

## CHAPTER 1

# Introduction

This volume of the *Guidelines for Safe Recreational Water Environments* describes the present state of knowledge regarding the possible adverse impact of the recreational use of coastal and freshwater environments upon the health of users. It also outlines monitoring, control and prevention strategies relating to the hazards associated with these environments. Any possible adverse impacts must be weighed against the enormous benefits to health and well-being associated with the use of recreational water environments.

Recreational uses of inland and marine waters are increasing in many countries worldwide. These uses range from whole-body water contact sports, such as swimming, surfing and slalom canoeing, to non-contact sports, such as fishing, walking, birdwatching and picnicking.

The hazards that are encountered in recreational water environments vary from site to site, as do the nature and extent of exposure. Most available information relates to health outcomes arising from exposure through swimming and ingestion of water. In the development of these Guidelines, all available information was taken into consideration, accounting for the different routes of exposure as much as possible.

In order to properly interpret and apply the Guidelines in a manner appropriate to local conditions, it will be necessary to take into account social, cultural, environmental and economic characteristics of the site, alongside knowledge of activities undertaken, routes of exposure and the nature and severity of hazards. In doing so, local, national and international standard-setting bodies may develop standards that differ between regions and within regions according to differences in these factors.

National and local agencies working in the area of recreational water use have a responsibility to promote and ensure a safe environment. Recreational water areas may be under some form of ownership or associated with a provider of facilities or services. Owners or service providers and their personnel are key players in the control of hazards to human health and in some jurisdictions may have a legal obligation to execute continued “due diligence” relative to the safety of water or beaches. Rural or undeveloped recreational water areas often have different management arrangements and priorities. In all cases, considerable capacity to limit health risks is in the hands of the user, who should assume a degree of responsibility when engaged in recreational activities. Nongovernmental organizations and special interest groups also have an important role to play.

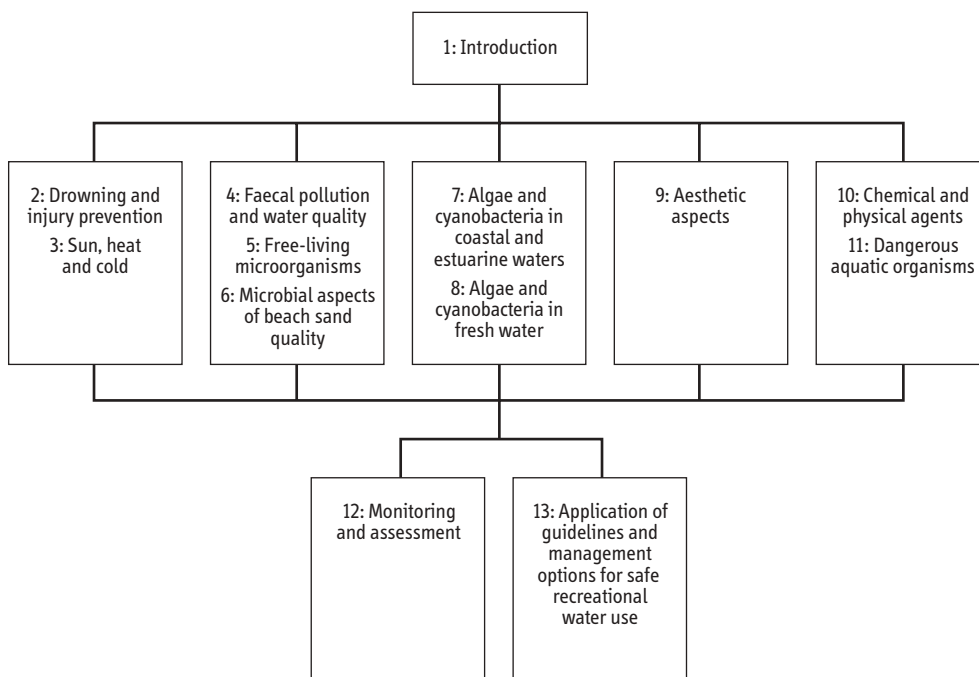


FIGURE 1.1. STRUCTURE OF *GUIDELINES FOR SAFE RECREATIONAL WATER ENVIRONMENTS. VOL. 1: COASTAL AND FRESH WATERS*

In seeking to control the health hazards associated with the recreational use of the water environment, responsible and concerned bodies have at their disposal a diverse range of interventions, including:

- monitoring and enforcing quality standards;
- general awareness-raising activities;
- adopting technical solutions to remediate problems; and
- preventing exposure to hazardous areas or conditions.

Ideally, these interventions should be adopted through proper planning and development of recreational water areas using a framework such as that provided by Integrated Coastal Area Management (see section 1.7.2)

In light of the diversity in exposure, hazard and nature of interventions, this Guidelines document is structured as shown in Figure 1.1.

## 1.1 General considerations

The primary aim of the *Guidelines for Safe Recreational Water Environments* is the protection of public health. The use of coastal and freshwater recreational water environments—and the resulting rest, relaxation and exercise—is associated with

significant benefits to health and well-being. The purpose of the Guidelines is not to deter recreational water use but, instead, to ensure that recreational water areas are operated as safely as possible in order that the largest possible population gets the maximum possible benefit.

The Guidelines are intended to be used as the basis for the development of international and national approaches to controlling the health risk from hazards that may be encountered in recreational water environments, as well as providing a framework for local decision-making. The Guidelines may also be used as reference material for industries and operators preparing development projects in recreational water areas, as a checklist for understanding and assessing potential health impacts of recreational projects, and in the conduct of environmental impact and environmental health impact assessments in particular.

Where guideline values are presented, these are not mandatory limits, but measures of the safety of a recreational water environment. The main reason for not promoting the adoption of international standards for recreational water environments is the advantage provided by adoption of a risk–benefit approach. In the specific case of recreational water use, development of such approaches not only concerns health risks and benefits, but interrelates with other risks and benefits, especially those concerning environmental pollution/conservation, local and national economic development, and the health benefits and well-being derived from recreational use of the water environment.

This approach can often lead to the adoption of standards that are measurable and can be implemented and enforced. These would deal with, for example, water quality and dissemination of information. Other standards may relate to the education of children and adults or to the obligation to prepare and disseminate comparative studies of the safety of alternative locations for recreational water use. In developing strategies for the protection of public health, competent government authorities would take into account the general education of both adults and children and also the efforts and initiatives of nongovernmental organizations and industry operators in this area.

Clearly, a broad-based policy approach will be required that will include legislation as well as positive and negative incentives to alter behaviour and monitor situations. Such a broad base will require significant efforts in intersectoral coordination and cooperation at national and local levels, and successful implementation will require development of suitable skills and expertise as well as the elaboration of a coherent policy and legislative framework.

## **1.2 Types of recreational water environment**

Coastal and freshwater recreational water environments are defined, for the purposes of these Guidelines, as any coastal, estuarine or freshwater area where any type of recreational usage of the water is made by a significant number of users. While uses may be diverse and the Guidelines are intended to be applicable to all types of use (see section 1.3), most concern relates to uses entailing water contact and, in the case of water quality, significant risk of water ingestion.

### 1.3 Types of use

There are many different types of recreational usage of water environments. These include, for example, sunbathing, wading, swimming, diving, boating, fishing and sailboarding.

Competition for suitable waters and the popularity of recreation often create conflicts between activities, as indicated in Table 1.1. These conflicts can be resolved by supervision, regulation, codes of good practice and voluntary agreements. High-activity sports often present an internal conflict between enjoyment of the excitement and hazard, resolvable by proper attention to safety, training and supervision.

Within the socioeconomic context of recreational water use, the importance of tourism is considerable—in terms of its size, impacts on socioeconomic and environmental spheres and the responsibility and means to intervene that it has at its disposal. Each year, millions of tourists flock to coastal areas. Tourism is the world's third largest industry and the prime economic sector in some states and regions, such as the Caribbean. This is creating increased competition for use of coastal waters and beach areas, increasing the need for clear regulations and codes of conduct.

TABLE 1.1. EXAMPLES OF CONFLICTING INTERACTIONS BETWEEN AND WITHIN DIFFERENT WATER RECREATIONAL ACTIVITIES, AND POSSIBLE CONTROL MEASURES

Recreational Activities	Conflicting interactions	Possible control measures
Whitewater rafting and canoeing, canoe slalom	Challenge and excitement enhance enjoyment but also present hazard of injury and drowning to participants and other water users	Wearing of buoyancy aids, safety helmets; organized training in life-saving; local and national codes of practice; classification of courses by difficulty; supervision and rescue cover at organized events; separation of conflicting uses
Waterskiing, jetskiing, windsurfing	Hazard of injury to swimmers; conflict with movements of commercial shipping, fishing and yachting; powered craft create noise and oil pollution, affecting enjoyment of other users	Creating local restriction zones to avoid conflict; engine designs and oil formulations to avoid visible emission of oil
Use of inland waterways for boating under power, canoe touring and angling	Injury to swimmers	Prohibit swimmers where water quality and conditions are unsuitable; otherwise create or designate swimming areas
Recreational use of drinking-water reservoirs	Contamination of drinking-water sources by faeces, litter, oil and fuel	Restrict uses to angling from shore or rowboat, dinghy sailing, birdwatching and walking, with local codes of practice, supervised by wardens and clubs; no dogs; provision of litter collection and toilets
Dog-walking and horse-riding on beaches	Fouling of beaches; potential transmission of toxocariasis from dog faeces, particularly to children; horses colliding with people on the beach	Banning dogs and horses from recognized swimming beaches during the swimming season

The recognition that all legitimate activities can be accommodated is the essence of integrated coastal area management (ICAM) or integrated river basin management (IBM). The process of ICAM or IBM (see section 1.7.2) introduces mechanisms to facilitate the resolution of conflicts between such competing sectors of the coastal zone or river basin and to help reach agreeable solutions, with respect to the carrying capacity of the environment, while satisfying the general needs of the area. In coming to agreement, management will usually have to adopt pragmatic solutions.

## 1.4 Types of user

Users of coastal and freshwater recreational water environments may include:

- the general public;
- children/babies;
- hotel guests;
- tourists;
- competitive swimmers;
- clients of camping parks; and
- specialist sporting users, including anglers, canoeists, boat users, scuba divers and so on.

Certain groups of users may be more predisposed to hazards than others. Children, for example, particularly when unattended, may cause an elevated risk of accidents for themselves and others because of their desire for attention and their general reluctance to observe formal rules of safety and hygiene. In addition, they generally play for longer periods of time in recreational waters and are more likely to intentionally or accidentally swallow water.

The elderly and disabled may have strength, agility and stamina problems that limit their ability to recover from problems encountered in recreational water environments. The elderly and immunocompromised individuals may also be at higher risk of health damage from microbial deterioration of water quality, as they are more susceptible to the pathogenic organisms that may occur in this environment.

## 1.5 Hazard and risk

Popularly, the terms hazard and risk are used interchangeably. Correctly, a *hazard* is a set of circumstances that could lead to harm—harm being loss of life, injury or illness. The *risk* of such an event is defined (Lacey & Pike, 1989) as the probability that it will occur as a result of exposure to a defined quantum of hazard. The *rate of incidence* or *attack rate* is the expected number of events that occur for this defined quantum of hazard. Strictly speaking, probabilities and rates obey different laws, but if the probabilities are small and events are independent, the two values will be approximately equal. Risks can vary from negligible—an adverse event occurring at a frequency of below one per million—to high—fairly regular events that would occur at a rate of greater than one in a hundred (Calman, 1996).

### **1.5.1 Types of hazard encountered**

The hazards associated with the use of coastal and freshwater recreational water environments fall into a number of groups:

- physical hazards (leading, for example, to drowning or injury);
- cold, heat and sunlight;
- water quality (especially exposure to water contaminated by sewage, but also exposure to pathogenic microorganisms free-living in recreational water);
- contamination of beach sand;
- algae and their toxic products;
- chemical and physical agents; and
- dangerous aquatic organisms.

The existence of a diverse range of hazards in the recreational water environment indicates the need for an understanding of their relative importance for health. Examples of adverse health outcomes associated with these hazards are given in Table 1.2.

Drowning and spinal injury are severe health outcomes of great concern to public health. Other injuries, such as cuts from glass and other wastes, while less severe, cause distress and decrease the benefits to well-being arising from recreation. Human behaviour—especially alcohol consumption—is a prime factor that increases the likelihood of injury (see chapter 2), for example, up to 50% of drowning deaths are associated with alcohol in some countries.

Notwithstanding the above, much attention has focused in recent years upon microbial hazards. In particular, health risks associated with contamination of water by sewage and excreta and associated gastroenteric outcomes have been the topics of both scientific and general public interest (see chapter 4). The hazards concerned are not restricted to gastroenteric outcomes and potentially include acute febrile respiratory illness and ear infections arising from pollution of water by excreta and swimmers and other naturally occurring or non-faecally derived infectious agents, such as leptospire (see chapter 5). However, in general terms, it appears that contamination of recreational water with excreta and sewage is widespread and common and affects large numbers of recreational water users, the majority of whom exhibit mild gastroenteric symptoms.

Hazards to human health exist even in unpolluted environments. For example, eye irritation in bathers may occur as a result of a reduction in the eye's natural defences through limited contact with water and does not necessarily relate to water quality or pollution *per se*.

### **1.5.2 Assessment of hazard and risk**

Assessments of hazard and risk inform the development of policies for controlling and managing risks to health and well-being in water recreation. Both draw upon experience and the application of common sense, as well as the interpretation of data. Isolated measurements of risk are not very helpful when decisions have to be made for managing risks or developing policies for controlling them.

TABLE 1.2. EXAMPLES OF ADVERSE HEALTH OUTCOMES ASSOCIATED WITH HAZARDS ENCOUNTERED IN RECREATIONAL WATER ENVIRONMENTS

Type of adverse health outcome	Examples of associated hazards (with chapter references in parentheses)
Drowning	<ul style="list-style-type: none"> <li>• Caught in tidal or rip currents, cut off by rising tides, falling overboard, caught by submerged obstacles, falling asleep on inflatables and drifting into deep water far from shore, slipping off rocks or washed off rocks by wave, misjudging swimming ability (2).</li> </ul>
Impact injury	<ul style="list-style-type: none"> <li>• Impact against hard surfaces or sharp objects (2), driven by the participant (diving, collision, treading on broken glass or jagged metal) or by the force of wind and water.</li> <li>• “Needle stick” injuries from used needles that have washed up or have been discarded on the beach (2).</li> <li>• Coral cuts, oyster cuts and abrasions from slipping on rocks (2).</li> <li>• Attack by aquatic animals (shark, conger and moray eels, piranhas, seals) (11).</li> </ul>
Physiological	<ul style="list-style-type: none"> <li>• Chilling, leading to coma and death (3).</li> <li>• Acute exposure to heat and ultraviolet radiation in sunlight—heat exhaustion, sunburn, sunstroke (3).</li> <li>• Cumulative exposure to sun—skin cancers (basal and squamous cell carcinoma, melanoma) (3).</li> </ul>
Infection	<ul style="list-style-type: none"> <li>• Ingestion of, inhalation of, or contact with pathogenic bacteria, viruses, fungi and parasites, which may be present in water as a result of faecal contamination, carried by participants or animals using the water, or naturally present (4–6).</li> <li>• Bites by mosquitoes and other insect vectors of parasitic diseases (11).</li> </ul>
Poisoning and toxicoses	<ul style="list-style-type: none"> <li>• Ingestion of, inhalation of, or contact with chemically contaminated water (10).</li> <li>• Stings of poisonous and venomous animals (jellyfish, snakes, sting rays) (11).</li> <li>• Ingestion of, inhalation of, or contact with blooms of toxigenic cyanobacteria in fresh (8) or marine water (7) and/or of dinoflagellates in marine water (7).</li> </ul>

The assessment of a beach or water should take into account several key considerations, including:

- the presence and nature of natural or artificial hazards;
- the severity of the hazard as related to health outcomes;
- the availability and applicability of remedial actions;
- the frequency and density of use; and
- the level of development.

Health risks that might be tolerated for an infrequently used and undeveloped recreational area, for example, may justify immediate remedial measures at other areas that are more widely used or highly developed.

Figure 1.2 provides a schematic approach to comparing health hazards encountered during recreational water use. A severe health outcome such as permanent paralysis or death, as a result of diving into shallow water, may affect only a small number

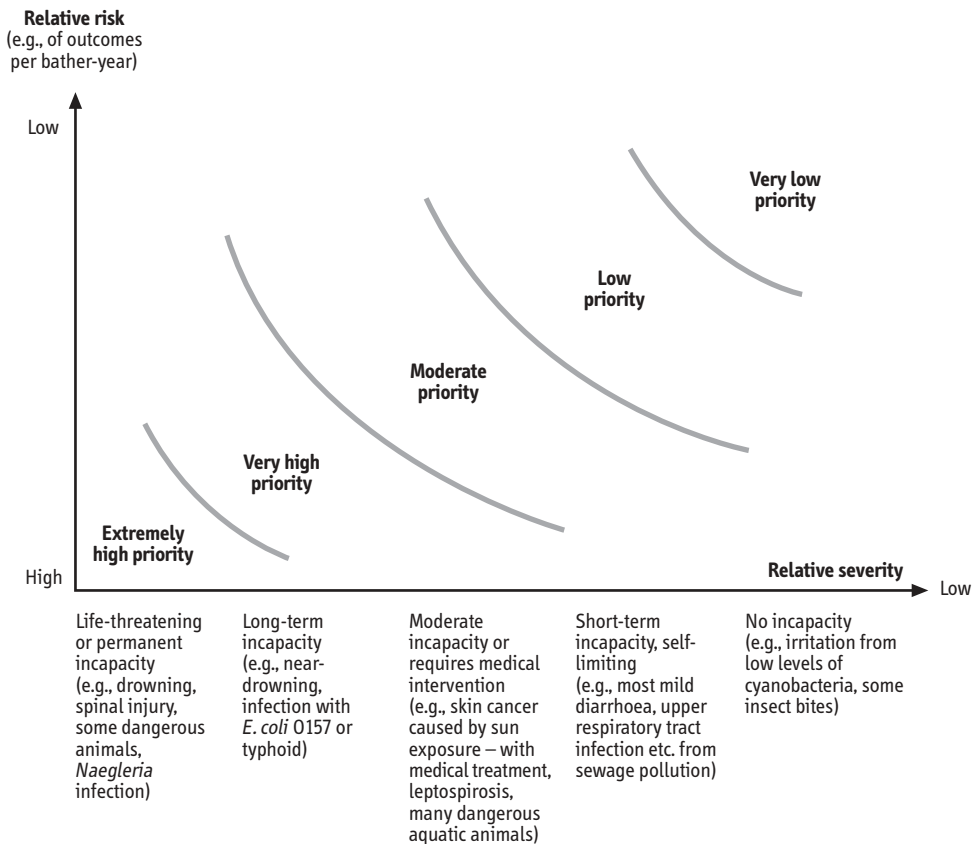


FIGURE 1.2. SCHEMATIC APPROACH TO COMPARING HEALTH HAZARDS ENCOUNTERED DURING RECREATIONAL WATER USE

of swimmers annually but may warrant a high management priority. Minor skin irritations, encountered at the other end of the scale, may affect a higher number of swimmers per year but do not result in any incapacity and thus require lower management priority.

Figure 1.2 can be applied throughout the Guidelines. For each hazard discussed, the “severity” of the hazard can be related to the relative risk in this figure and can serve as a tool to initiate further research or investigation into the reduction of risk as well as to highlight or emphasize priority protective or remedial management measures.

Data related to risk take four main forms:

- national and regional statistics of illness and deaths;
- clinical surveillance of incidence of illness and outbreaks;
- epidemiological studies and surveys; and

- accident and injury records held by recreational water area owners/managers and local authorities.

Although “incident records” held by local authoritative bodies are often comprehensive, published statistics are seldom sufficiently detailed for risk assessment. Processes of surveillance for drinking-water supplies (defined as the continuous and vigilant public health assessment of the safety and acceptability of supplies) have been recommended by WHO (1976, 1997) and involve a dual responsibility of a national, governmental regulator and the supplier or provider of the service. Systems for surveillance of public health operate in most countries. They serve the broad purpose of alerting either regulator or supplier to changes in incidence of disease and to the need for initiating immediate investigation of the causes and remedial action. Such investigation will involve epidemiology (the study of the occurrence and causes of disease in populations). Galbraith & Palmer (1990) give details of the use of epidemiology in surveillance. Epidemiology may also be used as a research tool to investigate hypotheses concerning the causes of illness (section 1.5.3).

There are other reasons why it is difficult to estimate risk directly, such as the following:

- In most active water sports, enjoyment arises from the use of skill to avoid and overcome perceived hazards. The degree of competence of participants and the use of properly designed equipment and protective clothing, accompanied by supervision and training, will considerably modify the risk.
- Risks of acquiring infectious disease will be influenced by innate and acquired immunity (for examples, see Gerba et al., 1996). The former comprises a wide range of biological and environmental factors (age, sex, nutrition, socioeconomic and geographic), as well as body defences (impregnability of the skin, lysozyme secretion in tears, mucus and sweat, the digestive tract and phagocytosis). Previous challenge by pathogens often results in transient or long-lasting immunity.
- Assessment of harm itself and the degree of harm suffered depend upon judgement at the time. Medical certification of injury and of physiological illness and infection, accompanied by clinical diagnosis, is the most reliable information. Information obtained by survey or questionnaire will contain a variable degree of uncertainty caused by the subjects’ understanding of the questions, their memory of the events and any personal bias of the subject and interviewer. Survey information is only as good as the care that has gone into the design and conduct of the survey. Data for aesthetic insult are subjective by nature, but frequencies of occurrence of particular types of waste objects on stretches of beaches can be quantified.
- The causes of harm must be ascertained as much as possible at the time. There are considerable difficulties in the cases of low-level exposures to chemical and physical agents that have a cumulative or threshold effect and of infectious diseases caused by those pathogens that have more than one route of infection or have a long period of incubation. For example, gastroenteric infections at

resorts may result from person-to-person contact or faulty food hygiene in catering, as well as from ingesting sewage-contaminated water.

- Where data are in the form of published regional or national statistics giving attack rates, the exact basis on which the data are collected and classified must be ascertained. For example, national statistics on deaths by drowning will usually include suicides and occupational accidents (fishermen, mariners, construction workers) as well as misadventure in recreation.
- It cannot be assumed that risk is directly proportional to exposure or that risks from multiple exposures or a combination of different factors will combine additively.

### **1.5.3 The use of epidemiology in risk assessment**

There is a considerable body of epidemiological information concerning the effects of faecal contamination of swimming waters on the incidence of gastroenteritis and other transmissible diseases in swimmers and other participants in water recreation. This has been critically reviewed (Pike, 1989, 1994; Cartwright, 1992; Fewtrell & Jones, 1992; Prüss, 1998) and is examined later in this volume (chapter 4). The level of epidemiological research concerning some other types of recreational water hazard is considerably less than that for faecal contamination. This may relate to a number of factors, including infrequent outcomes and ethical concerns.

Epidemiological information is more reliable than published statistics for assessing risks, since its rigorous disciplines are designed to eliminate sources of bias and errors in interpretation. On the other hand, this rigour limits epidemiological studies to single or a few closely related hazards and carefully defined populations. Hence, epidemiological approaches do not always measure the full range of variation in population responses (Grassman, 1996).

### **1.5.4 Degree of water contact**

The overall basis for development of a risk reduction strategy depends on broad classifications of recreational activities. For hazards where contact with and/or ingestion of water are important, an understanding of the different degrees of contact associated with different recreational water uses is essential. The degree of water contact directly influences the degree of contact with infectious and toxic agents and physical hazards found in water and therefore the likelihood of being injured or contracting illness.

The degrees of water contact encountered in coastal and freshwater recreational water environments may be classified as follows:

- *No contact*—recreational activity in which there is normally no contact with water (e.g., angling from shore), or where water is incidental to enjoyment of the activity (such as sunbathing on a beach).
- *Incidental contact*—recreational activity in which only the limbs are regularly wetted and in which greater contact (including swallowing water) is unusual—for example, boating, fishing, wading.

- *Whole-body contact*—recreational activity in which the whole body or the face and trunk are frequently immersed or the face is frequently wetted by spray, and where it is likely that some water will be swallowed—e.g., swimming, diving or whitewater canoeing. Inadvertent immersion, through being swept into the water by a wave or slipping, would also result in whole-body contact.

Routes of exposure to infectious and toxic agents in water will vary depending on the degree of water contact. Generally, exposure of skin and mucous membranes during recreational water activities is most frequent. For whole-body contact activities, the probability that some water will be ingested will be greater, although actual data on the quantities of water ingested while indulging in water sports are difficult to obtain. Inhalation can be important in circumstances where there is a significant amount of spray, such as in waterskiing. The skill of the participant in water recreation will also be important in determining the extent of involuntary exposure, particularly water ingestion.

## 1.6 Measures to reduce risks in water recreation

Because hazards may give rise to health effects after short-term exposures, it is important that standards, monitoring and implementation enable preventive and remedial actions within real time frames. For this reason, emphasis in the Guidelines is placed upon identifying circumstances and procedures that are likely to lead to a continuously safe environment for recreation. This approach emphasizes monitoring of both conditions and practices and the use of threshold values as key indicators, assessed through programmes of monitoring and assessment.

Table 1.2 in section 1.5.1 lists and classifies the main adverse health outcomes associated with exposure to hazards encountered in water recreation. Study of the examples given indicates that reduction of most, if not all, of their associated risks can be obtained by avoiding the circumstances giving rise to the hazard or mitigating their effect. Table 1.2 also suggests particular types of recreation that may be prone to certain hazards and actions that may be taken to reduce the risk. For example, glass left on a beach will cause the hazard of cuts to walkers with bare feet, which may be mitigated by regular cleaning of the beach, provision of litter bins, prohibiting the use of glass on the beach and educational awareness campaigns. This suggests that the types of recreational activity undertaken in a given location should be subject to a hazard assessment and the type of control measures that will be most effective determined.

Examples of potential control measures and bases for developing guidelines and for reducing risks in non-contact, incidental contact and whole-body contact water recreation are presented in Tables 1.3 (page 12), 1.4 (page 13) and 1.5 (page 14), respectively. For each recreational use, more than one hazard will be encountered and the list of hazards for each use will differ depending on circumstances. Measures for risk reduction will therefore be specific to each form of recreation and to particular circumstances. Detailed examples of hazards and their associations with particular forms of recreation will be considered in later chapters.

TABLE 1.3. HAZARDS AND MEASURES FOR REDUCING RISKS IN NON-CONTACT RECREATION

Examples of non-contact recreational activities <sup>a</sup>	Principal hazards	Potential risk reduction measures
Angling from shore (1–6) Boating under power (1–4) Picnics (1–4, 6) Walking (1–4, 6) Sunbathing (2–4, 6) Birdwatching (1–4, 6)	1. Falling in, drowning	1. Where appropriate: safety rails, lifebelts/lifejackets, warning notices, broadcast gale warnings, education, legislation regarding use of lifejackets while boating. Personal care.
	2. Sunburn, sunstroke, skin cancer	2. General and local publicity. Use of sunscreen or sunblock, limit exposure. Wearing protective clothing.
	3. Aesthetic revulsion from fish deaths, anaerobic conditions, oil and other visible pollution	3. Control and licensing of discharges from sewage works, industry, storm sewer outfalls, agriculture, landfills and watercraft.
	4. Bites from mosquitoes and other insect vectors of disease	4. Health warnings to travellers, anti-malarial therapy, avoidance of infested regions, application of appropriate insect repellants.
	5. Infection following skin injury and exposure to water	5. Exercising care; covering all injuries with waterproof dressings.
	6. Injury; treading on broken glass or jagged metal waste	6. Litter control, cleansing recreational area. Putting rubbish in bins or taking it away. Prohibiting use of glass on beach.

<sup>a</sup> Numbers in parentheses refer to principal hazards (column 2) and potential risk reduction measures (column 3).

Participants in the whole-body contact sports of sub-aqua diving, surfing, water-skiing, whitewater canoeing, rafting and windsurfing normally wear wet suits or other protective clothing, which limit skin exposure to the agents of leptospirosis and schistosomiasis and to venomous animal stings, as well as to chilling and ultraviolet radiation (UVR), but which may aggravate symptoms caused by contact with toxic cyanobacteria under some circumstances or enhance the absorption of chemicals through the skin. The wearing of helmets and buoyancy jackets in sailing and canoeing activities (Table 1.5) protects against head injuries and drowning, respectively.

## 1.7 Managing recreational waters

### 1.7.1 Stakeholders

Mutually supportive actions should take place, coherently, at the local, national and international level in order to reduce risks encountered during recreational water use. Multiple stakeholders intervene in the assessment, use and protection of recreational waters. Their roles and responsibilities should be defined and their efforts harnessed through an integrated planning framework. Figure 1.3 (page 16) illustrates the variety of stakeholders and their roles in the process of assessing and using recreational waters and taking remedial actions to limit health hazards.

TABLE 1.4. HAZARDS AND MEASURES FOR REDUCING RISKS IN INCIDENTAL CONTACT RECREATION

<b>Examples of incidental contact recreational activities<sup>a</sup></b>	<b>Principal hazards</b>	<b>Potential risk reduction measures</b>
Rowing, sailing, canoe touring (1, 2, 3, 5, 6) Wading (1–8) Fishing (1–8) Paddling, adults (1–8) (for paddling by young children,) see Table 1.5	1. Falling in, drowning	1. Where appropriate: safety rails, lifebelts/lifejackets, warning notices, broadcast gale warnings, education, legislation regarding use of lifejackets while boating, supervision and availability of rescue services. Personal care.
	2. Leptospirosis (fresh water)	2. Bankside management to control rodents, litter collection. Treating and covering cuts and abrasions prior to exposure. Seeking medical advice if influenza-like symptoms are noticed a few days after recreation.
	3. Cyanobacterial toxicoses (fresh water)	3. Control of eutrophication, monitoring and reporting of cyanobacterial populations, curtailing recreation during blooms. Local publicity. Personal awareness: reporting blooms, avoiding contact, washing down body and equipment after recreation.
	4. Injury; treading on broken glass or jagged metal waste	4. Litter control, cleansing recreational area. Putting rubbish in bins or taking it away. Prohibiting use of glass on beach.
	5. Sunburn, sunstroke, skin cancer	5. General and local publicity. Use of sunscreen or sunblock, limit exposure. Wearing protective clothing.
	6. Bites from mosquitoes and other insect vectors of disease	6. Health warnings to travellers, anti-malarial therapy, avoidance of infested regions, application of appropriate insect repellants.
	7. Fish stings	7. Local awareness raising where problem occurs.
	8. Swimmers' itch and schistosomiasis (freshwater)	8. Control weeds and aquatic snails. Avoiding warm, snail-infested ponds. Personal awareness raising. Information on occurrence of schistosomiasis.

<sup>a</sup> Numbers in parentheses refer to principal hazards (column 2) and potential risk reduction measures (column 3).

### 1.7.2 Integrated coastal area or river basin management

Integrated coastal area management (ICAM) and integrated river basin management (IBM) are usually initiated in response to issues relating to one or more of the following: fisheries, recreation/tourism, hazards and mangrove depletion. Therefore, recreational water hazards are just one of a wide range of issues, interests and constraints that affect the planning and management of coastal areas or river basins. Decisions relating to management of hazards should be made with reference to all relevant government policies and other factors that affect coastal/river basin amenity and use. Social, economic, aesthetic, recreational and ecological factors all need to be considered. Successful ICAM or IBM also requires “integration over time, with immediate

TABLE 1.5. HAZARDS AND MEASURES FOR REDUCING RISKS IN WHOLE-BODY CONTACT RECREATION

<b>Examples of whole-body contact recreational activities<sup>a</sup></b>	<b>Principal hazards</b>	<b>Potential risk reduction measures</b>
Sub-aqua diving (1–12) Swimming (1–12) Surfing (1, 2, 5–9, 11, 12) Waterskiing (1–12) Whitewater canoeing, rafting (1–3, 5–7, 11, 12)	1. Drowning	1. Where appropriate: lifebelts/lifejackets, warning notices, broadcast gale warnings, education, legislation regarding use of lifejackets while boating, supervision and availability of rescue services. Personal care.
Windsurfing (sailboarding) (1–12) Children's exploratory activities and paddling (1–12)	2. Waterborne infections <sup>b</sup>	2. Microbial standards. Licensing, control and treatment of discharges of sewage, effluents, storm overflows. Improvements where indicated by unsatisfactory microbial quality. Personal awareness of local conditions.
	3. Leptospirosis (fresh water)	3. Bankside management to control rodents, litter collection. Treating and covering cuts and abrasions prior to exposure. Seeking medical advice if influenza-like symptoms are noticed a few days after recreation.
	4. Cyanobacterial toxicoses (fresh water)	4. Control of eutrophication, monitoring of cyanobacterial populations, curtailing recreation during blooms. Local publicity. Personal awareness raising: reporting blooms, avoiding contact, washing down body and equipment after exercise.
	5. Impact injury	5. Notices indicating hazards. Personal awareness raising and avoidance, wearing head and body protection, where appropriate. Supervision and presence of lifeguards and rescue services. Removal/mitigation of the hazard.
	6. Injury; treading on broken glass or jagged metal waste	6. Litter control, cleansing recreational area. Putting rubbish in bins or taking it away. Prohibiting use of glass on beaches.
	7. Collision with or entrapment by wrecks, piers, weirs, sluices and underwater obstructions	7. Notices to mariners, marker buoys, posting warnings. Personal awareness. Legislation requiring boater training. Rescue services to respond to accidents and mitigate injuries. Appropriate oversight (e.g., harbour patrol).
	8. Fish stings	8. Local awareness raising where problem occurs.
	9. Attack by marine animals (sharks, conger and moray eels, seals)	9. Posting warnings. Personal awareness raising and avoidance.
	10. Swimmers' itch and schistosomiasis (fresh water)	10. Control weeds and aquatic snails. Avoiding warm, snail-infested ponds. Personal awareness raising. Information on the occurrence of schistosomiasis.

TABLE 1.5. *Continued*

<b>Examples of whole-body contact recreational activities<sup>a</sup></b>	<b>Principal hazards</b>	<b>Potential risk reduction measures</b>
	11. Bites from mosquitoes and other insect vectors of disease	11. Health warnings to travellers, anti-malarial therapy, avoidance of infested regions, application of appropriate insect repellants.
	12. Sunburn, sunstroke, skin cancer	12. General and local publicity. Use of sunscreen or sunblock, limit exposure. Wearing protective clothing.

<sup>a</sup> Numbers in parentheses refer to principal hazards (column 2) and potential risk reduction measures (column 3).

<sup>b</sup> Infections caused by pathogens derived from faecal pollution (see chapter 4).

day-to-day management objectives being co-ordinated and consistent with long-term national and international policy goals” (OECD, 1993, p. 16). It focuses on the interaction between various activities/resource demands carried out within the coastal zone or river basin as distinct from other regions.

Management should be coordinated to reconcile different, sometimes conflicting, uses:

- management of land resources for urban, industrial, mining, tourism and conservation activities;
- management of waters for recreation, aquaculture, conservation, transport and mining;
- management of living freshwater or marine resources; and
- provision of coastal and flood defences.

ICAM and IBM provide umbrellas for coordination among these areas of intervention, covering the economic, abiotic/biotic and social systems.

Current ICAM thinking encapsulates both coastal and river catchments. In the rest of this volume, therefore, only the term ICAM will be used.

### **1.7.3 Types of management action**

Figure 1.4 (page 17) provides a management framework with different levels of health risk and accordingly suggested relevant interventions (which will have differing time frames for implementation), ordered in four major fields:

- compliance and enforcement;
- control and abatement technology;
- public awareness and information; and
- public health advice and intervention.

Clearly, however, there are linkages between these, with, for example, public health advice having an important input into public awareness.

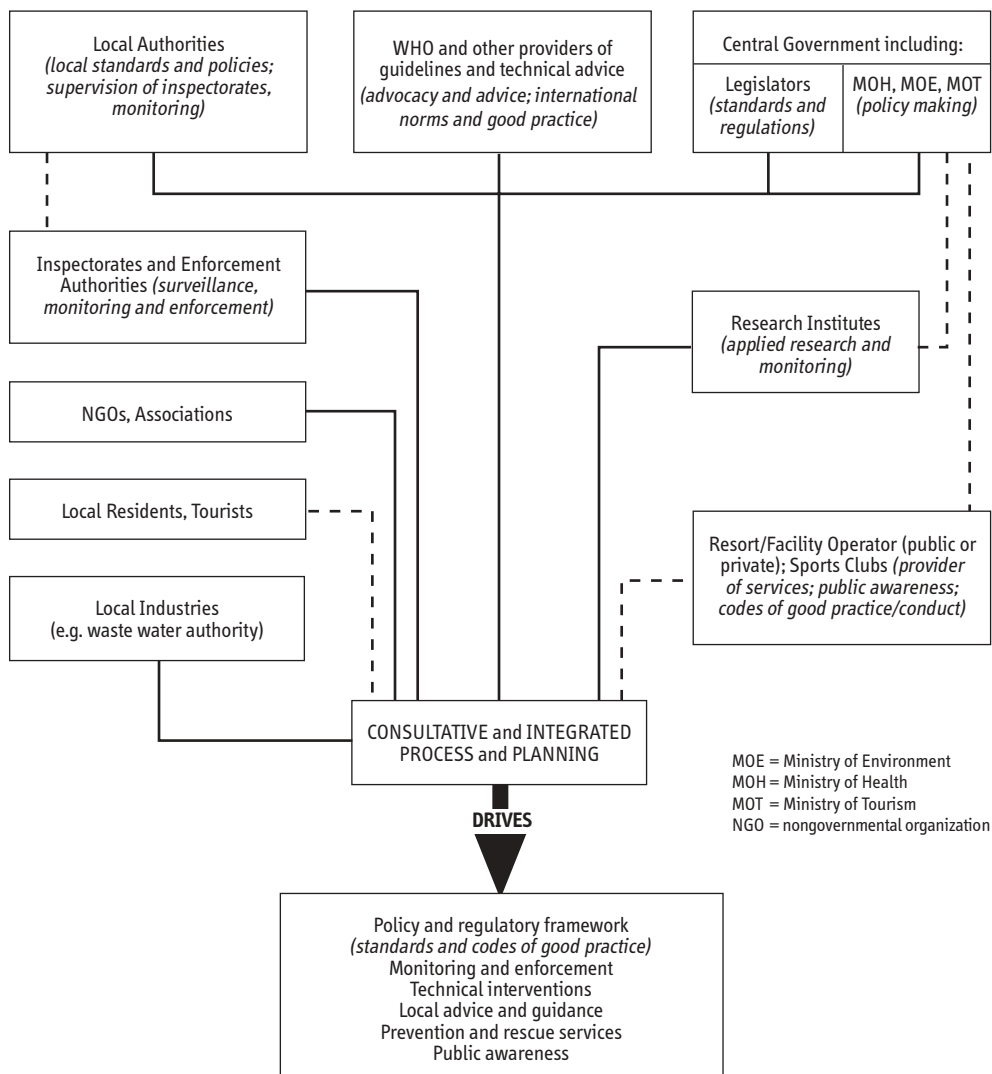


FIGURE 1.3. SOME STAKEHOLDERS IN RECREATIONAL WATER ENVIRONMENTS

The scheme shown in Figure 1.4 has general relevance and can be applied to all areas covered by the various chapters in this volume. The management interventions outlined in Figure 1.4 are discussed in more detail in chapter 13.

## 1.8 Nature of the guidelines

A guideline can be a level of management, a concentration of a constituent that does not represent a significant risk to the health of individual members of significant user groups, a condition under which such concentrations are unlikely to occur, or a combination of the last two. In deriving guidelines including guideline values, account

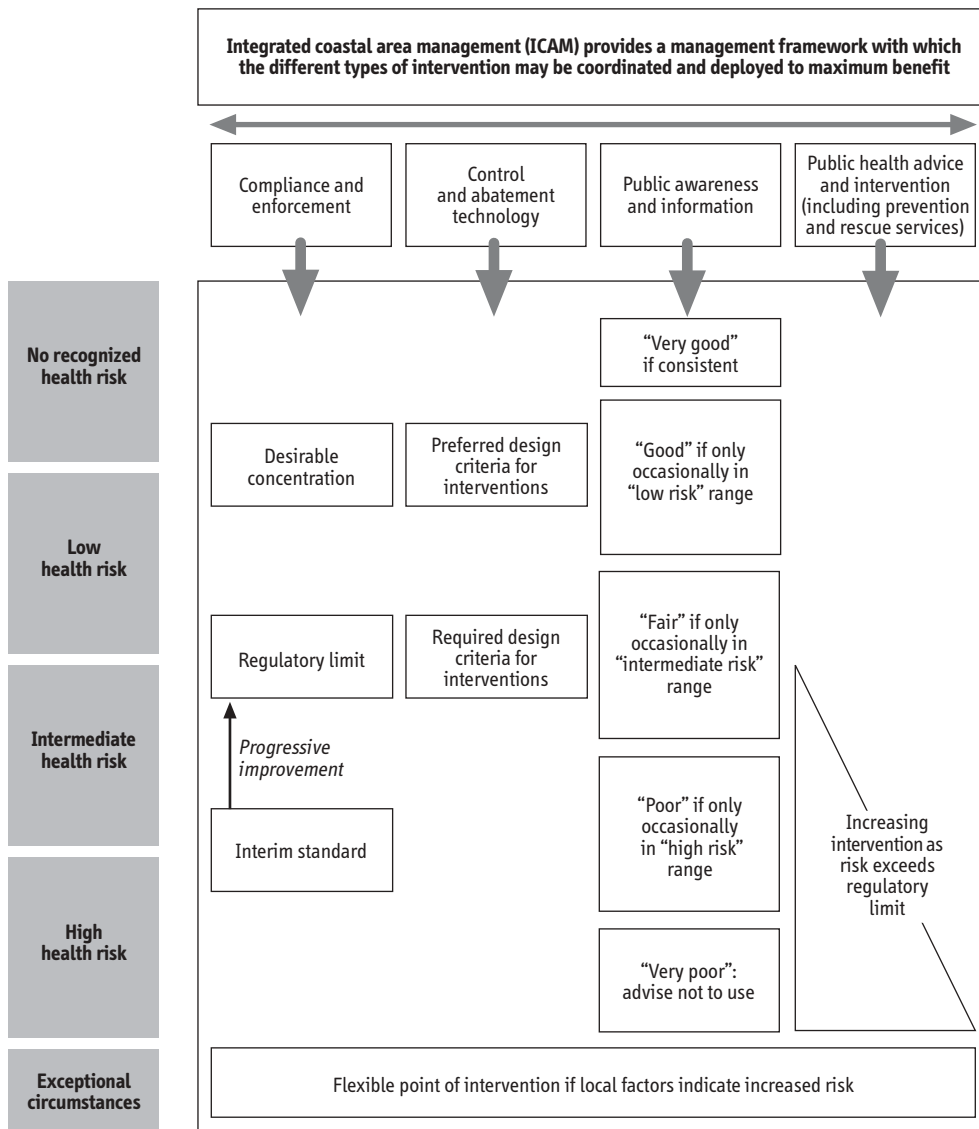


FIGURE 1.4. MANAGEMENT FRAMEWORK AND TYPES OF INTERVENTION IN RELATION TO DIFFERENT LEVELS OF RISK

is taken of both the severity and frequency of associated health outcomes. Water conforming to the guidelines may, however, present a health risk to especially susceptible individuals or to certain user groups.

When a guideline is exceeded, this should be a signal to investigate the cause of the failure and identify the likelihood of future failure, to liaise with the authority responsible for public health to determine whether immediate action should be taken

to reduce exposure to the hazard, and to determine whether measures should be put in place to prevent or reduce exposure under similar conditions in the future.

For most parameters, there is no clear cut-off value at which health effects are excluded, and the derivation of guideline values and their conversion to standards therefore include an element of valuation addressing the frequency, nature and severity of associated health effects. This valuation process is one in which societal values play an important role, and the conversion of guidelines into national policy, legislation and standards should therefore take account of environmental, social, cultural and economic factors.

The existence of a guideline value or national standard does not imply that environmental quality should be degraded to this level. Indeed, a continuous effort should be made to ensure that recreational water environments are of the highest attainable quality.

Many of the hazards associated with recreational use of the water environment are of an instantaneous nature: accidents and exposures to infectious doses of micro-organisms may occur in very short periods of time. Short-term deviations above guideline values or conditions are therefore of importance to health, and measures should be in place to ensure and demonstrate that recreational water environments are continuously safe during periods of actual or potential use.

This volume of the *Guidelines for Safe Recreational Water Environments* does not address:

- exposures associated with foodstuffs, in particular water products such as shellfish;
- protection of aquatic life or the environment;
- occupational exposures of individuals working in recreational water environments;
- especially susceptible individuals (or population groups);
- waters afforded special significance for religious purposes and which are therefore subject to special cultural factors;
- risks associated with ancillary facilities that are not part of the recreational water environment; for example, beach sand is addressed, while toilet facilities in adjacent areas are not considered beyond assertion of the need for them in order to minimize soiling of the recreational environment;
- guideline values for aesthetic aspects, since their valuation is one of societal and cultural values, which cannot be expressed solely in quantitative terms, and their control will not reduce adverse health effects; on the other hand, the importance of aesthetic factors in ensuring maximum benefit for well-being from recreational use of the water environment is discussed;
- seasickness;
- the “bends” decompression sickness and other phenomena restricted to sub-aqua and deep-sea diving;
- guidance on rescue, resuscitation or treatment; and
- therapeutic uses of waters (thalassotherapy, spas).

Swimming pools, spas and similar recreational water environments are addressed in the companion volume, *Guidelines for Safe Recreational Water Environments Volume 2: Swimming Pools, Spas and Similar Recreational Water Environments*.

## 1.9 References

- Calman K (1996) On the state of the public health. *Health Trends*, 28(3): 79–88.
- Cartwright R (1992) Recreational waters: a health risk? In: Kay D, ed. *Recreational water quality management. Vol. 1. Coastal waters*. London, Ellis Horwood, pp. 89–103.
- Fewtrell L, Jones F (1992) Microbiological aspects and possible health risks of recreational water quality management. In: Kay D, ed. *Recreational water quality management. Vol. 1. Coastal waters*. London, Ellis Horwood, pp. 71–87.
- Galbraith S, Palmer S (1990) General epidemiology. In: Smith GR, Easmon CSE, ed. *Topley and Wilson's principles of bacteriology, virology and immunity. Vol. 3. Bacterial diseases*. London, Edward Arnold, pp. 11–29.
- Gerba CP, Rose JB, Haas CN (1996) Sensitive populations: who is at the greatest risk? *International Journal of Food Microbiology*, 30(1–2): 113–123.
- Grassman JA (1996) Obtaining information about susceptibility from epidemiological literature. *Toxicology*, 111: 253–270.
- Lacey RF, Pike EB (1989) Water recreation and risk. *Journal of the Institution of Water and Environmental Management*, 3: 13–18.
- OECD (1993) *Coastal zone management: Selected case studies*. Paris, Organisation for Economic Co-operation and Development.
- Pike EB (1989) *Health effects of sea bathing (ET 9511 SLG). Phase I—Pilot studies at Langland Bay*. Medmenham, Water Research Centre (Report DoE 2518-M(P)).
- Pike EB (1994) *Health effects of sea bathing (WMI 9021)—Phase III. Final report to the Department of the Environment*. Medmenham, Water Research Centre, pp. 9–24 (Report DoE 3412(P)).
- Prüss A (1998) A review of epidemiological studies from exposure to recreational water. *International Journal of Epidemiology*, 27: 1–9.
- WHO (1976) *Surveillance of drinking-water quality*. Geneva, World Health Organization (Monograph Series No. 63).
- WHO (1997) *Guidelines for drinking-water quality*, 2nd ed. Vol. 3. *Surveillance and control of community supplies*. Geneva, World Health Organization, 238 pp.