Our Planet—Our Health

Louis J. Saliba

Making the Mediterranean safer

The coastal states of the Mediterranean are striving to reduce marine pollution, a significant threat to health.

The 18 countries bordering the Mediterranean Sea have a population of around 350 million people, of whom 135 million live in the coastal zone; in addition, approximately 100 million tourists visit the Mediterranean region annually. Tourism normally peaks between May and September and is concentrated in the coastal areas. During this period, bathing beaches are heavily overcrowded and there is a high consumption of fish and other seafood by both local people and tourists. There is also a high incidence of gastrointestinal and other diseases.

The sea is one of the main socioeconomic resources of the Mediterranean region. About 20 years ago, bathing in the Mediterranean began to be associated with various diseases and disorders affecting not only the gastrointestinal tract (such as cholera, typhoid and enteroviral diseases) but also the skin, eyes, ears and upper respiratory tract. Furthermore, the former types of disease became linked with the consumption of raw seafood, especially where epidemics occurred.

This situation, together with the reduction of fish populations and the disruption of marine ecosystems, became a matter of concern throughout the region. Marine pollution was adversely affecting both tourism and seafood production, and there was fear that a major oil spill might occur at sea. During the period 1971–75 there were many calls for concerted action to improve matters, which led to an expansion of research on marine pollution in several Mediterranean countries, a collaborative attempt to control pollution at the municipal level, and the conclusion of bilateral and multilateral agreements on the protection of the marine environment. An increased interest in the Mediterranean area was taken by several United Nations agencies, the Commission of the European Communities, the Council of Europe, and other bodies. Finally, the Mediterranean Action Plan, a multi-agency enterprise coordinated by the United Nations Environment Programme (UNEP), was adopted by practically all Mediterranean states in 1975.

Where pollution comes from

Other than the floating garbage that litters much of the coast, perhaps the most visible form of pollution in the Mediterranean is...
oil. Slicks of small to medium size are frequently left by oil tankers. However, 80–85\% of the total amount of pollutants entering the Mediterranean comes from land-based sources. Municipal wastes from coastal population centres, including tourist complexes, are discharged directly into the sea, very largely without having been treated. Industrial wastes may be discharged in a similar manner or may reach the sea from inland locations through rivers, canals, and the atmosphere. The intensification and mechanization of agriculture have led to the increased use of pesticides and fertilizers, a certain proportion of which reaches the sea indirectly through rivers and the atmosphere.

A survey conducted in 1976 and 1977 indicated that the annual pollution load entering the sea directly from the coastal zone or in rivers included 320 000 tons of phosphorus, 800 000 tons of nitrogen, 60 000 tons of detergents, 12 000 tons of phenols, 100 tons of mercury, 3900 tons of lead, 2400 tons of chromium, 21 000 tons of zinc, 90 tons of organochlorine pesticides and 120 000 tons of mineral oils (1). In addition, thousands of tons of chemicals, mainly pesticides, reach the sea via the atmosphere. The location of the major industrial areas along the Mediterranean coastline is shown in the figure.

Health effects

Humans are exposed to marine pollutants mainly through the consumption of fish and other seafood, the ingestion of sea water while swimming or bathing, and direct contact with sand or sea water. Exposure to bacterial or viral pollution produces relatively short-term effects in both local people and tourists, the latter being generally the more susceptible group. Exposure to chemical pollutants has relatively long-term effects, except where gross contamination occurs, local people being affected more than tourists.

The consumption of seafood contaminated with sewage has caused many outbreaks of gastrointestinal disease. The most important pathogens ingested with shellfish include *Salmonella*, pathogenic *Escherichia coli*, *Vibrio* (including the causative agent of cholera), enteric viruses, *Campylobacter*, *Shigella*, *Yersinia*, and *Aeromonas hydrophila*. The probability of infection during bathing is low, except with *Aeromonas* and certain *Salmonella*. The principal contact pathogens transmissible through bathing include staphylococci, which cause a wide range of infections, *Pseudomonas aeruginosa*, increasingly implicated in ear, throat and skin infections, and pathogenic fungi, most of them also transmissible through contact with sand on beaches (2).

The main health hazard arising from the industrial pollution of sea water is associated with the consumption of seafood. The toxicity of individual chemical pollutants is reasonably well known, but there is much less information on their interactions with each other and between them and naturally occurring substances. Seafood is not generally analysed for chemical pollutants; however, routine monitoring of certain substances is conducted. One of these is
mercury, for which some countries have established maximum acceptable concentrations in various fish and shellfish. Relatively high levels of chemical pollutants in seafood may have no noticeable effect on its smell or taste, and the earliest symptoms of accumulation in the human body are not, as a rule, specific for chemical poisoning. The presence of such pollutants can only be determined through relatively sophisticated clinical and biochemical tests.

Bacterial and viral diseases may affect anybody who eats seafood; diseases caused by contact with sea water or sand may affect bathers; and hazards arising from the consumption of seafood contaminated with chemicals mainly affect local population groups and individuals whose diet contains relatively high proportions of the affected produce. It is important to ascertain the extent of these problems, especially that of contaminated seafood, so that remedial action can be taken.

Prevention and control

The mobile character of the sea makes marine pollution a matter of international concern. The earliest approach to joint specific conditions of the area demanded a strategy separate from the overall global one then under discussion. Between 1972 and 1974 the states held a number of conferences aimed at developing an anti-pollution convention; similar meetings were organized independently both by United Nations agencies and private bodies. Environmentalist groups, both within and outside the region, pressed for remedial action. In 1975 a comprehensive action plan was prepared jointly by various United Nations agencies and submitted to the coastal states. The Mediterranean Action Plan has been operational since that time.

The Mediterranean Action Plan

The Convention for the Protection of the Mediterranean Sea against Pollution is supported by protocols covering the dumping of wastes at sea, cooperation in pollution emergencies, pollution from land-based sources, and specially-protected areas; other protocols are being prepared. The protocol covering land-based pollution is regarded by the countries concerned as one of the most important components of the Plan.

The Long-term Programme of Pollution Monitoring and Research in the Mediterranean Sea has been operational since 1982. It provides information needed for the development and implementation of preventive and control measures. The scientific work is done by laboratories in the Mediterranean countries. At the end of 1987 nearly 100 institutions were performing regular monitoring for the programme, and 125 research projects were in progress. During the last four years the research component has been orientated towards the implementation of the protocol on pollution from land-based sources.
An intersectoral prospective study aims to provide the states with data enabling them to combine socioeconomic development with environmental conservation. Complementary to this programme are subregional projects in water resource management, aquaculture, renewable energy, human settlements, tourism, and soil protection, where the state of existing knowledge is sufficient to justify concrete practical action.

Since 1979 the Plan has been financed mainly by the governments of the region and by the EEC, which contribute to a special fund. Furthermore, contributions in cash, services and kind are provided by various United Nations specialized agencies and there is support from the countries hosting the coordinating unit and the regional centres.

WHO implements the health-related aspects of the programme. These mainly concern pollution monitoring, studies on the health effects of contaminated sea water and seafood, the development of quality standards, and the preparation of guidelines for waste management.

**Preliminary evaluation**

In the more developed countries, legislation on the prevention and control of marine pollution has been consolidated and is being more strictly enforced. In other countries, basic laws have been enacted, some of them fairly comprehensive. In many instances their enforcement has involved establishing new structures and providing laboratory facilities and trained personnel. Perhaps the most encouraging sign is the environmental awareness now widely evident among decision-makers.

In several countries, activities aimed at protecting the marine environment were in progress long before the Action Plan came into being, and today they are continuing on an ever-increasing scale. Agreements largely concerned with collaborative research and the assessment of marine pollution have been signed between Italy and Yugoslavia, between France, Italy and Monaco, and between Greece and Italy.

Certain global programmes have contributed to environmental improvement in the region, as have those activities of the EEC, the Council of Europe, and other intergovernmental organizations which have been directed specifically at the Mediterranean area. The Mediterranean Action Plan has, however, been the only instrument bringing practically all the countries of the region together. The establishment of a forum for national decision-makers has done much to catalyse action. Moreover, the Action Plan is the only programme in the Mediterranean in which all the main organizations of the United Nations system are working together.

**Coastal water quality control**

The most frequently used recreational beaches are located in or near densely populated areas, and consequently the majority of them are directly affected by municipal sewage. In some areas,
recreational beaches have been under regular sanitary surveillance for several years, normally within the framework of public health programmes. The enforcement of standards is variable, but compliance is gradually improving and the monitoring of the quality of coastal water is becoming better organized. In countries where standards for the microbiological quality of bathing waters were not previously enforced, monitoring programmes are now in various stages of operational development.

The countries jointly adopted interim environmental quality criteria for bathing waters in September 1985, with the proviso that any country that already had established standards would continue to apply them while making a comparative study between them and the agreed standards. In order to develop and apply common quality standards it is necessary to create an appropriate infrastructure in those countries not previously possessing one. This involves considerable investment, particularly when the standards can only be met by controlling pollution with municipal sewage at source if popular bathing beaches are not to be closed. Countries already possessing standards are reluctant to alter them for legal and other reasons. The situation is particularly difficult where countries are bound by the standards of international organizations such as the EEC. Furthermore, new standards may require modification of sewage works and of pipelines taking sewage out to sea, again at considerable expense.

It remains to be ascertained whether present standards adequately protect the health of the bather. The overcrowding and long exposure times on Mediterranean beaches demand stricter anti-pollution standards than in more temperate zones. The variety of diseases and disorders affecting bathers in the Mediterranean raises some doubts as to the validity of current standards.

For the last five years, microbiological and epidemiological studies have been performed in various areas to try and correlate water quality with health effects. Current water quality standards are based on concentrations of bacteria indicative of pollution with sewage. There is strong epidemiological evidence linking concentrations of bacteria derived from sewage with the main gastrointestinal diseases (3). The evidence of correlation with diseases and disorders of other parts of the body, particularly the eyes, ears, nose, skin and upper respiratory tract, is more controversial. Most studies have included the analysis of a wider range of bacteria in

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The question arises as to whether there is a real prospect of success in the attempt to get 18 diverse countries to agree to common standards for microbiological parameters, when even the methodologies utilized differ within the region. A better approach might be to develop common guidelines and to encourage each country to work out the details according to its particular situation.
only be made safe if sources of pollution are removed through adequate treatment and disposal methods.

**Shellfish pollution**

The most likely cause of gastrointestinal diseases in the region is the consumption of raw shellfish that are contaminated with bacteria. In 1987, common microbiological standards were agreed for waters in which shellfish are grown or harvested. The laws on the quality of these waters in the main producing countries now actually go well beyond these standards. Furthermore, the collection and consumption of naturally-occurring shellfish, except from authorized areas, is strictly forbidden in most countries because of the health risks.

**Mercury**

In 1987, emission standards were adopted for mercury discharges into the Mediterranean. However, a considerable amount of the mercury in the sea originates from natural sources.

Analyses of mercury levels in Mediterranean fish and shellfish between 1976 and 1981 suggested that there was no risk to human populations at large, as seafood consumption was not generally high. However, in certain areas, particularly coastal fishing villages, some people were probably at risk because of their relatively high fish consumption.

A pilot study was conducted in Greece, Italy and Yugoslavia (4), in which mercury levels were determined in seafood and in the hair of people consuming it. Areas were selected in which it was known that people were eating more than the average amount of fish and shellfish, and a dietary survey was undertaken to find out the approximate quantities. Most of the hair samples did not contain mercury above acceptable levels. However, abnormally high levels were found in some fishermen who spent a large proportion of the year at sea and whose diet during this time consisted mainly of fish.

A protocol for the conduct of clinical studies on people with high mercury levels in their hair has been devised by WHO, and national institutions are expected to begin putting it to use shortly.

The results of the pilot study are expected to form the basis of further work on the subject both in the same three countries and in other Mediterranean states. There could be an aggravation of the problem since, in some countries, fish-meal is used extensively as a livestock feed. In at least one country, rather high levels of mercury have been detected in poultry meat and eggs.

The health hazard presented by mercury is being tackled through the control of discharges and the laying down of maximum acceptable concentrations in fish and shellfish. Perhaps limits should also be placed on mercury levels in produce intended for conversion into fish-meal. Such measures, however, do not protect consumers of large amounts of fish. These people have to be properly identified and the extent of their exposure assessed so that practical action, particularly in the form of dietary advice, can be taken.

**Other pollutants**

Several other chemicals being discharged into the Mediterranean also accumulate in seafood. However, seafood is not the only vehicle by which chemicals are taken in by man, and even moderate amounts of chemicals, if ingested in addition to those in other foods, could lead to safety limits being exceeded. Control over the amounts reaching the sea would clearly be beneficial.
Other sources would have to be controlled in different ways.

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In 1985 the Mediterranean states issued a declaration specifying targets to be achieved during the second decade of the Action Plan. They include: the establishment of sewage treatment plants in all cities round the Mediterranean with more than 100 000 inhabitants, and of appropriate outfalls and/or treatment plants for all towns with more than 10 000 inhabitants; the assessment of the environmental impact of proposed developments, with a view to ensuring their suitability; measures for reducing industrial pollution and for the disposal of solid waste; and the reduction of air pollution, which may give rise to acid rain and thus menace coastal areas and the marine environment.

References


Manufacturing techniques and accidents

In developing countries, the adoption of heavy industry and the introduction of agricultural machinery have accounted for some of the increase in severe and fatal accidents. Conversely, the increase in the proportion of persons working in service industries rather than in manufacturing may have helped the decline in traumatic injuries documented in developed countries.