REGIONAL SEAS

UNITED NATIONS ENVIRONMENT PROGRAMME

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Thalassogenic diseases

UNEP Regional Seas Reports and Studies No. 79

UNEP 1986

NOTE: The preparation of this review has been commissioned by the United Nations Environment Programme (UNEP) from Professor Hillel I. Shuval, Director, Environmental Health Laboratory, School of Public Health and Community Medicine, Hebrew University, Hadassah Faculty of Medicine, Jerusalem, Israel under Project FP/5102-85-05. The review was commissioned by the Oceans and Coastal Areas Programme Activity Centre of UNEP as an input into the WHO/UNEP Consultative Meeting on the Correlation between Coastal Water Quality and Health Effects (Follonica, Italy, 21 - 25 October 1985) which was convened in the framework of the UNEP sponsored Mediterranean Action Plan.

For bibliographic purposes this document may be cited as:

H.I.Shuval, Thalassogenic diseases. UNEP Regional Seas Reports and Studies No 79. UNEP, 1986.

PREFACE

With the growing concern for the quality of the marine environment the diseases associated with bathing attracted the justified attention of holidaymakers and public health officials. While avoiding bathing in waters polluted by municipal and industrial effluents made undisputable common sense, the public health officials were confronted with the difficult task to define what should be considered as "safe" or "acceptable" quality of bathing waters. Aside from the aesthetic quality of a beach, the health risk associated with bathing was obviously the most important criterion, but it proved to be difficult to obtain statistically significant data linking the quality of bathing waters with the incidence of illnesses which could be directly related to that quality. This led to the variety of national regulations and standards, which were often based more on beliefs and feelings of those who originated them, than on hard scientific evidence.

The Regional Seas Programme of the United Nations Environment Programme (UNEP)[1/] was confronted with the need to provide the Contracting Parties to the numerous regional conventions developed in the framework of that Programme, with a sound, scientifically based advice on commonly acceptable environmental quality criteria which could be translated into national regulations. The definition of criteria for acceptable quality of bathing beaches was among the first priorities.

The review prepared by Professor H.I. Shuval was commissioned by UNEP as a contribution to clarify our present understanding of the problem.

1/ The Regional Seas Programme at present covers ten regions (Mediterranean, Kuwait Action Plan Region, Caribbean, West and Central Africa, Red Sea and Gulf of Aden, South Asian Seas, Eastern Africa, East Asian Seas, South Pacific and South-East Pacific) with more than one hundred and twenty participating coastal States.

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INTRODUCTION

This review shall deal only with those forms of thalassogenic infections[1/] associated with microbial contamination of the sea resulting from the disposal of wastewater into the sea and/or microbial contamination directly from the bodies of bathers in restricted coastal bathing areas. Such exposure to contaminated sea water, containing human pathogens, may lead to infection and disease among bathers who ingest some sea water while bathing. Fish or seafood, particularly bivalves (mullosks) which are found in such water may become contaminated and cause infection in humans who consume such sea products raw, partially cooked, or processed in a way which inadequately inactivates the pathogens. Greater detail of specific thalassogenic infections resulting from the above routes of infection will be presented in later sections.

However, other forms of infection and disease are associated with sea-contact and can cause confusion with the above sources of infections. These can include the following: certain human infections, associated with the consumption of raw or partially cooked fish and seafood are caused by pathogenic microorganisms, such as Vibrio parahaemolyticus and Clostridium botulinum (type E), whose native habitat is the sea (WHO, 1974). Others, less common, are associated with - nemotodes such as Anisakis and Angiostrongylus cantonensis, whose normal hosts are apparently fish-eating mammals, birds and possibly preditory fish. These pathogens can cause disease in man from consuming infected fish or seafood served raw, undercooked, pickeled or smoked (WHO, 1974).

Another category of infections often associated with bathing, may be caused by microorganisms such as Staphylococcus aureas, Clostridium welchi, Pseudomonas aeraginos and Candida Albicans which are often present in man, but may give rise to disease when, the resistance of the individual who harbors them is lowered, as might occur in the case of extended periods of bathing in cold water (Mood and Moore, 1976). These same organisms may also cause infection as a result of being forced into breaks or tears in delicate membranes in the ear or nose resulting from the trauma associated with diving into water. While all the above four species of bacteria may also be found in polluted water, Mood and Moore (1976) caution that the suggestion that a bather suffering from infection with one of these organisms has acquired it from polluted water, "must be treated with reserve, unless there is strong supporting evidence to the contrary".

Other risks to health (although not infections), associated with recreational contact with the sea may be quite serious and include, injury from striking submerged rocks while diving, drowning, and in some areas even fatal attacks by sharks. On the shore-contact side, there is always the danger of severe sunburn and food poisoning from poor food sanitation at beach-side eating establishments and vendors. Another example of a potential danger to swimmers health is the report of erosion of dental enamel among competitive swimmers in a chlorinated pool in Virginia (MMWR, 1983). In this study, 15 per cent of 452 frequent pool swimmers reported symptoms of enamel erosion compared to 3 per cent among 295 infrequent and non-swimmers. The investigators attributed this pathology to extended exposure to extremely low pH of 2.7 in the swimming pool which was chlorinated. Proper procedures to neutralize the acid effects of the gas chlorination were not followed.

1/ Definition of thalassogenic infections: Thalassogenic infections have been defined by Mosley (1974) as human infections whose source is the sea (Greek: thalass = the sea + genesis = source).

GOALS OF REVIEW

The goal of this paper is to present a critical review of the epidemiological studies correlating thalassogenic infections - with the microbial quality of marine bathing waters, shellfish growing waters and shellfish. Such studies are essential to provide an epidemiological basis for establishing a criterion for health risks associated with bathing in marine waters of varying microbial qualities or of eating shellfish grown in marine waters of varying microbial quality. Health effects, recreational water criteria, guidelines, and standards will be discussed in detail later.

Many, if not most coastal beaches, recreational and fishing areas are in the vicinity of urban areas. The disposal of urban wastewater, laden with pathogenic microorganisms, into the sea, in the vicinity of such beaches and fishing areas, has always been of some concern to public health authorities as a possible route of infection, either by exposure of bathers to pathogens of wastewater origin at bathing beaches, or exposure of fish and shellfish to those same pathogens in fishing and shellfish growing areas. Attempts to control or regulate such risks may be by reducing or removing sources of pollution and by treatment of wastewater prior to sea disposal. Such engineering control measures usually require some sort of environmental achievement guideline or standard to enable designers to aim for a defined goal in reducing pollution. As a result, marine water quality standards have been developed.

Such standards have at times been based on pragmatic engineering and economic considerations, such as technical feasibility or attainability, or on visual esthetic considerations. However, it is the purpose of this review to evaluate the epidemiological basis for establishing quantitative microbial guidelines and standards for marine waters.

CRITERIA, GUIDELINES AND STANDARDS

Definition of terms

There are varying definitions of the terms criteria, guidelines and standards as applied to environmental quality management. The Webster Dictionary definition for criterion "a standard for comparison or judgement" and that given for standard - "a basis of comparison; a criterion; measure", while providing little differentiation between the two terms, presents the usual lay understanding of these words.

Definitions of the European Communities

The Official Journal of the European Communities (E.C., 1973) provides a detailed definition of "Environmental Protection Terminology" as follows:

Criteria

1. The term "criterion" signifies the relationship between the exposure of a target to pollution or nuisance, and the risk and/or the magnitude of the adverse or undesirable effect resulting from the exposure in given circumstances.

2. "Target" means man or any component of the environment actually or potentially exposed to pollution or nuisance.

3. The "exposure" of a target, envisaged in this relationship, should be expressed as numerical values of concentration, intensity, duration or frequency.

4. "Risk" is the probability of occurence of adverse or undesirable effects arising from a given exposure to one or more pollutants or nuisances considered alone or in combination with others.

5. The "adverse or undesirable effect" envisaged in this relationship may be a direct or indirect, immediate or delayed, simple or combined action on the target. The risk and the magnitude of this effect should be expressed, whenever possible, in quantitative terms.

6. The methods of evaluating the parameters describing exposure and adverse or undesirable effects should be harmonized to ensure compatability of the results from studies and research on criteria.

Quality objectives

1. The "quality objective" of an environment refers to the set of requirements which must be fulfilled at a given time, now or in the future, by a given environment or particular part thereof.

2. In setting this objective, the following are taken into account:

   a) a "basic protection level" so that man or another target is not exposed to any unacceptable risk.

   b) a "no-effect level" so that no identifiable effect will be caused to the target.

These two levels are determined on the basis of the criteria described above. Due allowance is also made for the specific regional conditions, the possible effects on neighboring regions, and the intended use.

Environmental protection standards

"Standards" are established in order to limit or prevent the exposure of targets and can thus be a means of achieving or approaching quality objectives. The standards are directly or indirectly addressed to the responsible individuals or bodies; they establish limits for pollution or nuisance that must not be exceeded in an environment, target, product, etc. They may be established by means of laws, regulations or administrative procedures or by mutual agreement or voluntary acceptance.