	No. of samples analyzed	46	46	46
	95th percentile (CFU/100ml)	**56.7**	**89.5**	**99**
	90th percentile (CFU/100ml)	34.8	53.3	60
Intestinal Enterococci [(2)]	No. of samples analyzed	46	46	46
	95th percentile (CFU/100ml)	**43.5**	**66.8**	**65.6**
	90th percentile (CFU/100ml)	27.9	42.3	40.3
Microbial Water Quality Assessment Category		***Excellent***	***Excellent***	***Excellent***
[(1)] *Reference method of Analysis: ISO 9308 - 1*				
[(2)] *Reference method of Analysis: ISO 7899 - 1*				

The data presented shows no evident difference in the levels of microbial water quality at the three monitoring stations, (Dh1, Dh2, Dh3) though the state was excellent.

6 Assessment of the potential for proliferation of cyanobacteria and of eutrophication

No data is available on the phytoplankton composition of the waters in this bay.

7 Combined Sanitary and Microbial Water Quality Assessment

Sanitary Inspection Category: LOW

Microbial Assessment Category: A (Excellent Quality)

On the basis of the data above, this beach is rated as **EXELLENT.**

The main management issues to be addressed are:

- It exists a project for the sewer network construction of the area.
- Bather shedding may be significant due to the high densities of bathers but the possibility of dilution is very high because of the high depth of water.
- Improved toilet facilities.
- Improvement of garbage collation

8. References

1. Malanotte-Rizzoli, P., Manca, B. B., Ribera d'Alcala, M., Theocharis, A.,Bergamasco, A., Bregant, D., et al. (1997). A synthesis of the Ionian Sea hydrography, circulation and water mass pathways during POEM-Phase I. Progress in Oceanography, 39, 153–204.
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5. http://maps.google.com