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MEDWAVES

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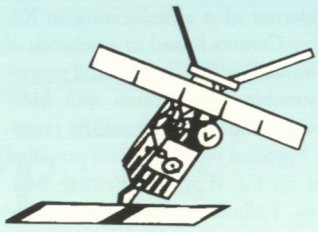
REMOTE SENSING IN THE MEDITERRANEAN

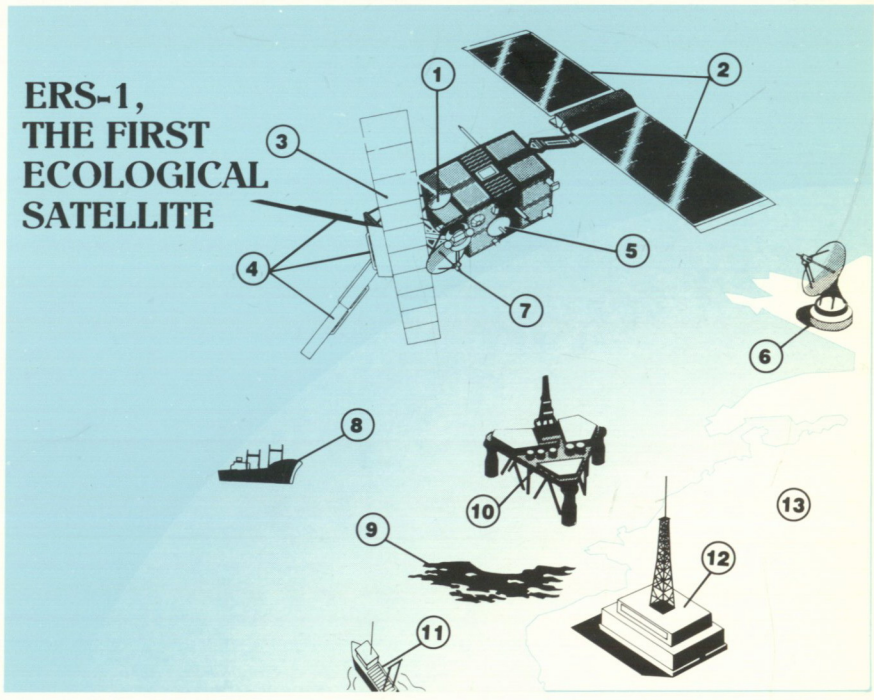


THE ENVIRONMENT SEEN FROM ABOVE

Remote sensing is in the news in MAP, as is shown by the two latest meetings. One of the recommendations approved by participants in the Joint Meeting of the Scientific Committee and the Socio-Economic Committee held in Athens from 6 to 10 May last was «To Call upon the Secretariat to promote and support all measures aimed at utilizing remote sensing technology at the Mediterranean level». At their meeting held in Paphos, Cyprus, on 16 and 17 July, the members of the Bureau of the Contracting Parties also discussed the question. The Italian representative announced the establishment in Palermo of a «Mediterranean Remote Sensing Centre» linked to a network of other operational centres in Italy and proposed that possible co-operation with MAP and the Contracting Parties should be considered. The Egyptian representative provided information on the «Egyptian Remote Sensing Centre». Following the discussion, the Bureau decided that the question of remote sensing should be included in the agenda for the Seventh Ordinary Meeting in Cairo under the heading «Pollution Monitoring».

The reason why MEDWAVES is including an article on remote sensing is that it wishes provide some points of reference and information on the exceptional possibilities afforded by such technology for the monitoring and protection of the environment. It is when observing our planet from space that one can best apprehend the global nature of the environment and its vulnerability to change, whether man-made or caused by nature. Satellites have already enabled us to explore our planet and better understand some phenomena whose «universality» escaped our notice as «insects crawling on the face of the earth» (although it must be said that for nearly a century aviation has already given us wings). As a result of the spectacular progress made in this field, there has been a prodigious leap forward in the quantity and quality of data on the environment.

The Mediterranean as a whole, and *a fortiori* MAP with the limited means at its disposal, are far from envisaging a joint programme to launch and operate remote sensing satellites because of to the high costs involved, which only industrialized countries or even groups of industrialized countries are able to bear. Nevertheless, specialized centres for the processing and dissemination of remote sensing data are already in operation in the Mediterranean region and continue to expand. In addition, through the Mediterranean States members of the EEC, the Mediterranean has access to the programmes of the European Space Agency. The launching on 17 July 1991 of the first European remote sensing satellite, ERS-1 (ERS = European Remote Sensing), is to be followed within three years by the launching of another satellite of the same type, ERS-2, which will take over from ERS-1 and carry out the same tasks. It will also have equipment for ozone measuring. The two satellites will provide users with a pre-operational service. Originally, they were conceived to provide pictures of the Earth like Landsat and Spot so that they could be used for industrial and commercial purposes. Developments in recent years mean that these new satellites are entering the market at a time when crucial questions are facing mankind with regard to the environment, pollution and global climate trends.



1. *Microwave detection antenna: measures the temperature of the clouds, vapour content in the atmosphere and the surface of the sea* ***2.*** *Solar panels* ***3.*** *Synthetic aperture radar* ***4.*** *Wind scatterometer antenna* ***5.*** *Antenna for data transmission* ***6.*** *Receiving station* ***7.*** *Height-finding radar: measures the topography of the sea bed and the ocean surface* ***8.*** *Routing* ***9.*** *Pollution* ***10.*** *Offshore oil activities* ***11.*** *Fisheries* ***12.*** *ERS-1 Centre for data storage and processing* ***13.*** *Other users:meteorological services, oceanographic institutes, environmental agencies, research centres*

Towards 1997, ERS-1 and ERS-2 will be followed by at least one platform placed in polar orbit as part of the International Space Station project. Platforms of this type will open up new possibilities because their maintenance and operation will be carried out in orbit and they can carry much heavier equipment. This European Space Agency programme will also include a project on terrestrial solid state physics which will enhance our knowledge of the physical forces and processes taking place under the Earth's crust. Seismologists and volcanologists are already awaiting conclusive and valuable data, particularly concerning the Mediterranean region where the risk level means making use of everything that can contribute to forecasting and prevention. The task of ERS-1, and subsequently ERS-2, is to show the operational possibilities available to users - offshore industries, fisheries, navigation aids, the maritime sector - while at the same time giving scientists the information they need to further their knowledge of the ocean's behaviour in coastal zones and the world as a whole. This will constitute a major contribution to the World Climate Programme at a time when the anticipated climate change represents one of the greatest ecological challenges of the close of the century.

Since 17 July 1991, the first «green» satellite ERS-1 has scanned the entire

surface of the globe every three days in 43 full orbits of the earth and every second it transmits a wealth of figures that are equivalent to 5,600 pages of text! It monitors the polar regions, the oceans and submerged zones, using its synthetic aperture radar (SAR), which allows it to obtain pictures covering a length of 100 km. and 25 m. definition of the surface of the globe, day and night, whatever the cloud cover. In addition, a scanning radiometer measures the temperature of the water on the ocean surface and the vapour content of the atmosphere. A scatterometer gives wind speed and direction at sea level. A height-finding radar determines the height of the waves. These are all essential parameters for the understanding and management of the marine environment.

Like any advanced technology, remote sensing also involves a risk: that it will remain a monopoly and privilege of rich countries. MAP may not have the necessary financial resources to make a meaningful contribution in this field, but due to its composition and role it at least has the possibility of serving as a forum and convincing the industrialized countries of the Northern Mediterranean that they must associate the developing Southern Mediteranean countries in this new approach to the environment through space. This is undoubtedly the first interpretation to be given to the recommendation by the Joint Meeting of the Committees in Athens to which we referred earlier.

SHIPS IN SPACE:

Remote Sensing, a vital tool for marine environmental research and management.

by: Paul Geerders(*)

The environmental problems of the Mediterranean Sea are enormous, especially in some of the coastal zones near estuaries. Eutrophication, pollution, toxic blooms are a few of the keywords in this context.

A first and essential requirement for marine research and management is up-to-date information on the area in question. Remote sensing has clearly proven to be a potentially useful complementary tool for obtaining such information.

With the increase in the number of earth observation satellites, a vast flow of images and other types of «remotely sensed» data has become available. Presentations, publications and posters often use such beautiful, colourful images to illustrate the potential of this new tool (Fig. 1). But do we use this potential to the full extent? And is the potential of remote sensing as great as some want us to believe?

WHAT IS REMOTE SENSING?

The expression «remote sensing» is used for a variety of techniques to obtain information about objects «at a distance». In this article we will focus on the usage of electromagnetic radiation to observe the ocean. This radiation can be heat («thermal») radiation, sunlight or radio («micro») waves.

Related to these three types of radiation, remote sensing provides us with information on three specific characteristics of the ocean. Heat radiation closely relates to the temperature of the water surface, while the reflected sunlight tells us something about the colour of the upper layer. Finally, radio waves are especially sensitive to the form of the sea surface.

Electronic systems, called sensors, on board aircraft or satellites capture this radiation and process it. In the case of satellites, the resulting information is transmitted to receiving stations, while aircraft usually record the information on-board for later use. Mostly, «raw» satellite information is converted into a variety of forms such as pictures, magnetic tapes or diskettes. These are aimed at specific applications and are distributed to the various customers.

Several processes and phenomena of the ocean are in one way or another related to the above -mentioned primary characteristics. River outflows show as temperature differences, oil spills and other types of pollution often show as colour differences, waves and wind have a marked influence on the form of the sea suface.

In order to use remote sensing effectively, the relation between the phenomenon under study and the above characteristics needs to be known. When that is the case, remote sensing data can lead to interesting and useful results. Fig. 2 provides an example of the use of remote sensing data acquired by the Landsat satellite to provide information on phytoplankton concentrations in the Mediterranean and Black Seas.

HOW TO USE RS DATA?

The user of remote sensing mostly wants to do more than just watch beautiful pictures: quantification of the information is required. To achieve this, two additional elements are needed: *in situ* data and numerical models.

In situ data measurements carried out in the area viewed by the sensor and preferably simultaneously with the acquisition of the remote sensing data, - provide a basis for the calibration of this data in oceanographic units such as sea surface temperature or wave height.
Numerical models of hydrodynamical processes can provide additional useful information and can be used to present to the end-user a fairly complete and reliable «image» of his area of interest.

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Geographic Information Systems (GIS) form a new tool to present information graphically on computer screens. In our case, GIS provides a common substrate to present remote sensing information in a comprehensible form to the end-user. In such a structure, the end-user need not worry about questions concerning the source of the information presented. This source may be a numerical model in a computer, a ship that happens to be in the area or several different satellites, complementing each other. This complementarity is illustrated in Fig. 3.

Remote sensing information can effectively support different phases of marine research and management activities. It can be used to plan activities (where to find a specific frontal area), to direct ongoing activities in real-time (where is the oil spill?) or as a complement to already completed activities (what was the overall distribution of suspended sediments in the area just sampled?).

Remote sensing provides useful additional information when dealing with marine pollution. In disaster situations, the location, quantity and behaviour of marine pollution can be estimated. In management applications, remote sensing supports decision making e.g. with information on the transport of sediments, the turbidity of the water in a certain area or the amount of coastal erosion in a specific region. All these are highly relevant for research and management connected with the Mediterranan Sea.

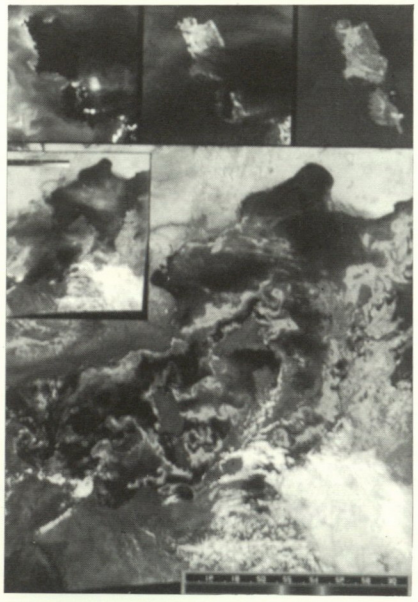

Fig. 1 Example of a NOAA image of the Mediterranean Sea (courtesy ESA).

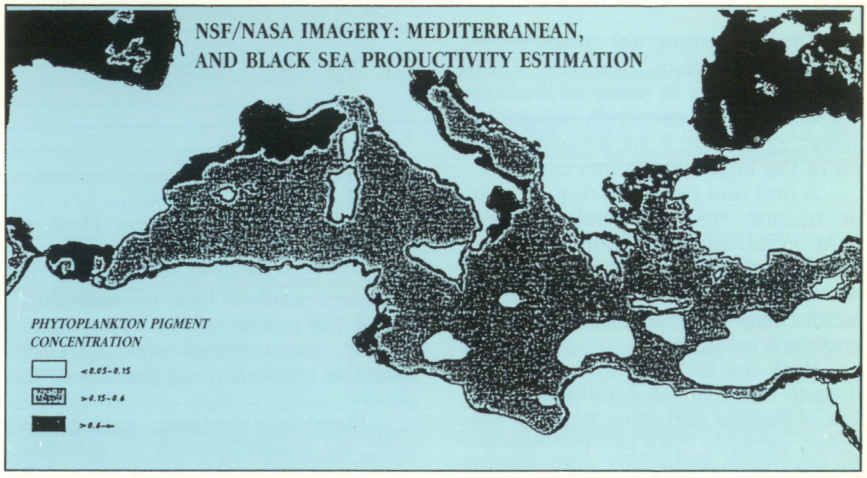

Fig. 2 Distribution of phytoplankton concentrations in the Mediterranean and Black Seas, drawn from 30 NSF/NASA images taken during May 1980 (J.F. Caddy, FAO, Rome).

LIMITATIONS

Although it has large capabilities, remote sensing also has a number of limitations. Cloud cover may hamper the observations, especially of water colour and water temperature. Satellites observe specific parts of the ocean only at regular intervals that sometimes do not coincide with the requirements, e.g. disaster situations. In such cases, aircraft do much better than satellites. There is also a limit to the smallest detail on ground level that can still be discerned: we cannot detect individual fish or turtles! Finally, the contrast between the phenomenon and its surroundings may sometimes be too small for it to be visible.

For each application, a careful analysis needs to be made of the requirements taking into account the above elements, and on the basis of that, a choice should be made of the specific technique, the platform and the required additional information.

WHICH SATELLITE?

These days many people talk about ERS-1, the European satellite that has been launched in July 1991. A large number of projects has been defined, also in the Mediterranean Sea, with the aim of studying the potential applications of the sensor systems aboard ERS-1.

Its successor, ERS-2, is planned to have an instrument on board, designed for accurate measurements of ocean colour. In view of the experience with ERS-1, the marine community should make a timely, strong and well-founded statement of its requirements in order to ensure that this instrument will finally fly.

For marine applications all around the world, much use is made of the meteorological satellites of the NOAA series. Their sensors regularly (every day) provide information on the sea surface temperature and, to

a certain extent, on the colour of the top layer. This information is used to detect frontal areas, to signal and predict the occurrence of algae blooms and to follow the circulation in the oceans. It is, however, amazing to observe that maybe only five percent of the fifteen years of daily historical NOAA data of the Mediterranean Sea has ever been studied for marine applications!

With regard to historical data, the Coastal Zone Colour Scanner, CZCS, and a satellite such as Seasat-A deserve to be mentioned. The CZCS sensor has collected a wealth of information on ocean colour while Seasat-A focused on observations related to the form of the sea surface. A major part of their data has never ever been looked at! Recently, however, projects have been started

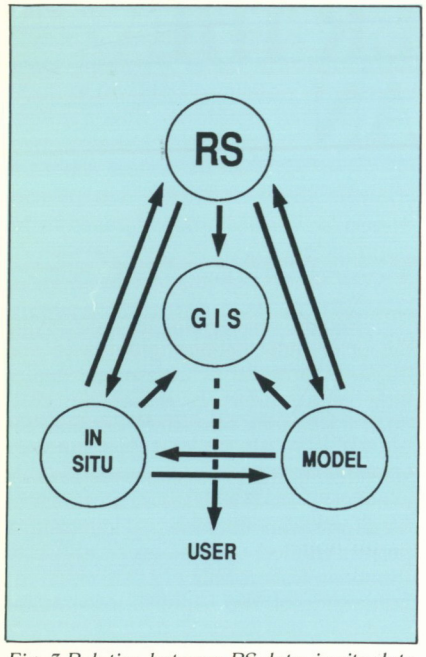

Fig. 3 Relation between RS data, in situ data and models.

by NOAA (USA) and by JRC and ESA to make CZCS data and data products available on a CD-ROM.

EXPERTISE

In and around the Mediterranean area, several international centres and organizations have been established that deal with RS of the sea. These centres and organizations are active in RS - related research or in the processing and distribution of RS data and related information. The most important are:

- ESA-Frascati [1],
- EURIMAGE, Rome [2]
- SPOT-IMAGE, Toulouse [3],
- JRC, Ispra [4],

Apart from these international centres of expertise, there are national centres in several countries around the Mediterranean Sea. The expertise of these centres is a valuable tool to promote and develop an effective usage of RS in marine applications.

INFORMATION

Various sources of information exist on remote sensing in general and on the marine environment in particular. In this context the following should be mentioned:

- RS Yearbook [5],
- European Compendium on Remote Sensing of the Marine Environment [6].

TRAINING AND EDUCATION

At present, there are hardly any regular courses on RS of the marine environment specifically aimed at marine scientists or managers. Several developments are under way to improve this situation. It is worthwhile in this context to mention two initiatives in particular.

The office of the Intergovernmental Oceanographic Commission (IOC) and Marine Science Related Issues of UNESCO has developed:

- a diskette-based series of learning modules on RS for Marine Applications [7]. This series for self-training is continuously being expanded with new modules contributed by experts in various countries.
- a short course on Remote Sensing of the Marine Environment. This course was run for the first time in Caracas, Venezuela in 1990 and will be held in other places in the coming years [8].

For more training and education opportunities in Europe the reader is referred to [2].

CONCLUSION

Remote sensing can be a valuable and unique tool to acquire information about the marine environment that cannot be collected in any other way. Care should be taken to use such information in an integrated way, together with *in situ* and model data, and always to be aware of the limitations. A strong involvement of the marine science and management community around the Mediterranean Sea will be required to develop the potential of this tool to the full extent, for the benefit of the marine environment of the Mediterranean, as well as of the countries around this sea.

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[2] EURIMAGE, Viale E. D'Ofrino 212, 00155 Rome, Italy, tel. +39-6 406941, fax. +39-6-40694231/32.

[3] SPOT-IMAGE, 16 bis Avenue Edouard Belin, 31030 Toulouse Cedex, France, P.O. Box 4359, tel. +33-61 274705, tlx. 532079, Mr. Dominique Lapeyre de Chavardes.

[4] Joint Research Centre-JRC, Institute of Remote Sensing Applications, Casella Postale no. 1, 21020 Ispra, Italy, tel. +39-332 789934 789034, tlx. 324889, Dr. B. Sturm.

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FROM THE FORESTS TO THE SOIL, SATELLITES ARE WATCHING OVER THE MEDITERRANEAN

In the 1960s, the launching of telecommunications, meteorological and remote sensing satellites opened up new perspectives for environmental studies. Remote sensing has the advantage of providing a global overview, highlighting the links and inter-relationships among the various spheres, activities and processes of large-scale areas of the ocean, the continents and the coasts. In addition to its interest for increased knowledge and more sound management of the marine environment - as shown in the article opposite by P. Geerders - the scope of remote sensing covers many different aspects of the environment. For example, in the context of natural resources it has made a decisive contribution in geology and geomorphology, agriculture and forests, land use and planning, water resources. It allows the definition of "ecozones" that transcend traditional territorial and geographical limits.

In the case of soils, the information provided by remote sensing allows the definition of their biophysical use, capabilities, the various types of wet lands, the nature and quality of plant cover, hydrographic networks (depth, turbidity, aquatic plants, nature of beds, fresh water/sea water contact), the real impact of large-scale development on the natural environment - particularly coasts. In recent years, its screening potential has been widely used for the Mediterranean together with other traditional systems of data collection such as aerial photography and surveying. The struggle against pollution obviously largely benefits from this new source of visual and numerical data which are both quantitative and qualitative in addition to being exhaustive, analytical, localized and continual.

The Blue Plan fascicle on "Mediterranean Forests" underlines the benefits of remote sensing in this area. The main subjects for study using this new technology include:

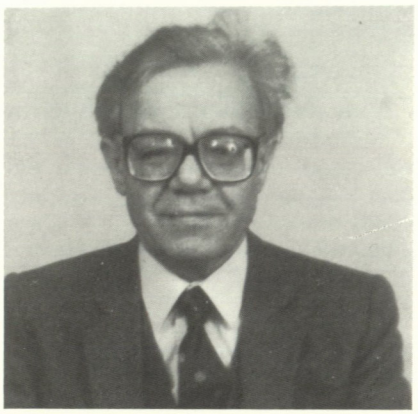
- maps and areas of major species and forest zones;
- relative importance of the phytomass, evapotranspiration approach;
- monitoring of zones affected by fire: damage caused and regeneration;
- assessment of the effects of natural disasters, frost, drought, landslides, etc.
- help in identifying forest zones to be protected;
- contribution to impact assessment.

Remote sensing enables the carrying out of periodic detailed inventories and ongoing appraisal of widespread and/or little known areas at reasonable cost. Such inventories have been possible for several years using the Landsat and Spot satellites. In this connection, the EEC - a member of MAP with the same status as Mediterranean countries - launched a project entitled "Land Cover" with contributions from member States within the framework of the CORINE programme (gathering and co-ordination of information on the state of the environment and natural resources in the Community) decided upon in June 1985. The collection of reliable information on land use is one of the priorities. Portugal was the first country to have an inventory, followed by Spain and the South of France. The inventory is on a scale of 1/100,000. In future, it will ensure harmonization of the data on member States. The CORINE programme will be integrated within the European Environment Agency and will become one of its main components.

BATHING IN THE MED BECOMES SAFER

Ten to fifteen years ago, many people who bathed in a number of Mediterranean resorts, especially near the larger cities, became ill. Thanks to tighter control measures and improved monitoring techniques, the situation is much better today.

Louis Saliba



Dr Louis Saliba was born in Malta in 1935 and graduated in Biology from the University of Malta and the University of London, UK. Between 1959 and 1981, he occupied various positions in the Ministries of Agriculture and of Health, and in the University of Malta. Since January 1982, he has been Senior Scientist in the MAP Co-ordinating Unit, responsible for the implementation of the WHO components of the Programme.

Municipal effluent contains a large amount of bacteria and viruses. When discharged into the sea, most of these die after variable lengths of time but some, especially viruses, are relatively resistant to seawater. When raw sewage is discharged regularly in the vicinity of bathing beaches, the pathogenic micro-organisms in it can affect bathers, who contract diseases either through ingestion of polluted seawater, or even by contact with it. When beaches are overcrowded, pathogens released into the water, as well as onto the beach, are added to those already present, and increase the health risk.

In the Mediterranean, a large amount of sewage is still being discharged into the sea in the raw untreated stage. However, during the last ten years, several sewage treatment plants have been installed in coastal areas and the number is continuously increasing. In addition to this, long submarine pipelines taking the sewage out to sea are gradually replacing the old structures, from which sewage used to be discharged immediately on the coastline itself, sometimes from multiple points. With such outfall structures, many of which extend more than 1 kilometre out to sea, even if the sewage is discharged without treatment, it is considerably diluted by the time it reaches the coastline and any pollution of bathing areas becomes much less.

Within the framework of the Mediterranean Action Plan, the World Health Organization has been busy for the last few years developing a set of guidelines for Mediterranean States to ensure the maximum possible prevention of pollution by sewage at source. These guidelines include the factors and conditions under which authorizations by national and local authorities for the discharge of liquid wastes should be granted, the establishment of submarine outfall structures for small and medium-sized coastal communities, and treatment requirements for industrial effluents. Although most of these guidelines are practically ready for widespread distribution among Mediterranean States, actual implementation of measures by national and local authorities will take time and money.

POLLUTION MONITORING

The only way of determining the quality of coastal waters, and their state of pollution, is by regular monitoring, the results of which can be utilized both to take any such immediate measures in particular areas as the situation may demand, and, when correlated with onshore activities, to determine causes, and the results of any longterm remedial measures in force. In all the various aspects of marine pollution monitoring, the oldest and most extensive is microbiological monitoring of bathing waters, which in many Mediterranean countries forms, or used to form, part of regular public health programmes.

Microbiological monitoring of coastal recreational waters has, from the beginning of the operation of the MED POL Programme in 1975, formed a strong component of the Programme. During the first phase of MED POL (1975-1981), the WHO/UNEP pilot project on coastal water quality control in the Mediterranean, organized and implemented by the former, involved 30 laboratories in 15 Mediterranean countries, and provided a very good framework for the upgrading (and establishment where necessary) of national programmes. During the current phase of MED POL, operational since 1982, all national programmes falling under its aegis include a strong microbiological component with the emphasis on bathing waters.

Although determination of concentrations of micro-organisms in seawater is sometimes considered simple in comparison with determination of chemical parameters in marine matrices, which normally require relatively sophisticated instrumental methodology, the actual process of obtaining accurate results on the basis of which decisions on water quality and its relation to health hazards have to be taken is relatively complicated, and beset with problems. Practically all the methods in current use were originally developed for analysis of drinking water which, apart from any polluting bacteria from other sources, is microbiologically pure. On the other hand, seawater contains a significant number of naturally occurring bacteria which interfere with sample cultures, often producing false readings. As a possible way of overruning this particular problem, WHO

has developed a number of standard recommended methods for seawater analysis, which include the normal indicator bacteria used for quality determination, and some of the more common pathogens such as *Salmonella, Pseudomonas aeruginosa* and *Staphylococcus aureus*. These methods are all issued as part of the UNEP Regional Seas Series «Reference methods for marine pollution studies». WHO is continually updating these methods in the light of results from microbiological research in the Mediterranean. While continuing to be essentially based on the principles underlying standard international methodology, the methods take account of prevailing conditions in the region.

STANDARD METHODOLOGY

The development of standard methodology for microbiological analysis of seawater is not an easy task. There are two internationally recognized methods for analysis of the three main bacterial indicator organisms (total coliforms, faecal coliforms and faecal streptococci) used for determining the degree of pollution by sewage: the Membrane Filtration Culture (MF) method and the Most Probable Number (MPN) method. The use of these methods in the Mediterranean is divided approximately 50-50 between the various countries, where microbiologists prefer either one or the other. Each method has its advantages and disadvantages. Perhaps more important, they are not completely comparable and the acceptability of a beach for bathing on the basis of prescribed numerical standards could very well depend on which of the two methods of analysis is utilized. To fit in with country preferences from this viewpoint, WHO has developed double methods for indicator organisms, one set using the MF technique and the other the MPN technique. Both are geared to Mediterranean conditions, but the question of comparability still remains.

Another problem is that of actual pathogens present in seawater. As determination of pathogens themselves would be difficult and costly as compared to bacterial indicators and, in the case of viruses, beyond the capability of a large number of laboratories, these indicators are the ones normally measured on a routine basis. The concentration of these provides a reasonable assessment of the degree of sewage pollution, but correlation with the presence and density of actual pathogens still has to be firmly established, especially in the case of viruses, which survive much longer in seawater than the indicator bacteria. The results of a number of research projects on this topic have provided valuable data on this point, but much still remains to be done.

QUALITY CONTROL AND INTERCALIBRATION

Whatever the methodology in use, good decisions can only be taken on the basis of (a) accurate results based on high-quality sampling and analytical procedures, and (b) equally accurate scientific interpretation of such results.

During the first phase of MED POL, microbiological equipment and expendable materials were supplied by WHO to participating laboratories. All items were standard, to ensure that all laboratories were using identical apparatus and culture media. The pilot project did not, however, contain an intercalibration element. In the case of microbiological samples, deterioration precludes the distribution of prepared samples used with intercalibration exercises for chemical pollutants. Following the start of the long-term phase of MED POL in 1982, six intercalibration exercises were organized by WHO between that year and 1985. These were held in Rome (November 1982), Barcelona (November 1983), Athens (June 1984), Tunis (November 1984), Split (April 1985) and Marseille (November 1985). A total of 139 microbiologists from 16 Mediterranean countries attended these exercises, in each of which approximately 20 participants analyzed the same samples with identical materials in the same laboratory, and compared results. At a very early stage in the series, it was recognized that one of the major factors leading to variation was the difference in experience among each group of participants.

The situation was very carefully reviewed after 1985, and the conclusion reached was that the large increase in the number of Mediterranean laboratories engaged in the microbiological monitoring of coastal recreational waters was not being accompanied by a similar increase in trained manpower. In a number of laboratories, particularly the new ones, personnel still required experience and, in many cases, even basic training. As a result, it was decided that WHO should organize short intensive training courses in microbiological methods, designed for relatively young scientists working in MED POL who had already received basic microbiological training, but required familiarization with specific seawater techniques.

As a result, training courses were commenced in May 1988 in Athens with 18 participants from 10 Mediterranean countries. The course was held in English. The second course was held in French in Tunis in October 1989, with 22 participants from 6 Mediterranean countries, and the third, in English, in Malta in September 1990 with 22 participants from 9 Mediterranean countries. The fourth course, in French, will be held at the Institut National d'Hygiène in Morocco during October 1991. Although the emphasis in this series of course is on training, with laboratory exercises supplemented by relevant lectures, an intercalibration component has been retained, and the results obtained by participants are reviewed and analyzed at the end of each course.

CONCLUSIONS

In very general terms, bathing in most parts of the Mediterranean Sea is considered to be safer today than was the case ten years ago, mainly as a result of the progressive measures being undertaken in the various countries to control pollution by sewage at sources, together with the greatly increased emphasis on regular monitoring to provide a continuous indication of quality and to enable remedial action to be taken as necessary. However, there are still a number of major problems to be tackled, including training of laboratory personnel to enable the production of high-quality data, more research on methodologies to produce good indicator/pathogen relationships and last, but not least, properly conducted microbiological / epidemiological studies to provide the link between water quality, as expressed in terms of its microbiological content, on the one hand, and health effects, in terms of actually recorded data on exposed population groups, on the other hand.

VIRUSES IN SEA WATER: A RISK DIFFICULT TO DEFINE

The assessment of the state of pollution of the Mediterranean Sea by pathogenic micro-organisms, prepared by the Co-ordinating Unit in co-operation with the World Health Organization, was considered by the Joint Meeting of the two Committees held in Athens from 6 to 10 May 1991. Together with a series of measures, it will be submitted to the Cairo meeting next October for adoption by the Contracting Parties. The assessment throws light on the most recent developments regarding certain micro-organisms other than bacteria such as toxic algae, fungi (particularly in sand on beaches) and viruses. The latter pose a special problem due to their very nature. The word "virus" covers a number of specific pathogenic agents which cannot be cultivated in an artificial medium and can only reproduce in living cells as parasites. They take the form of such minute particles that they pass through normal bacteria filters and are invisible under an optical microscope.

Viruses, like bacteria, are excreted in the faeces and/or urine of infected humans, whether or not they themselves have pathological symptoms. They belong to several different groups of which the best known are the enteroviruses (polioviruses, coxsackieviruses, echoviruses and hepatitis A virus), reoviruses and adenoviruses. The presence of polioviruses is the result of the oral vaccination campaigns against paralyzing poliomyelitis, which use a living but attenuated virus. All these viruses are found in urban sewage discharged into the sea, often close to bathing areas. However, sewers are not the only channel of transmission. Seawater is also contaminated by tiny airborne drops and particles that contain viruses. Bathers are another source and, if they themselves are carriers of viruses, they can transmit viral diseases to other bathers who happen to swallow sea water or have an open wound (broken skin on the body or in the mouth, etc.) which is infected through contact with the contaminated water. Although epidemiological studies on this subject have not been able to establish a clear link between swimming in polluted water and viral epidemics (which occur in summer), there is a risk and it needs to be studied by scientists and scientific organizations in the future.

THE ROLE OF SEAFOOD

Despite the lack of precision in the above area, the role of shellfish as vectors of human enteroviral diseases is well documented. This is the case for hepatitis A and gastroenteritis transmitted by the Norwalk virus, which appear to be of the most concern in the area of public health. A study carried out in Frankfurt, Germany, showed that 19% of the cases of hepatitis A in the city affected persons who had eaten oysters and mussels on the Mediterranean coast. In Greece, scientists isolated the hepatitis A virus and antigen in shellfish from polluted waters. The main difficulty is that depuration of shellfish, even when correctly implemented, is not enough to eliminate the virus, and environmental quality criteria will probably have to be reviewed in the future. It is well known that shellfish - like mussels - feed on suspended particles and, when viruses become associated with these particles, their survival capacity increases considerably and the potential for interaction with local marine organisms intensifies.

COMPLEX PROCEDURES

Diagnosis of a viral infection involves isolation of the virus, detection of the viral antigen or study of the immune response. Aetiological diagnosis is facilitated if the virus is isolated or detected by an electron microscope and by a fluorescence microscope in the diseased tissues. In many Mediterranean countries the necessary diagnostic equipment is not routinely available and it is thus difficult to assess the extent of viral disease in the region. The long and costly process of identification can only be undertaken within the framework of specific research programmes. Studies so far carried out show that viruses can survive for long periods in the sea, particularly in sediments, and they can also travel long distances. According to a survey carried out in the United Kingdom, viruses can remain in the sea for several months in an infective state and at detectable levels, thereby underlining the inadequacy of bacterial indicators as a way of monitoring pollution by micro-organisms. In addition, experiments carried out recently in the Adriatic Sea showed that some algal species adsorb viruses and reduce their detectable infectivity, but that the viruses adsorbed could still be infectious when returned as free viruses. The unicellular algae responsible for the algal blooms ("red tides") therefore serve as a vector for the transmission of viruses to bathing and shellfish-growing areas. The epidemiology of viruses linked to swimming or the consumption of seafood contaminated by polluted seawater is complicated by the fact that only global data on morbidity are generally available and the diseases caught, even when correctly identified, may have been caught by means other than direct or indirect contact with seawater (drinking water, etc.). Current epidemiological methods are not sufficiently sensitive to allow efficient detection of the transmission of viral disease by seawater - molluscs and shellfish - since clinically observable disease is only found among a small number of those infected. At present, there are no viral diagnostic methods for all the presumed aetiological agents of gastroenteritis. In most cases, the diagnosis of a viral infection is reached "through elimination", when it has not proved possible to detect the usual easily identifiable bacteria and the symptomatology and inefficacy of traditional anti-infectious treatment by antibiotics and sulphamides leads to the probability of a viral aetiology. Viruses cover a wide spectrum of symptoms and clinical signs, from meningitis, encephalitis, fever, rashes, and diarrhoea, to respiratory disease and eye infection,

cardiovascular infections and paralysis. Until new unequivocal scientific conclusions allow the provisional criteria on bathing waters adopted jointly in 1985 to be made more binding and detailed - which will undoubtedly take some time - the Joint Meeting of the Committees approved as an immediate measure the recommendation that new microbiological studies within MED POL should focus as a priority on the epidemiology, pathogenicity and survival of viruses in seawater and shellfish and on their resistance to sewage treatment and to depuration techniques. Large quantities of molluscs and shellfish are cultivated and harvested in the Mediterranean region and are consumed on the spot by local populations and tourists (approximately 12,000 tonnes annually in Mediterranean countries as a whole). Since this production is on the increase, it calls for the establishment of a more rigorous health policy on prevention based on indisputable scientific data.

THE GEF: A NEW MECHANISM TO HELP DEVELOPING COUNTRIES PROTECT THE ENVIRONMENT

In November 1990, a new structure to help protect the environment was set up in Paris by representatives of a group of industrialized and developing countries: the Global Environment Facility (GEF). It is a three-year pilot programme providing grants and low interest loans to developing countries to help them carry out programmes to relieve pressures on global ecosystems. The US$ 1,5 billion fund supports international environmental management and the transfer of environmentally benign technologies. The goals assigned to the GEF are all critical to the management of emerging planetary problems. They include:

- reducing and limiting emission of greenhouse gases which cause global warming;
- preserving the earth's biological diversity and maintaining natural habitats;
- arresting the pollution of international waters;
- protecting the ozone layer from further depletion.

Donor countries recognize that industrialized countries must assist developing countries' efforts to sustain fragile ecosystems. More than 20 countries, five of them from the Mediterranean (Egypt, France, Italy, Spain, Turkey) have contributed to the GEF, and other nations are expected to participate in the future.

The participating countries have requested the World Bank, UNDP and UNEP to create a tripartite cooperative means of implementing the GEF. The GEF trust fund is administered by the World Bank, while UNEP provides scientific and technological guidance in identifying and selecting projects. UNDP co-ordinates and manages the financing and execution of pre-investment and technical assistance activities.

To qualify for financial support from the GEF, both the beneficiary country and the project itself must meet strict criteria. To be eligible, developing countries must have a per capita GDP at or below US$ 4,000. Basically, GEF grants and low-cost loans should support a country's programmes and activities which, while they benefit the environment of the world as a whole, would not otherwise be economically viable for that country. The GEF complements, but does not replace, action under existing programmes to achieve its objectives.

The recipient of GEF funds, whether a government, NGO or specialized agency, will have primary responsibility for making the project work.

A meeting of the countries participating in the GEF was held in Washington on 1 and 2 May 1991. Its objective was to review the GEF's work programme for 1991, including 15 environmental protection projects that will cost US$ 214 million and 11 technical assistance proposals totalling US$ 59 million.

Two projects for the Mediterranean region were selected for approval:

- El Kala National Park (Algeria), under the biodiversity component, with an amount of US$ 12 million from the GEF and US$ 30 million from the World Bank;
- the Regional Screwworm Control (North Africa), with an amount of US$ 9 million.

The first projects are expected in 1991. This will enable experience of the GEF's operations to be shared at the United Nations Conference on Environment and Development in Brazil in June 1992.

PREPARATIONS FOR THE SEVENTH ORDINARY MEETING OF THE CONTRACTING PARTIES IN CAIRO

The Joint Meeting of the Scientific and Technical Committee and the Socio-Economic Committee (Athens, 6-10 May 1991)

This Meeting had before it a very heavy agenda. Taking place only five months before the Seventh Ordinary Meeting (Cairo, 8-11 October 1991), it had to review the programme budget for 1992/1993, as well as the recommendations to be put before the Contracting Parties in Cairo.

Among the recommendations was a series of common measures for four groups of substances for which an assessment of the state of pollution in the Mediterranean Sea has been formulated: organophosphorus compounds, persistent synthetic materials (both those that float and sink), radioactive substances and pathogenic micro-organisms. The adoption of these measures at Cairo will further strengthen the mechanism (quality and emission criteria) already implemented jointly since 1985.

As far as MAP's legal component is concerned, the Contracting Parties will have to take decisions on two draft texts: the Offshore Protocol (for which a further meeting of experts on 4 and 5 October will consider the annexes and pending issues) and Annex IV to the Land-Based Sources Protocol concerning airborne pollution from land-based sources.

In addition to carrying out preparatory work for the Cairo meeting, the Joint Meeting also provided an opportunity to review a number of recent developments and to look to the future. Turkey, for example, announced that the possible accession of the Black Sea countries to the Barcelona Convention - with the legal implications this might have entailed - was no longer envisaged as the four Black Sea countries had drawn up draft texts of a Convention and three Protocols analogous to those in force in the Mediterranean.

The USSR, Romania, Bulgaria and Turkey (which is also party to the Barcelona Convention in its capacity as a Mediterranean State) have therefore embarked upon a process parallel to MAP for the Black Sea, which also faces considerable pollution problems. Arrangements to allow co-operation between Mediterranean and Black Sea States are being examined in the context of the UNEP Regional Seas Programme (OCA/PAC in Nairobi). The Joint Meeting invited the representative of Turkey, as a "dual member", to make available to the Cairo meeting relevant information on developments with regard to the Black Sea.

The MAP Co-ordinator, Mr. Aldo Manos, informed the meeting that, on 29 April 1991, an Agreement on SPA/RAC had finally been signed in Tunis between Tunisia and UNEP. The difficulties that had momentarily paralyzed the activities of this important MAP component had therefore been resolved and participants in the Joint Meeting welcomed with satisfaction the official signing of the host country agreement.

The observer for the European Environment Bureau (EEB) announced that a meeting of Mediterranean NGOs would be held in Athens in November 1991. It would be organized by the EEB in collaboration with UNEP, other United Nations organizations and the EEC, with the objective of preparing a Mediterranean contribution to the Paris meeting of December 1991 (which would bring together NGOs from all over the world) and the 1992 Conference in Brazil. United action by NGOs serves to underline the important role they play in protecting the Mediterranean environment. Mediterranean States already officially recognized this role at their Sixth Ordinary Meeting in 1989.

Finally, Mr. Manos informed the meeting that MAP had received a message from the Albanian Minister for Foreign Affairs in which the Albanian Government expressed support for the new coastal areas management project for Albania. The representative of Albania attending the Meeting stated that since his country had become a Contracting Party it had received valuable assistance from MAP and PAP/RAC in studying and assessing the environmental situation in Albania's coastal regions. The Meeting approved the initiation of a coastal areas management project for Albania.

Tributes by delegates to Mr. Manos

The Joint Meeting of the Committees from 6 to 10 May was the last in which Mr. Aldo Manos took part in his capacity as Co-ordinator of the Mediterranean Action Plan. At the closing session, all participants took the floor to pay warm tribute to Mr. Manos. In the words of the Meeting's report, they "acknowledged the skill, intelligence, tact, realism and dignity with which Mr. Manos had discharged his functions. As a Mediterranean born and bred he had placed his outstanding talents unstintingly at the service of the interest of the region and, above all, its environment. During his stewardship he had displayed the judicious balance of diplomacy and firmness that had been largely responsible for the present stature of the Action Plan and its diversified activities".

The World Bank and MAP/UNEP hold a meeting on co-operation in the Mediterranean

A meeting was held on 17 June 1991 at the Unit's offices in Athens among three representatives of the World Bank, the Director of OCA/PAC in Nairobi (UNEP) and the Officer-in-Charge a.i. of the MAP Co-ordinating Unit. The objective of the meeting was to review co-operation activities among the Mediterranean Technical Assistance Programme (METAP), the World Bank and MAP, and to discuss possibilities for future co-operation. Three activities currently receive Bank support:

- strengthening of institutional capacities within the framework of the MED POL programme on pollution monitoring and research;
- the Coastal Areas Management Programme (Kastela Bay and the Island of Rhodes);
- conservation of biodiversity.

Consideration was given to pursuing co-operation in the three above-mentioned areas during the period 1992-1993 and to initiating and developing co-operation in the following fields:

- contingency plans for oil pollution;
- port reception facilities;
- sewage treatment and disposal for coastal cities.

Representatives of the World Bank expressed their intention to play an active role in the forthcoming Seventh Ordinary Meeting of the Contracting Parties in Cairo.

THE MEETING OF THE BUREAU OF THE CONTRACTING PARTIES (Paphos, Cyprus, 16-17 July 1991)

The meeting of the Bureau in Paphos gave participants the opportunity to review developments in MAP for the last time before the Ordinary Meeting in Cairo. Financial matters were high on the agenda of the Bureau and it examined the report by the financial experts on the effects of inflation and fluctuations in exchange rates on MAP's budget. It was proposed that the Cairo meeting should, when appropriate, establish an *ad hoc* Committee to report to the plenary on this question.

Mr. L. Jeftic, Officer in Charge of the Co-ordination Unit following the departure of Mr. Manos, provided information on co-operation among Black Sea countries and it was decided that the Secretariat should invite the latter to participate in the Seventh Ordinary Meeting as observers. The provisional agenda for the Seventh Ordinary Meeting was also considered and, after making some minor changes, the Bureau approved it.

With regard to the "Adriatic Initiative", Mr. Butini, representative of Italy and

Vice-President of the Bureau, informed the meeting that, on 13 July 1991, at Ancona, Italy, the Ministers for Foreign Affairs of Albania, Greece, Italy and Yugoslavia, together with the member from the Commission of the European Communities, had signed an "Adriatic Sea Declaration", which established an environmental co-operation project at the sub-regional level. In this declaration, the four signatory countries and the EEC committed themselves *inter alia* to implementing the principle of the precautionary approach, in other words, to take effective measures to avoid the potentially prejudicial impact of hazardous substances and toxic waste when there is reason to believe that damage or harmful effects on marine ecosystems, particularly in environmentally sensitive areas, could be caused by these substances. They also agreed to meet at regular intervals and at an appropriate level in order to monitor the progress made in implementing all the measures already adopted to protect the Adriatic Sea's environment and to decide upon further joint measures. This revival and strengthening of co-operation in the region where, for a number of years, there have been disturbing pollution phenomena - for example, eutrophication and "red tides" - underline the political determination to act without delay on this matter.

Finally, Mr. Butini also announced that Italy had offered to host the next Mediterranean Water Conference in Rome in May 1992 and he proposed that it should be held under the auspices of MAP.

Members of the Bureau also further discussed the perspectives opened up within MAP by remote sensing (see the dossier on this subject in this issue).
They thus confirmed the renewal of interest aroused by these new environmental monitoring technologies on the very day that Ariane launched the first European remote sensing satellite into orbit (17 July 1991).

ECHOES OF MEDITERRANEAN COUNTRIES

FUTURE COURSES AND SYMPOSIUMS

Workshop on Energy and the Environment, 9-15 November 1991, Tripoli, Libya

The Workshop will focus on various aspects related to the impact of energy production and consumption on the environment. Organized under the auspices of the International Energy Foundation, UNDP and the Municipality of Tripoli, it will include technical and plenary sessions, an exposition, short courses and field trips. (Enquiries to the Workshop on Energy and the Environment, International Energy Foundation, P.O. Box 83617, Tripoli, Libya). Libya is making considerable efforts in environmental information and training and will also be holding in May 1992 the "First Exposition for New and Renewable Energy Equipment" (Enquiries to the same address).

Workshop on the setting up of a Fund to support the establishment of Port Reception Facilities in the Mediterranean Malta, 19-22 November 1991

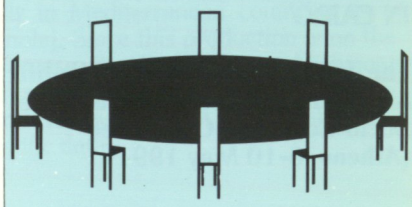
The proposed Workshop will discuss the requirements for setting up such a fund, and the manner in which such a concept would benefit Mediterranean costal states in protecting their marine environment from ship generated involved will also be discussed so as to enable the necessary recommandations ot be made at a regional level. The Workshop is being organised within the framework of the Clean Seas '91 Conference and Exhibition which is being organised in Malta on 19-22 November 1991 by the Mediterranean Oilfield Services Co. Ltd. on behalf of the Ministry of Maritime and Offshore activities of the Government of Malta.

The organisation of the Conference of Clean Seas '91 is being coordinated by the Foundation for International Studies and the Euro-Mediterranean Centre on marine Contamination Hazards (for further information, please contact: Euro-Mediterranean Centre, University of Malta, St. Paul Street, Valetta, Malta, tel: 224067).

BOOKS MAGAZINES

"OUR PLANET". Issue no. 2 of 1991 of the magazine of the United Nations Environment Programme opens with an editorial by Mr. Aldo Manos, Co-ordinator of the Mediterranean Action Plan until 1 June last. Shane Cave has written a well-documented article on tourism in the Mediterranean, laying emphasis on the Blue Plan scenarios. One section of the article highlights the Mediterranean Action Plan, while another draws attention to the dangers threatening the wild flora and fauna and a map shows the over-population of the Mediterranean coastline during the summer season.

"WORLD DEVELOPMENT", the magazine of the United Nations Development Programme, contains an article by Emma Robson on soil erosion in Tunisia. After describing the devastation caused by progressive desertification in Tunisia (10 to 15,000 hectares are lost each year), she goes on to explain the strategy of a new campaign to restore the soil, based on promoting awareness among farmers and training them in conservation techniques.



MAP CALENDAR

Meeting of Experts on Offshore Protocol	4-5 October Cairo Egypt
Seventh Ordinary Meeting of the Contracting Parties to the Convention for the the Protection of the Mediterranean Sea against Pollution and its related Protocols	8-11 October Cairo Egypt
Intercalibration and training course on microbiological methods for marine pollution monitoring	21-26 October Rabat Morocco
Training course on Harmful Substances	21-26 October Malta
Meeting of Arab Experts on Methodology of rehabilitation of historic Settlements	27-30 October Tripoli Libya
Consultation Meeting on MEDPOL data processing programme and guidance for future work	November Athens

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