Interim Report **R&D Project 037**

DEVELOPMENT OF MICROBIOLOGICAL STANDARDS

Patterns of water usage, contact and risks in water sports

WRc plc
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EXECUTIVE SUMMARY

This is the fourth Interim Report produced under this Contract. It describes four inter-related tasks, which have been carried out to meet the objective of developing a scheme of classifying the various recreational uses of tidal and non-tidal waters according to degree of contact, by using a scientific assessment of the risks. Firstly, published information was used to identify three classes of illness, related to recreational use of water:

(a) waterborne, spread by ingesting or inhaling faecally polluted water;

(b) water contact, not directly related to pollution (e.g. cyanobacterial toxins, leptospirosis); and

(c) water-washed, caused by opportunist skin organisms washed in by water.

Secondly, surveys of national governing bodies for various water sports and of 209 responding clubs and limited observations of sports activities have been used to classify sports according to degree of water contact and, hence, risk. The classes derived are:

(a) whole-body contact, with immersion, facial wetting and risk of swallowing (e.g. long-distance swimming, surfing, sub aqua, water skiing, white-water canoeing, windsurfing, sea bathing, children's wading and dabbling);

(b) incidental contact, with wetting of limbs only (rowing, canoe touring, sailing) and non-contact (angling, boating, walking).

Perception of risks from gastrointestinal, ear, eye, nose and throat symptoms was greatest among clubs for whole-body contact and certain sports were aware of leptospirosis and cyanobacterial toxins. The greatest activity was for non-contact sports involving about one-sixth of the population and twice the participation of the other two classes together. The only quantifiable risks nationally are for leptospirosis and drowning. It is considered that epidemiology is needed should it be required to quantify risks of waterborne and water contact illnesses more definitively.

KEY WORDS

Recreation, Recreational waters, Diseases (waterborne), Diseases (water-related), Algae - blue-green, Leptospirosis.

1. INTRODUCTION

1.1 Project description

1.1.1 Background

In the United Kingdom, only coastal waters are used extensively for bathing, but other sports involving a greater or lesser degrees of contact with water and hence different risks of acquiring infection from waterborne pathogens, are becoming extremely popular and involve all surface waters. Although the bathing water Directive 76/160/EEC applies to all surface waters used for bathing, it is inapplicable to waters used for other recreation. The NRA (1991) is currently in discussion with the Secretary of State for the Environment over the creation and implementation of statutory Water Quality Objectives under Section 105 of the Water Act, 1989 (now consolidated into the Water Resources Act 1991). The process will involve identifying uses to which waters will be put - including basic amenity and contact recreation - and the establishment of standards and appropriate monitoring programmes, incorporating the requirements of relevant EC Directives. Dates will be set by which these standards and those of the New General Classification Scheme for water quality must be met. Since protection of health is a paramount consideration for contact recreation and it is appropriate that such standards are microbiological, it is important that they should be related to risk. A key factor of this project will be to classify various recreational uses according to risk and to degree and duration of exposure to water, since this will influence risk.

1.1.2 Objectives

The objectives of this project are:

1. To review all relevant literature on the health risks associated with recreational uses of inland waters and on the relationship between health risk and microbiological quality of such waters.

2. To develop a scheme of classifying the various recreational uses of tidal and non-tidal waters according to degree of contact. Such a classification should be based on a scientific assessment of the risks.

3. To collate available data upon microbiological and virological quality of inland waters used for recreation and assess in relation to existing standards.

4. To review the risks associated with recreation involving different degrees of contact with tidal and non-tidal waters of varying quality and so far as is possible from the present state of knowledge, establish the relationship between various uses and health.

5. To identify future research needs in both tidal and non-tidal waters.

The agreed strategy for realizing these objectives is as follows and references to work already reported are given in parentheses:

1. Review all relevant literature on the health risks associated with recreational uses of inland waters and on the relationship between health risks and microbiological quality of such waters (Pike *et al* 1989).

2. Collect statistics on the numbers of participants and frequency of participation in various water sports at favoured venues from national sports organizations and presentative facilities and analyze to determine patterns of usage and of risks (Gale 1991, this report).

3. Conduct a limited number of observational studies to establish the degree of water contact for various sports (this report).

4. Develop a scheme of classifying the various recreational uses of water according to degrees of exposure, the extent of contact of the participants body with the water, the risk of water being swallowed etc. Such a classification must be based on a scientific assessment of the risks (this report).

5. Collect available data on microbiological and virological quality of inland waters used for recreation and assess in relation to EC Bathing Directive Standards and other existing standards (Gale 1992, Gale *et al* 1990).

6. Compare statistical distributions of indicator bacteria numbers in inland waters with marine waters. If differences exist, determine their significance on the use of percentiles for compliance testing. Recommend monitoring strategies for inland waters (Gale 1992, Gale *et al* 1990).

7. Consider the use of sanitary survey and proximity to sewage discharges as a means of grading sites with respect to potential health risks.

8. Review the risks associated with recreation involving different degrees of contact with natural waters of varying quality (both freshwater and marine) and as far as is possible from the present state of knowledge, establish the relationships between various uses and health (Pike *et al* 1989).

9. Prepare outputs as detailed and 3 monthly progress report.

10. Complete final report which should include recommendations for future research needs.

This report specifically addresses Objective 2, by reporting on the patterns of usage of water for various sports and the degree of contact the participants have with the water. It will use this information, together with that on health risks, already published and reviewed for Strategies 1 and 8, to produce a scheme for classifying risks.

The Final Report will describe the health risks associated with the various kinds of recreation carried out in fresh, marine and estuarial waters. It will attempt to relate the health risks to available, published information upon the relationship between risks and microbiological

quality of the water. Much of this information has already been reviewed under this contract (Pike *et al* 1989) and as part of the UK's national programme on the Health Effects of Sea Bathing (NRA Project Reference, Bathing Water Epidemiology, A11.1), sponsored jointly by the Departments of the Environment and Health, the National Rivers Authority and the Welsh Office (Pike 1990, 1991). A parallel project, Environmental Behaviour of Microbiological Contaminants (NRA Project Reference A1 034/036), has also produced information upon sources of microbial contamination in rivers and lakes and of variability in numbers of faecal bacteria. All this information will be considered when making recommendations for guidelines or standards of microbiological quality for various recreational uses of water in the Final Report.

Important parts of any water quality standard are the statistical description of the overall long-term quality required and the allowance for variability, together with advice on the frequencies and position of sampling. Firm background information has been obtained, using Strategies 5 and 6.

1.2 Review of the literature

1.2.1 Measuring risks to health

It is important to distinguish between hazard and risk. Hazard is the potential for causing harm, e.g. water presents the hazard of drowning, a car for accidental death. Risk is the probability that the harm will occur under given circumstances and is measurable as a probability or as a rate, e.g. the probability of dying from lung cancer is x percent, or the rate of injury in motor accidents is 'y' cases per year or 'z' cases per million vehicle-miles (Lacey and Pike 1989). It is the object of standards and guidelines to reduce defined risks.

Risks can be measured in various ways. Studies of case histories identify the illnesses of concern and usually the pathogen and factors responsible. The more often an illness is reported in association with an activity, the more it is likely that they are truly related. The likelihood is increased if the biology of the pathogen is consistent with the observed course of the illness and with transmission of the disease by water. The relationship of an illness with water is further increased if a dose-response relationship can be shown, for example, if the risk can be shown to increase with the duration or intensity of contact with water or with increasing deterioration in the microbiological quality of water. These general principles have been formulated by Bradford Hill (1965).

Such observations help to confirm association between hazard and risk and may give a semi-quantitative assessment of risk. Risk can be more fully quantified by official reporting of cases (e.g. of drowning or of notified cases of leptospirosis associated with water contact), but this usually underestimates the true risk. Epidemiology enables the cause-effect relationship between a hazard and its risk to be studied under controlled conditions, which exclude confounding factors, but is necessarily expensive and only able to study a narrowly and precisely defined set of circumstances.

A little thought will show that there are many reasons why participants in a water sport, involving wetting or immersion, may become ill afterwards. The obvious conclusion is that they have swallowed or inhaled polluted water containing pathogenic organisms and viruses.

However, they may have travelled or lodged with fellow participants, who were infected, perhaps sub-clinically, or eaten food prepared or kept unhygienically. Unwise indulgence in food or drink may cause gastrointestinal upsets unrelated to infection. These confounding factors to waterborne illness are obviously increased for sports which are gregarious or where lodging, camping and long travel are featured. Another difficulty in assessing risk is low-level exposure, in which only the small proportion of sensitive individuals in a population may actually become infected, perhaps without displaying symptoms, but are able to transmit infection secondarily by contact to others in the group. This shows why great care is needed in attributing a cause-effect relationship in waterborne disease.

1.2.2 Medical aspects of risk in water recreation

The medical risks of waterborne recreation and the factors which influence them, have been reviewed recently by Cartwright (1991). The key points of his paper are summarized below:

1. Man is a terrestrial animal and water is a hostile environment.

2. The skin normally carries a complex microflora of bacteria and fungi, which rarely infect normally immune persons. It may also transiently carry well-recognized pathogens, which may infect under certain circumstances.

3. The skin, ears, eyes and upper respiratory tract all have recognized barriers to infection which operate optimally in air, but which can be disturbed through contact with water, enabling micro-organisms which normally live symbiotically or commensally to become pathogenic.

4. Chains of infection involve successively the source, the reservoir, the route of spread and the susceptible host. Control of disease aims to break one or more links in this chain.

5. In water recreation, the source and reservoir merge and can be the natural microflora of water, pathogens excreted with sewage or by animals and opportunistic or transient organisms on the skin or other body surfaces wetted by water.

6. The routes of spread are direct contact, inhalation or ingestion.

7. Infection will only occur if the subject is unable to cope with the challenging pathogens, firstly when the body's defences are breached and secondly when the immune mechanisms are inadequate.

To those points may be added the difficulty in distinguishing between irritations caused by contact with water and symptoms of infection, particularly when infection is mild. In all reported epidemiological studies of water recreation and health, except the controlled cohort study of Jones *et al* (1991) in the UK sea bathing programme (Pike 1989, 1990), self-reporting has been used and not clinical and medical examination.

1.2.3 Risks assessed by case history, reporting and epidemiology

This subject was extensively reviewed in the first Interim Report for this Project (Pike *et al* 1989) and dealt particularly with recreation in fresh water. An exhaustive review, extended to marine recreation was presented in the first report on the UK's studies of the Health Effects of Sea Bathing/ Bathing Water Epidemiology (Pike 1990) and of the first definitive study (Pike 1991). It is not intended to repeat this survey here, but the strategy for assessing the risks to health from different types of recreation will be reasoned and then stated.

1.2.4 Waterborne infections associated with faecally polluted water

Studies of case histories have associated grossly polluted water with certain illnesses notably:

- Typhoid and paratyphoid fever;
- Shigellosis;
- Infectious hepatitis (Hepatitis A);
- Pharyngo-conjunctival fever (Adenovirus type 4).

The gastrointestinal symptoms most commonly associated with bathing in polluted waters have an incubation period of about 48 hours and attack rates suggesting a viral aetiology (Cabelli 1983). They are now thought to be caused by the Norwalk virus or related small, round viruses. Gastrointestinal symptoms do appear to be related to the degree of pollution of water (Stevenson 1951, Cabelli 1983, Dufour 1984, Foulon *et al* 1983, Cheung *et al* 1990, Seyfried *et al* 1985a, b, Pike 1989, 1990, Balarajan *et al* 1991) and, for windsurfing, with the frequency of falling in the water (Dewailly *et al* 1986). There is circumstantial evidence that Cryptosporidiosis can be transmitted by bathing in polluted water (Gallagher *et al* 1989, Casemore 1990).

It is these illnesses for which microbiological standards of water quality are appropriate. The presumption is that the likelihood of waterborne pathogenic organisms and viruses being present and their numbers are related to the degree of excremental pollution, measured by faecal indicator bacteria. However, no constant relationship can be expected, because numbers of pathogens will depend upon the rates of infection in the community discharging sewage and upon the relative rates of decay of pathogens and faecal indicators in the environment. Furthermore, illness and excretion of pathogens, particularly those less common will be sporadic. Susceptibility of the population to such illness will vary with state of health, nutrition and socio-economic factors. It would not be surprising to find that the relationships between water quality and health will vary from place to place. Indeed, this has been noted by Fleischer (1991) in his re-examination by the US EPA's data for marine bathing (Cabelli 1983).

1.2.5 Water contact illnesses not related to faecal pollution

Three illnesses are associated with contact with water, but not with faecal contamination:

- Leptospirosis, particularly Weil's disease;
- Allergies and toxic effects of cyanobacteria;
- Swimmers' itch (schistosomiasis).

Contact with water and canoeing are two risk-categories for leptospirosis and accounted for 20 and 29 cases respectively out of 229 reported to the Public Health Laboratory Service in 1985 - 1989 (Ferguson 1990). Conversely in Scotland, only 4 cases related to water sport were reported over the 22 years, 1969 - 1990 (Thakker and Reilly 1991).

The causative organisms, *Leptospira interrogans* are released in the urine of infected rats and other aquatic rodents and by cattle and deer. Infection is by contact of the urine or urine-contaminated water with abraded skin.

The incidence of the illness appears to be static. The significance is that infection by the serovar *ichterohaemorrhagiae,* usually associated with rats and other rodents, may be severe leading to severe liver damage and death, if not recognized early and treated. The incidence of disease is not related to degree of pollution.

Contact with the scums of certain Cyanobacteria species ('blue-green algae') during blooms has resulted in allergic reactions and skin irritations and gastroenteritis on ingestion of the water. In one severe case, two army canoeists practising capsize and 'Eskimo roll' procedures suffered pneumonia and liver damage (NRA 1990, Turner *et al* 1990).

A rare condition is 'swimmers' itch'. Aquatic snails are the intermediate hosts of certain flukes, infesting cattle and other vertebrates. Infected snails release large numbers of motile cercariae which infect the primary host by puncturing the wet skin or upon ingestion. Occasionally in Britain, outbreaks of pustular dermatitis, with itching, have occurred in bathers in lakes, infested with snails, during warm weather (e.g. Eastcott 1988).

For completeness, it is necessary to mention primary amoebic meningo-encephalitis, a disease, usually fatal, caused by inhaling water containing the amoebae, *Naegleria fowleri.* These are able to multiply in warm, nutrient-enriched waters, usually contaminated with soil, e.g. in hot springs. The only recorded case in Britain was an 11 year old, who had bathed in the thermal spring waters at Bath (Galbraith *et al* 1987).

1.2.6 Water-washed illnesses

Point 5 from Cartwright's (1991) review, summarized in Section 1.2.2, points out that some illnesses are caused by water disturbing the natural defences of the body, enabling transient or normal inhabitants of the body flora to invade and cause infection. It follows that no attempt to control microbiological quality of water or imposition of standard will have any effect upon risk from such infections. The only practicable measure of control is to reduce exposure to water. This will, in most cases, curtail enjoyment of the sport, although advice to wear goggles, to protect the eyes, or of ear plugs may achieve some effect. This matter is

one, where education of the sporting public may be needed, in order to explain the circumstances in which water quality standards may reduce risk.

There is epidemiological evidence for this point. For example, nearly all the major epidemiological studies reviewed (see Pike *et al* 1989, Pike 1990, Pike 1991) show higher rates of ear, eye, nose and throat symptoms among bathers than non-bathers and that frequency of reporting symptoms increased with the frequency of bathing (Stevenson 1953), or of immersing the head (Foulon *et al* 1983, Seyfried *et al* 1985a). In the early US studies conducted by Stevenson (1953) at Dayton, Kentucky, swimmers in a properly chlorinated pool reported a higher incidence of ear, eye, nose and throat infections than swimmers in the nearby polluted Ohio River, although the reverse was found for gastrointestinal symptoms. Outer ear canal infection (*Otitis externa*) was related to swimming in indoor swimming pools and associated with warmth and high humidity (Calderon and Mood 1982).

1.3 Approaches to the classifications of risk and water activity

The survey of illnesses related to water sports and their causes in Section 1.2 leads to a classification of the types of illness and the types of control measures and water quality standards which are appropriate to reduce risks (Table 1.1).

The evidence for recommending standards to protect health of water sports participants will be considered in the Final Report. However, Table 1.1 and Section 1.2 suggest that a prior need is to classify various sports according to the factors which influence risk. It also shows that microbiological standards related to faecal pollution are only appropriate for waterborne illnesses. The factors most influencing risk are the following:

- Duration of contact;
- Frequency of participation;
- Intensity of contact;
- Part of body wetted;
- Type of water used.

Other important factors are the numbers of participants nationally, age distribution, seasonal participation and the control of each sport (e.g. club participation or non-organized). It was also thought desirable to ascertain the views of national bodies controlling sports and individual clubs upon what are perceived as the principal risks to health and to relate these risks to those of physical injury or drowning among participants. The study therefore comprises three investigations, which are each considered fully before deriving general conclusions on a classification of water usage, contact with water and risks:

- A survey of national sports organizations;
- A survey of individual sports clubs;
- Observational studies of participants.

Table 1.1 A classification of the types of illness associated with water recreation and the most suitable control measures and water quality standards

Class of illness (with examples)	Appropriate control measures and water quality standards
1. Waterborne - pathogens deriving from faecal pollution (typhoid, paratyphoid, shigellosis, infectious hepatitis, pharyno-conjunctival fever, gastro-enteritis, cryptosporidiosis).	- Licensing and control of discharges of sewage, treated effluents and slurries. Microbiological standards of water quality enforced.
2. Water contact - agents unrelated to faecal pollution contact the skin and mucous membranes: (a) Leptospirosis; (b) Cyanobacterial blooms - contact allergies, absorption of toxins; (c) Swimmers' itch.	- Standards for ecological and biological quality: (a) Bankside management to control rodents; (b) Control of eutrophication, monitoring of cyanobacterial population, curtailment of recreation during blooms; (c) Awareness of a rare problem. Control of snail-infested vegetation in warm weather.
3. Water-washed - low-grade, opportunist pathogens, deriving from the skin and other body surfaces. Water interferes with body's defence mechanisms and washes pathogens on to sensitive skins.	- No water quality standards or water management policies appropriate. Curtailment of activity or protection of eyes and ears may reduce risks but will reduce enjoyment of sport.

2. SURVEY OF NATIONAL WATER SPORTS ORGANIZATIONS

2.1 The questionnaire

The Sports Council, established by Royal Charter, is the Government-funded controlling agency for various sports. Preliminary enquiries of the Countryside and Water Unit and of the Information Centre revealed that the Sports Council has commissioned two surveys of coastal recreation in Southern England and reports on coastal management strategy. Their Digest of Sport 1986 contains information on the numbers of participants from the various national governing bodies. A more recent survey had not been published at the time of enquiry and WRc was unable to obtain advance information. For the majority of sports, records of easy individual participating are not available, since many do not belong to registered clubs. The view of the Countryside and Water Unit was that, "There is no turnstile method to monitor numbers and at best, any monitoring strategy only produces 'guesstimates'".

Nevertheless, a questionnaire was developed, with the advice of the NRA's Project Leader and is presented in Appendix A. The questionnaire was designed to provide the following information upon participation and health hazards, as seen by the various governing bodies for particular sports:

- Numbers of participants: nationally, regionally;
- Distribution by age and sex;
- Frequency of participation;
- Effect of season on participation;
- Degrees of water contact;
- Awareness of health hazards.

Questionnaires were sent to the following national governing bodies. This was followed by telephone discussions with their offices to explain the purpose in more detail and, if necessary, to elicit further detail.

1.	Angling	National Anglers' Council National Federation of Anglers
2.	Canoeing	British Canoe Union
3.	Orienteering	British Orienteering Federation
4.	Rowing	Amateur Rowing Association
5.	Sailing, yachting	Royal Yachting Association
6.	Surfing	British Surfing Association

7.	Swimming, long-distance swimming	Amateur Swimming Association British Long Distance Swimming Association
8.	Sub-aqua	British Sub-Aqua Club
9.	Water skiing, aquaplaning	British Water Ski Federation
10.	Windsurfing	UK Board Sailing Association Royal Yachting Association

Additionally, information was sought from the British Waterways Board, as the owners or navigation authority of nearly 3200 km (2000 miles) of canals and rivers, which together with about 90 reservoirs and dock basins, form a major leisure resource.

2.2 Results of the questionnaire

2.2.1 Replies received

Preliminary results were given in Section 10 of the third Interim Report (Gale 1991). At that time, a few replies were outstanding. Because the replies are germane to the subjects of this report, they are represented below in a complete revised form.

Replies were received from most of the national governing bodies listed in Section 2.1 with the following exceptions:

1. Orienteering - this was only included in the survey because water may be a factor in enjoyment of the sport, but not integral. No reply was received.

2. The National Anglers' Council. A fully detailed reply was given by the National Federation of Anglers.

3. The UK Board Sailing Association. However, the Royal Yachting Association replied as the national authority for all kinds of sailing, for windsurfing and for power boat racing.

The Royal Yachting Association drew attention to an independent report on 'Boating and Water Sports in Britain', published by Leisure Consultants (1989), giving details of participation.

2.2.2 Participation

Table 2.1 lists the information upon members of participants and sex distribution estimated for various sports in the United Kingdom. This shows that five million people or more participate in these water sports and that more than two-thirds are men. About half follow coarse angling, which involves little or no contact with water, but the remainder are sports requiring physical effort and, in some cases, considerable contact with water.

Table 2.1 Participation in various water sports and their sex distribution reported by governing bodies

Sport	Number of participants		% males (thousands)
Angling, coarse	2200		99.9
Sailing	1500[1]		nd
Windsurfing	600[1]		nd
Water skiing, aquaplaning	>400	14[2]	68
Canoeing	100[3]	1000[4]	85
Sub-aqua	>100		75
Surfing	30		>90
Rowing	12[5]		75
Long-distance swimming	0.3		72

Notes (1) Provided by Royal Yachting Association from report of Leisure Consultants (1989)
(2) Membership of the British Water Ski Federation
(3) Regular participants
(4) 'Try canoeing at least once a year'
(5) Club members, active competitively
nd No data provided

The Leisure Consultants (1989) report compiled six sources of information to derive the table of participation given in Table 2.2. This includes the categories of power boating and jet skiing, not included in the WRc survey, but omits surfing and open-water swimming. Information on age distributions was obtained for five sports (Table 2.3).

Table 2.2 Estimated numbers of persons of 16 years or older who participated in various water sports at least four times in 1988 (Leisure Consultants 1989)

Sport	Participants (thousands)	Percentage of population, Great Britain
1. Listed in Table 2.1:		
Angling, coarse	nd	nd
Sailing	1500	3.4
Windsurfing	600	1.4
Water skiing, aquaplaning	400	0.9
Canoeing	800	1.8
Sub-aqua	90	0.2
Surfing	nd	nd
Rowing	400	0.9
Long-distance swimming	nd	nd
2. Not listed in Table 2.1:		
Power boating	1000	2.3
Jet skiing	90	0.2

Notes A significant number of children take part in certain sports, especially canoeing and rowing. Adults (over 16 years) taking part include those doing so on holiday.
nd - no data

Table 2.3 Age distributions for participation in water sports supplied by governing bodies*

Age class (years)	Percentage distribution of participants in: Water skiing	Surfing	Canoeing	Long-distance	Sub-aqua
5 - 14	10	15	10	6	0
15 - 24	43	40	40		20
25 - 34	26	20	30		20
35 - 44	5	15	10	94	20
45 - 54	11	9	5		10
55+	5	1	5		10

Notes * No returns for coarse anglers. Leisure Consultants (1989) report gives dominant age group as 15 - 24 for sailing, windsurfing and jet skiing, 25 - 54 for power boating. The Amateur Rowing Association estimate that 25% of rowers are under 18 years old.

This shows a significant following by under 15 year olds for all the sports for which returns were made, except sub-aqua diving. In most cases, the dominant age groups were from 15 to 34.

Four organizations provided information upon the regional distribution of their sports (Table 2.4).

Table 2.4 Regional distribution of participation in four water sports (numbers or percentage of total representation)

Region	Canoeing (%)	Surfing	Open-water swimming	Water skiing
London	28	4 000	73	99 000
East England	8	3 000	13	92 000
South West England	10	10 000	25	5 400
Central England	19	3 000	58	73 000
Wales	4	5 000	10	14 000
Northern England	14	4 000	160	82 000
Scotland	16	1 000	15	14 000
Northern Ireland	1	nd	2	nd

Notes nd: no data given

2.2.3 Water contact

A preliminary assessment of the nature of water contact for each of the water sports was addressed in the questionnaire. The responses obtained are presented in Table 2.5. A seventh category of contact to hands only was identified by the National Federation of Anglers. It would appear that for all water sports there is some splashing of the face and for all except angling there is a chance of swallowing the water. Swimming, surfing, canoeing and water skiing involve whole body contact. Also summarized in Table 2.5 is the frequency of water contact experienced for the various water sports. It would appear that long-distance swimmers, surfers, wind-surfers and water skiers experience a high frequency of water contact.

Table 2.5 Nature and frequency of water contact experienced in water sports, from questionnaire sent to governing bodies

Water contact	Long-distance swimming	Surfing	Angling	Sailing, wind-surfing	Canoeing	Water-skiing
1. Nature						
Whole body	X	X				X
Up to neck						
Up to waist						
Feet and legs and/or arms				X		
Chance of swallowing	X	X		X	X	X
Splashing of face	X	X	X	X	X	X
Heads only			X			
2. Frequency						
All the time	X	X	(1)	(2)		X
Once every outing						
Once every other outing						
Very infrequently						

Notes (1) Wetting of the hands, but no other part of the body
(2) For windsurfers

2.2.4 Awareness of potential risks to health

The questionnaire asked whether each organization was aware of any particular risks to participants from waterborne infection or illnesses. Without exception the response from each sports organization to this question was 'Yes'. To ascertain further the nature of the morbidity, the questionnaire suggested various illnesses. The responses are summarized in Table 2.6.

The least level of problems was reported for angling and water skiing. However, both the National Federation of Anglers and the British Water Ski Association were aware of the hazard from leptospirosis. The commonest syndrome was acute diarrhoea, vomiting, stomachache and nausea, suggestive of gastroenteritis, using Cabelli's (1983) criteria. The Royal Yachting Association (for sailing and particularly windsurfing), the British Canoe Union and the British Surfing Association all reported concern about sewage pollution.

Table 2.6 Illnesses from which participants of water sports were reported to be at risk, from responses of governing bodies

	Sailing, wind-surfing	Canoeing	Long-distance swimming	Surfing	Coarse angling	Water-skiing
Eye complaints	X		X	X		
Ear complaints	X		X	X		
Sore throat			X	X		X
Skin irritation	X		X	X		
Acute diarrhoea	X	X	X	X	?	
Vomiting	X	X	X	X	?	
Stomachache/nausea with fever	X	X	X	X		
Leptospirosis		X	X		X	X

Information provided on the hazards from drowning and leptospirosis are given in Table 2.7. The British Canoe Union has kept detailed records of injuries and fatalities to canoeists. Of the fatality rate of 8.8 per year between 1971 and 1985 only about one per year occurred to experienced canoeists and the remainder occurred mainly in calm waters involving non-swimmers and those not wearing buoyancy aids.

Table 2.7 Responses by governing bodies to questions concerning annual incidence of drowning and awareness of leptospirosis

Sport	Drowning (annual cases)	Leptospirosis
Sailing, windsurfing	5 or less	No
Water skiing	None known	Almost none, members made aware
Surfing	1 - 2	No
Angling	None	Advice sheet to anglers
Long-distance swimming	Negligible	Yes
Sub-aqua	5	Yes, 3 cases annually
Canoeing	9*	Yes

Notes * British Canoe Union report 123 fatalities in the 14 years 1971 - 1985; see text for details

The Royal Yachting Association was concerned about dinghy sailing on inland waters affected by cyanobacterial blooms ('blue-green algae') and has prepared three documents (Appendix B) to advise clubs and those teaching children to sail.

2.2.5 Seasonal variation of participation in various water sports

Since there may be seasonal fluctuations in the levels of faecal pollution as judged by faecal coliform counts and because all-year round participation may influence immunity or susceptibility to infection, it is important to know at what times of the year participation of various water sport activities occurs. This was addressed in the questionnaire and the information obtained is presented in Table 2.8.

Table 2.8 Seasonal variation in participation of recreational water sports as judged by the governing bodies

	Long-distance swimming	Sailing, windsurfing	Angling	Surfing	Skiing	Canoeing
All year		X		X	X	X
Spring					X	
Summer					X	
Autumn					X	
Winter						
Other	May-October		*			April-Sept[+]

Notes * Restricted by close season for coarse fishing, 15 March to 15 June inclusive.
+ Casual canoeists only; 'main-line' canoeists - all year

2.3 Information on recreational and leisure usage of canals

British Waterways (BW) own, or are the navigation authority for, a network of canals, rivers and reservoirs which form a leisure and tourism resource. This comprises nearly 3200 km (2000 miles) of waterway, plus 90 reservoirs, and dock basins, which support a variety of leisure and tourism activities enjoyed by millions of people each year. The waterways are a multi-use leisure resource, catering for a variety of activities including fishing, boating, walking and nature study.

The waterways are divided into three groups:

1. Commercial waterways 555 km (345 miles), for the commercial carriage of freight;

2. Cruising waterways 1875 km (1165 miles) for cruising, fishing and other recreational purposes;

3. Remainder waterways 809 km (503 miles).

The number of people pursuing recreational and leisure activities on BW canals was quoted as three times those visiting properties owned by the English Heritage and four times those visiting National Trust properties. In 1986, some 20 200 000 visitors paid to pursue activities on BW properties, compared to 7 271 000 visitors to properties managed by English Heritage and 5 588 000 visitors to National Trust properties.

In 1986 the inland waterways provided some 119 000 000 user-days of leisure. The numbers of adults and adult user-days pursuing the various water recreational activities are summarized in Table 2.9. Bathing is strictly prohibited in the BW canals on the basis of danger from drowning.

Table 2.9 Participation in various water activities pursued on inland waterways in 1986, from the Planning and Research Unit of British Waterways

Activity	Adults	Adult user-days
Walking/informal recreation	4 830 000	96 100 000
Angling	770 000	16 200 000
Trip boats	500 000	1 000 000
Private boating	400 000	1 800 000
Unpowered boating	400 000	2 800 000
Hire boating	140 000	1 200 000
Total	7 040 000	117 000 000

It should be noted, however, that over 80% of the adult user-hours are devoted to walking, in which no water contact or exposure to water is likely. British Waterways is the largest single owner of fishing rights. According to a National Opinion Poll Survey carried out in 1986, 770 000 people over 12 years of age regularly fish the BW inland waterways. When adding irregular users and youngsters under 12, BW estimate that nearly 1 000 000 anglers used the inland waterways in 1989. Overall, in Great Britain, it was estimated in 1988 that there were 3 900 000 adult anglers, of which 58% 2 300 000 went coarse angling during the year. These made up a total of 17 300 000 visits to the system in that year. Canal fisheries generally provide an excellent training ground for youngsters, being fairly shallow and slow flowing. They are extremely popular with match anglers providing the fairest venues owing to their fairly uniform nature and the fact that they are easily accessible. BW are improving facilities for anglers providing car parks and improving the quality of tow paths.

Three types of powered pleasure boats are used on British Waterways canals and lakes. These are privately-owned pleasure boats (about 22 218 in 1989/90), commercially-run hire boats (1603 in 1989/90) and commercial trip and restaurant boats (98 trip boats, 13 restaurant boats and 29 hotel boats). Overall, for both inland and coastal waters, the British Marine Industries Federation estimated that in 1988 there were 1 300 000 private boat owners in the country (power and sail), with a further 2 300 000 people participating in boating. A British Waterways survey in 1989 estimated that between 500 000 and 600 000 people went out on privately-owned powered boats on BW waterways, either as owners or participators. It is estimated that some 175 000 people participated in hire boating on BW waterways in 1990. Although the numbers of trip and restaurant boats are small compared with other categories, they do move substantial numbers of people, with an estimated 600 000 people taking trips on boats on BW waterways in 1989. Inland waterways are not

really suited to fast, powered boating activities, such as speed-boating, jet skiing or water skiing, although they may take place on some reservoirs and river navigations. No figures are available to show the extent of these activities on BW waterways, but their size is likely to be small.

Canoeing, sailing and rowing all occur on BW waterways and on some reservoirs. A licence is required for sailing, sail boarding and rowing boats although canoes have been exempted through an agreement with the British Canoe Union. In 1989/90 1733 sailing and rowing craft were registered. Slow moving, shallow and narrow inland waterways are particularly appropriate for beginner canoeists. They are often easily accessible from urban areas, as are many of the reservoirs. An estimated 200 000 people used BW waterways for canoeing in 1989, making an estimated 1 400 000 visits to the waterways during the year. This compares with national estimates for 1988 of 500 000 people owning canoes, plus a further 600 000 participating in canoeing. Inland waterways (and reservoirs) tend to be used mainly for placid water canoeing and long-distance canoeing, which are less likely to involve contact with water than other types of canoeing, such as slalom or white water racing.

2.4 Discussion

2.4.1 Participation

The statistics upon participation are subject to considerable errors of estimation, as may be judged in comparing Tables 2.1 and 2.2. As obvious difficulty is that of estimating the casual participants, who do not belong to registered clubs.

Table 2.1 indicates that at least two-thirds of the participants in the sports listed are men. As might be expected of vigorous sports, the majority of participants are young adults and teenagers. Rowing has a particular following among those under 18 years, doubtlessly through school clubs and is a sport which has a high proportion of its participation by club members.

These are strong regional tendencies among the sports shown in Table 2.4, doubtlessly reflecting the availability of suitable waters, e.g. surfing in South West England and water skiing in lakes and gravel pits near London, East, Central and Northern England.

2.4.2 Water contact and hazards to health

The reviews in Sections 1.2 and 1.3 show how the nature and degree of contact with water can influence risks to health from infections disease and toxic shock from cyanobacterial blooms.

The assessment of water contact provided by the sports organizations (Table 2.5) contains some anomalies. Complete immersion is a regular feature of white-water canoeing (see Section 4.3.2), through Eskimo rolls and capsizing but is not given in the reply. The return for sailing also refers to windsurfing (a sport controlled by the Royal Yachting Association). All six categories were stated to involve splashing of the face and all except angling, a chance of swallowing water. Long-distance swimming, surfing and water skiing were stated to involve wetting of the entire body. To these must be added sub-aqua diving and white-water canoeing. Capsizing is common in dinghy sailing, but rare in seagoing yachting.

Canoe touring in smooth water involves less water contact than white-water canoeing. Some discretion is used in the following arguments.

It is convenient to recognize three classes of recreation, based upon degree of water contact and hazard to health:

1. **Whole body contact**

   Those in which the whole body, or the face and trunk are frequently immersed or the face is wetted by spray, and where it is likely that water will be swallowed.

2. **Incidental contact**

   Those in which only the hands or feet are wetted and when greater contact is not a normal feature.

3. **Non-contact**

   Those where there is normally no contact with water and where water is incidental to enjoyment of the activity.

This classification is considered in two ways: by the extent of participation by the public (Table 2.10) and by perception of illness by the governing bodies (Table 2.11).

Table 2.10 Estimated participation (thousands) in sports, classified by degree of water contact

Whole-body contact		Incidental contact		Non-contact	
Canoeing	1000	Rowing	10	Walking	4830*
Windsurfing	600	Sailing	1500	Boating	2300*
Water skiing	400			Angling	2200
Sub-aqua	>100				
Surfing	30				
Long-distance swimming	0.3				
Totals	c 2130		1510		9330

Notes Sources: Tables 2.1 and 2.2
* British Waterways

Table 2.10 shows that non-contact recreation greatly predominates, being nearly three times greater than the other two classes combined. This has great significance for the identification of uses in controlled waters and in the designation of appropriate statutory Water Quality Objectives.

Table 2.11 shows that symptoms of the eyes, ears, throat and skin and gastrointestinal symptoms are regarded as hazards of whole-body contact sports by those organizations which replied. This is consistent with the view expressed earlier that water contact predisposes to such complaints. Four sports organizations, representing surfing, sailing, windsurfing and canoeing report drowning as a real risk, amounting to about 20 cases yearly. Deaths from 'accidental drowning and submersion' in 1983 and 1984 in England and Wales were recorded in the Report of the Registrar General as 379 (282 males) and 303 (215 males) respectively. These exclude water transport accidents and suicides (OPCS 1985). Drownings in these sports amount to about a twentieth of total deaths by accidental drowning and submersion.

Table 2.11 Hazards to health reported for the three classes of sports of Table 2.10

Class and sports	Symptoms reported	Leptospirosis	Drowning (annual cases)
1. Whole-body contact			
Long-distance swimming	Ear, eye, throat, skin, GI	Yes	Negligible
Surfing	Ear, eye, throat, skin, GI	-	1-2
Water skiing	Throat	Yes	-
Canoeing	GI	Yes	9
Windsurfing	Ear, eye, skin, GI, cyanobacteria	-	5 or less
Sub-aqua diving	-	-	5
2. Incidental contact			
Rowing	-	-	-
Sailing	*	-	*
3. Non-contact			
Angling	-	Yes	None
Walking	-	-	-
Boating	-	-	-

Notes - No reply
* Reply grouped with windsurfing

Leptospirosis was regarded as a hazard by the organizations for open-water swimming, water skiing, canoeing and angling. This is commensurate with canoeing and water contact being regarded as risk factors in leptospirosis by the Communicable Disease Surveillance Centre (Ferguson 1990).

Contact with cyanobacterial blooms is seriously regarded by the Royal Yachting Association for sailing and windsurfing on inland lakes. However, there is good cause for considering other whole-body and incidental contact sports, carried out on inland lakes, at risk during periods of bloom. Levels of risk for different activities have been specified by the NRA (1990).

2.5 Conclusions

A questionnaire was sent to national organizations governing various forms of water recreation. Additionally, information was obtained from the British Waterways Board about the use of their canals, navigable waterways and lakes for water-based recreation and leisure. The following conclusions were made concerning participation:

1. Precise estimates of participation cannot be made because casual participants are not usually club members. However, club members are the most active, particularly competitively.

2. Five million people, or more, are active in water sports in the United Kingdom and two-thirds are men.

3. Of organized sports, coarse angling (2.2 million) and sailing (1.5 million) are the most popular. However, the greatest leisure use of water appears to be for walking and informal recreation (4.8 million) and for boating (2.3 million), neither of which involve significant contact with water.

4. Regional tendencies in certain sports, particularly surfing and water skiing, may reflect the availability of suitable water.

5. In the organized sports, much of the activities involve those over 14 years old and young adults, but rowing has a significant school age following (25% being under 18 years old).

In attempting to relate activities to risks of contracting illness it was convenient to recognize three classes of water contact, although recognizing that there would be overlapping for sports in which water contact was variable. These classes were as follows:

1. Whole-body contact, involving immersion or splashing and wetting of the face and trunk, with a likelihood that water would be swallowed: canoeing, windsurfing, water skiing, sub-aqua, surfing and long-distance swimming.

2. Incidental contact; contact with water not a major feature of the sport: rowing, sailing (particularly coastal).

3. Non-contact; contact unusual and water only required for enjoyment: walking, boating, angling. This category accounted for three times the participation of the other two classes taken together.

The following conclusions were made concerning risk to health from these three classes of recreation:

1. Whole-body contact sports were reported by their organizing bodies to present hazards from symptoms of the eyes, ears, throat and skin and gastrointestinal symptoms.

2. Leptospirosis was seen as a hazard for sub-aqua, open-water swimming, water skiing, canoeing and angling.

3. Drowning was regarded as a significant hazard for surfing, canoeing, windsurfing, sailing and sub-aqua, amounting to about 20 cases annually or about one-twentieth of the cases of accidental drowning or immersion in England and Wales.

4. The toxic hazards of contact with blooms of cyanobacteria ('blue-green algae') were recognized for sailing and windsurfing on inland lakes, but it is highly probable that other sports involving contact are also at risk.

3. QUESTIONNAIRE SURVEY OF INDIVIDUAL SPORTS CLUBS

3.1 Questionnaire

While the survey of national governing bodies (Section 2) was in progress, it became clear that more detail upon participation, water exposure and perceived risks to health could be obtained from individual clubs. Thus, the governing bodies would report a consensus view on national issues but would not be in a position to give finer detail.

The questionnaire which was devised, with the approval of the NRA's Project Leader, is presented in Appendix C. The issues addressed were as follows:

- Numbers of active participants;
- Patterns of water usage by active participants;
- Degree of body exposure;
- Experience of morbidity and its nature;
- Relationships between morbidity, water contact and type of water used.

Concerns over cyanobacteria were voiced by some clubs, although not specifically requested.

The responses to these questions and their analyses are given, in turn, in the following Sections 3.2 - 3.8. The likely bias in the data obtained by this method is assessed in Section 3.9 and the specific conclusions from the study are presented in Section 3.10. Some clubs provided direct and explicit comments about pollution issues and health. These are recorded verbatim in Appendix D.

3.2 Numbers of clubs contacted and numbers of active participants

Details of the numbers of clubs targeted for each water sport and the proportion of clubs responding are discussed together with the number of active participants covered.

3.2.1 Targeting and overall response

The names and addresses of individual water sports clubs were obtained from the governing bodies for individual sports, as provided by the Sports Council's Information Centre. Questionnaires were sent to the following clubs:

1. All 64 canoe clubs registered in 1991 with the British Canoe Union in Berkshire, Buckinghamshire, Hampshire, Oxfordshire, Bedfordshire, Cambridgeshire, Essex, Hertfordshire, Norfolk and Suffolk.

2. All 154 water ski clubs in England and Scotland affiliated to the British Water Ski Federation in 1991.

3. All 30 surfing clubs affiliated in 1991 to the British Surfing Association.

4. Individual rowing clubs throughout England were selected from the British Rowing Almanack (1991) published by the Amateur Rowing Association. Of the 136 clubs targeted, 17 were university/polytechnic boat clubs and 31 were schools.

5. The British Sub-Aqua Club supply a booklet listing all their branches throughout the UK. Clubs were selected randomly from counties in England including Avon, Bedfordshire, Berkshire, Buckinghamshire, Cambridgeshire, Cheshire, Cleveland, Cornwall, Cumbria, Derbyshire, Devon, Dorset, Durham, Essex, Gloucestershire, Hampshire, Isle of Wight, Hertfordshire, Humberside, Kent, Lancashire, Leicestershire, Lincolnshire, London, Manchester, Merseyside, Middlesex, Norfolk, and Northamptonshire. No clubs in Northern Ireland, Scotland or Wales were approached.

6. The Royal Yachting Association (RYA) supply a booklet listing all those organizations in the UK which are affiliated to the RYA. These clubs include those which perform not only dinghy sailing but also board-sailing, windsurfing, yachting and motorized cruising. Clubs which were called "sailing clubs" or "windsurfing" or "board-sailing" were selected in preference to those which were called "yacht clubs" and targeted in an attempt to exclude clubs using the very large sailing (yachts) and motorized boats. Clubs in Wales and all regions of England, with the exception of the West Midlands and Yorkshire/Humberside regions, were randomly selected and sent questionnaires. Clubs in Scotland and Northern Ireland were not approached.

Statistics for the numbers of clubs contacted in each water sport and the proportions of questionnaires returned are presented in Table 3.1.

Table 3.1 Numbers of questionnaires completed and returned for each water sport compared to numbers of individual clubs which were targeted

Sport	Clubs targeted	Clubs completing questionnaire	Percentage responding
Rowing*	136	70	51
Sailing/windsurfing	123	35/9	36
Canoeing*	64	36	56
Water skiing	154	30	19
Sub-aqua*	97	22	23
Surfing	30	7	23

Notes * Stamped-addressed envelope enclosed with questionnaire

A total of 604 individual sports clubs were targeted with the questionnaire. The response rate was 35% with 209 completed questionnaires being returned. The proportion of questionnaires completed and returned varied between 19 and 56%. The inclusion of stamped addressed envelopes (as suggested in some of the returned questionnaires) may have been responsible for the better responses by the rowing and canoeing clubs.

A total of 35 questionnaires were returned from sailing clubs. Of these 15 referred to their sport as 'sailing', 10 as 'dinghy sailing', 5 as 'sailing/ yachting', four as 'sailing with windsurfing or canoeing or water skiing' and one as 'inland waterways cruising'.

Only nine questionnaires were returned which were devoted exclusively to windsurfing. An additional five questionnaires were returned in which windsurfing was discussed in conjunction with other sports such as canoeing, sailing or water skiing.

3.2.2 Numbers of active participants targeted in the questionnaires

The total numbers of active participants in the clubs which responded for each water sport are presented in Table 3.2. The mean number of active participants per club is also calculated for each sport.

Table 3.2 Total number of active participants in the clubs which responded

	Clubs responding	Total active members	Active members per club (mean)
Rowing	68	4567	67.2
Sailing	27	3916	145.0
Windsurfing	8	382	47.8
Canoeing	31	1677	54.1
Water skiing	25	2979	119.2
Sub-aqua	20	904	45.2
Surfing	6	174	29.0

It would appear that the individual sailing clubs demonstrate the largest mean number of active members, with almost 60% of the clubs reporting more than 100 active participants.

The relatively high mean number of active participants in water ski clubs may not be representative of the majority of clubs, in that the largest club reported 1000 members. The active membership for the second largest club was 250, while 68% of the water ski clubs claimed less than 100 active participants.

3.3 Patterns of water usage by active participants at water sports clubs

The ratio of active male to female participants, age distributions of members, seasonal variations in usage and the frequency of participation are discussed for the different water sports. In addition, an assessment is made of the types of waters favoured for different water sports.

3.3.1 Ratios of active male to female participants in water sports clubs

The numbers of male and female members who actively participate in all of the clubs for which data were available are analyzed in Table 3.3. For all water sports, the number of active male participants exceeds the number of female participants. In general there are

approximately twice the number of active male participants, although for sports such as sub-aqua diving and surfing the difference appears to be larger.

Table 3.3 Ratios of active male to female participants in each sport

	Male	Female	Male/female ratio
Rowing	3107	1460	2.13
Sailing	2786	1108	2.51
Windsurfing	269	113	2.38
Canoeing	1179	498	2.37
Water skiing	1892	1087	1.74
Sub-aqua	695	209	3.3
Surfing	159	15	10.6

3.3.2 Age distribution of active male participants

The questionnaire asked the secretaries of individual clubs to state the numbers of active male participants in each of the age categories:

5 - 14, 15 - 24, 25 - 34, 35 - 44, 45 - 54, 55 - 64, and 65+.

The percentages of total active male participants for the different water sports were calculated for each age category and the frequency distribution is presented in Figure 3.1. There would appear to be differences in the age distributions of active male participants for the seven water sports studied. Statistics for age distributions of active male participants are presented in Table 3.4.

Table 3.4 Statistics for age distributions of active male participants in water sports clubs

	No. of clubs analyzed	No. of active male participants	Modal age group	Average age
Rowing	64	3015	15 - 24	26.8
Sailing	23	1900	35 - 44	34.9
Windsurfing	8	267	25 - 34	28.1
Canoeing	24	860	15 - 24	25.3
Water skiing	21	1121	25 - 34	32.0
Sub-aqua	20	784	25 - 34	34.3
Surfing	6	167	15 - 24	27.6

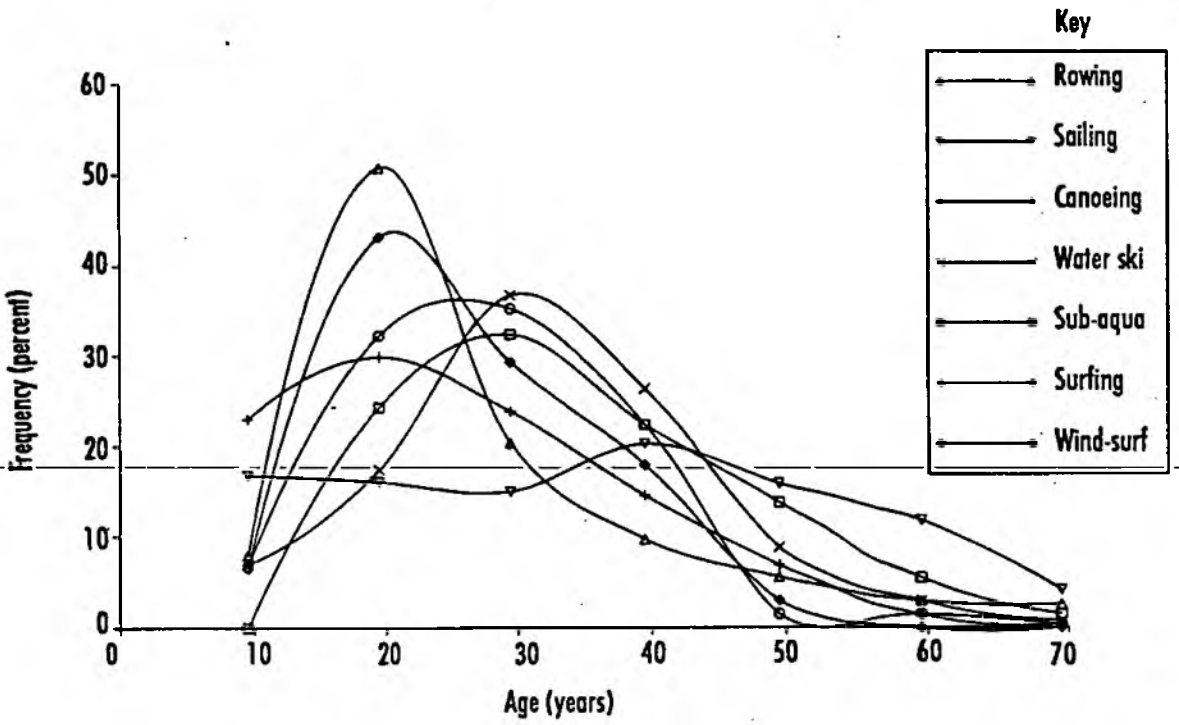


Figure 3.1 Age distributions of active male participants in water sports clubs

Rowing appears to be dominated by young participants with 51% registering between 15 and 24 years of age and 80% of the active male participants being less than 34 years of age. Water skiing, however, appears to be undertaken by older males with 63% of participants registering between 25 and 44 years of age. Whereas rowing and water skiing show a large proportion of participants to be in relatively narrow age ranges, there does not appear to be this age restriction on male sailors. Indeed the proportions of sailors in all age categories (with the exception of the 65+ year old class) are similar, although there are slightly more participants in the 35 - 44 years of age group. Canoe, windsurfing and surfing clubs show a broad distribution in ages of active male participants although over 90% are younger than 44 years. Indeed, there are very few participants over 55 years of age for both the surfing and windsurfing clubs. The age distribution of sub-aqua diving participants is broad with 80% of active male participants between the ages of 15 and 44 years. It should be noted that sub-aqua diving clubs do not permit members below the age of 14 years old to go underwater with air tanks. Canoeing and sailing appear to be the only sports which children in the 5 - 14 year old category participate to a considerable extent.

3.3.3 Seasonal participation

The questionnaire defined four seasons as follows:

Summer: June - August
Autumn: September - November
Winter: December - February
Spring: March - May

and asked the club secretaries to indicate the numbers of people actively participating in the considered water sport within their club for each of the different seasons.

The numbers of active members (including males and females) participating each season were summed for all the clubs in each sport. Results are presented in Table 3.5, together with the total number of active participants for all the clubs in each sport and the number of clubs which satisfactorily completed the relevant parts of the questionnaire.

Table 3.5 Total number of active club members (male and female) participating each season

	Summer	Autumn	Winter	Spring	Number of clubs	Total active participants in clubs
Rowing	3541	3439	3265	3629	64	4109
Sailing	4310	2721	987	2412	27	5113
Windsurfing	406	227	76	195	8	477
Canoeing	1773	1297	854	1189	32	1717
Water skiing	2715	1335	212	1132	21	2771
Sub-aqua	957	614	231	661	21	1064
Surfing	279	244	201	253	7	281

In Table 3.6, the proportions of club members participating each season for individual clubs are summed and expressed as a percentage of the number of clubs analyzed. This gives an indication of the seasonal participation in clubs as a whole rather than throughout all the active members in each sport.

Table 3.6 Seasonal participation in water sports clubs. Proportions of club members participating in each season were calculated for each club, summed and expressed as a percentage of the total number of clubs

Sport	Summer	Autumn	Winter	Spring
Rowing	91.2	90.4	84.8	93.2
Sailing	90.3	61.0	21.5	55.7
Windsurfing	82.8	54.1	20.0	50.3
Canoeing	102.4	79.9	54.7	74.4
Water Skiing	99.2	59.4	8.9	51.5
Sub-aqua	94.1	62.2	24.9	66.9
Surfing	99.1	86.1	74.0	86.7

All sports show some decrease in popularity during the winter, compared to the summer, although the degree of seasonal variation differs considerably for different sports. Thus, rowing experiences only a small decrease in participation during the winter months and appears to be performed relatively consistently throughout the year. Water skiing demonstrates the largest decrease in participation during the winter months with less than 10% of total club active members braving the colder weather. Participation in sailing, windsurfing and sub-aqua diving is also observed to decrease considerably in the winter months with only a fifth or a quarter of total active members participating. The level of participation for water skiing, sailing, windsurfing and sub-aqua diving in spring and autumn is approximately half that observed in the summer months. Participation in surfing and canoeing appears not to be reduced as much during the winter months as sailing, windsurfing, water skiing and sub-aqua diving. One windsurfing club indicates that it is not so much the season which influences participation as the wind conditions. One canoe club notes that, "During the summer our numbers fluctuate considerably due to holiday makers joining us for the 'give it a try' sessions..".

3.3.4 Frequency of participation by active members in different water sports

The questionnaire listed ten categories for frequency of participation in the sport and asked the secretaries of individual clubs to estimate the numbers of individuals in each category. The proportions (expressed as a percentage) of total active participants in each frequency category are presented in Table 3.7 for the different sports.

Rowers demonstrate the highest frequency of participation with approximately 10% performing 6/7 days a week. The modal frequency of participation for rowers is three days a week. For water skiers and sailors the modal frequency is two days a week while for canoeists and surfers this is one day a week. Scuba-divers show the lowest frequency of participation with a modal frequency of 1 day a fortnight. Indeed one club reports that, "Most active members go diving once a fortnight in summer." Around 10% of sailors, windsurfers, canoeists, water skiers and surfers participate three days a week. Very few sailors, windsurfers, or scuba-divers perform more than three days a week, while some 35%

of the rowers perform this regularly. One sailing/yachting club reports that, "We are so seasonal that these categories (referring to questionnaire) have little relevance. About 100 use the club daily in July, 500 daily in August, and 60/80 once a week in May/June and September/October." Two surfing clubs note that frequency of participation is dictated by the tide and prevailing weather conditions.

Table 3.7 Frequency of participation by club members expressed as the percentage of total active participants for each water sport

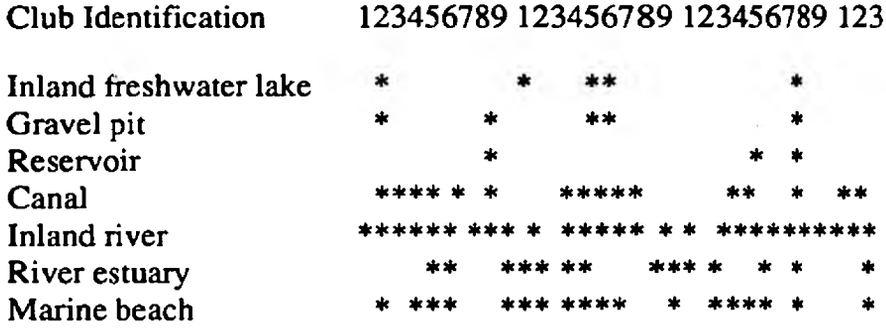
Frequency	Rowing	Sailing	Wind-surfing	Canoe	Water skiing	Sub-aqua	Surfing
6/7 days a week	9.3	0.04	0.2	1.9	2.3	0	0
5 days a week	11.5	0	0	4.2	1.2	0	0
4 days a week	13.9	0.9	0.5	3.5	3.4	0.5	5.5
3 days a week	26.4	13.3	12.5	7.8	9.8	4.6	7.3
2 days a week	18.5	34.4	29.4	21.6	56.1	12.0	21.8
1 day a week	13.8	28.2	29.2	29.2	19.0	25.2	26.1
1 day a fortnight	2.5	12.5	12.3	17.2	5.2	31.4	19.4
1 day a month	2.3	5.7	6.9	9.7	2.0	19.1	17.0
Twice a year	1.5	3.0	7.2	4.1	0.8	4.3	3.0
Once a year	0.3	1.9	1.8	0.7	0.1	2.8	0
Total participants	4487	2691	391	1573	2731	930	165
Total Clubs	66	21	8	27	22	19	5

3.3.5 Types of water used for performing different water sports

The questionnaire listed seven types of water and asked the club secretary to tick which type the club provided for its members to perform the considered water sport. For each sport a bar chart representation, indicating the relative popularities (as a percentage) of the different water types is presented. In addition, for some sports a more detailed pictorial assessment indicating the waters used by individual clubs is presented.

Canoeing

The sites used by each club are depicted pictorially below. It would appear that the majority of canoe clubs use several types of waters.



Rivers/canals are the most favoured by canoe clubs accounting for approximately 50% of the sites used. Still waters (lakes, gravel pits and reservoirs) appear to be the least popular. River estuaries and marine beaches appear to be used to a considerable extent, together accounting for approximately 40% of sites used.

		Total	%
Inland freshwater lake	*****	11	13
Gravel pit	****		
Reservoir	**		
Canal	**********	43	50
Inland river	**********		
River estuary	**********	14	16
Marine beach	**********	18	21

Rowing

Very few rowing clubs use more than one type of water. Rivers are by far the most favoured water type, accounting for 65% of the sites used by rowing clubs. Relatively few clubs use marine beaches and these are mainly harbours.

		Total	%
Inland lake	***	8	10
Gravel pit	*		
Reservoir	****		
Canal	**********	66	79
Inland river	**********		
River estuary	******	6	7
Marine beach	****	4	5

Water skiing

Still waters, in particular inland lakes and gravel pits, appear to be particularly popular with water ski clubs, accounting for 75% of the sites used. However, relatively few reservoirs are used. River estuaries are used to some extent, while canals are not used by any of the clubs who responded to the questionnaire.

		Total	%
Inland freshwater lake	*******		
Gravel pit	**********	21	75
Reservoir	***		
Canal		0	0
Inland river	**	2	7
River estuary	***	3	11
Marine beach	*	1	3
Dock	*	1	3

Sub-aqua diving

All clubs without exception use marine beaches for sub-aqua diving. However, many clubs also used other types of waters.

Club identification	123456789 1234567891
Inland freshwater lake	* * **** ******** **
Gravel pit	* ****** * *** *** *
Reservoir	***** *** *
Canal	* ** * *
Inland river	* * **** ?* ** **
River estuary	* **** *** ** **
Marine beach	**********

One club notes that inland river diving is rare (3 - 4 individuals of 40 in club perhaps 3 - 4 times per year). Another club reports that most diving is performed at sea, though inland lakes, estuaries and possibly rivers are occasionally used. However, the secretary of this club reports an increasing reluctance to dive in fresh water.

		Total	%
Inland freshwater lake	**********	15	17
Gravel pit	**********	15	17
Reservoir	*********	11	12
Canal	*****	5	6
Inland river	**********	11	12
River estuary	**********	12	13
Marine beach	**********	21	24

Surfing

All clubs perform surfing in the sea, although one club also used a river estuary. Other types of water are not used. This presumably reflects the requirement for waves.

		Total
Inland freshwater lake Gravel pit Reservoir		0
Canal Inland river		0
River estuary	*	1
Marine beach	*******	7

Sailing

The types of waters used by sailing clubs are depicted pictorially below. It would appear that inland still lakes and river estuaries are popular.

		Total	%
Inland freshwater lake Gravel pit Reservoir	****** ******** *****	19	41
Canal Inland river	* ******	7	15
River estuary	**********	12	26
Marine beach	********	8	17

To obtain a more detailed assessment, the types of water used by each individual sailing club are shown below. Clubs in general either use inland still lakes or alternatively marine beaches/river estuaries. Only one club uses both.

Club identification	123456789	123456789	123456789	1234
Inland freshwater lake	*	*	**	**
Gravel pit	*		* ** *	***
Reservoir	*	**	*	*
Canal	*			
Inland river	*	* * * *		
River estuary	*** ** *	* ** *	**	
Marine beach	** ** *	**	* *	

Windsurfing

The types of water used by the nine windsurfing clubs are analyzed in the histogram below. In addition, data from four clubs which used inland still waters but performed other water sports in addition to windsurfing are included. Clubs either use marine beaches/river estuaries for windsurfing or alternatively inland still waters. Seventy–seven percent of the clubs responding to the questionnaire used inland still waters.

Club identification	123456789	123	Total	%
Inland freshwater lake Gravel pit Reservoir	* ** * * ** * **		10	66
Canal Inland river			0	0
River estuary	**		2	13
Marine beach	***		3	20
			Total 15	

3.3.6 Summary of patterns of usage

The patterns of usage by active club members for the seven water sports are summarized in Table 3.8.

Table 3.8 Summary of patterns of usage for active participants of water sports clubs

	Male/female ratio	Mean age (male)	Summer/winter ratio*	Modal frequency (days/weeks)	Most popular water type
Rowing	2.1	27	1.1	3	River
Sailing	2.5	35	4.4	2	Lakes/estuaries/all
Windsurfing	2.4	28	5.3	2	Lakes/estuaries/marine
Canoeing	2.4	25	2.1	1	River/canal/all
Water skiing	1.7	32	12.8	2	Inland lake
Sub-aqua	3.3	34	4.1	0.5	Marine beach/all
Surfing	10.6	27	1.4	1	Marine beaches

Notes * The summer/winter ratio is the number of active participants in the summer months (June-August) relative to the number in the winter months (December-February)

The conclusions are:

1. The number of active male participants exceed female participants by approximately twofold, although the difference appears to be greater for sub-aqua diving and surfing;

2. Most clubs with the possible exception of rowing and surfing show a decrease in popularity in the winter months compared to the summer months. This is most notable for water skiing;

3. The modal frequency of participation for active members is 1 - 2 days per week for most water sports, although rowers appear to participate more regularly than this and sub-aqua divers less;

4. Some sports appear to be performed on all types of water, although rowing clubs, water skiing clubs and surfing clubs prefer rivers, inland lakes and marine beaches, respectively;

5. The age distributions of active male participants vary for different water sports.

3.4 Degree of body exposure to water by competent participants

Question 7 of the questionnaire asked whether active immersion or complete wetting of the body including the head is a normal (rather than accidental) feature of the considered sport. Some indication of the degree of contact to water experienced by participants is obtained from assessing the proportion of clubs which answered this question in the affirmative (Table 3.9).

Table 3.9 Percentage of clubs reporting that active immersion or complete wetting of the body including the head is a normal (rather than accidental) feature of each water sport

Sport	Total clubs which returned questionnaire	Number of clubs answering 'yes'	Percentage of clubs answering 'yes'
Rowing	70	0	0
Sailing	35	3	9
Canoeing	36	13	36
Windsurfing	9	7	77
Water skiing	30	24	80
Sub-aqua	22	22	100
Surfing	7	7	100

From the responses to this question, the various sports may be ranked in order of decreasing total body contact to the water as follows:

Surfing > Water skiing > Canoeing > Sailing > Rowing
Sub-aqua Windsurfing

In general the sports can be divided into two categories. Windsurfing, water skiing, sub-aqua diving and surfing fall into the category in which more than 75% of clubs report that complete wetting of the body, including the head, is a normal feature of the sport. Sailing and rowing belong to the category in which less than 10% of the clubs report that complete wetting is normal. Canoeing, however, is more difficult to classify, since complete wetting of the body will depend on the type of canoeing being performed. White-water canoeing or performing capsize drills will result in wetting of the body, including the head. However, gentle paddling in a canoe will not result in complete wetting of the body.

The questionnaire asked what degree of contact with water normally occurs in the case of competent participants performing each sport and listed seven categories to tick. Some rowing clubs added an extra category, 'None'. The information for the various clubs in the questionnaires is depicted in two types of pictorial representation. The first (labelled A) is a histogram showing the total number of positive responses in each category from all the clubs in a particular sport so that an overall assessment of the degree of exposure may be made. The second pictorial presentation (labelled B) presents the results from each individual club.

3.4.1 Canoeing

Some exposure with the water is reported by all canoe clubs although the actual degree of contact of the body with water appears to vary for participants in different clubs. It seems that for the majority of clubs (75%) there is splashing of the face. Some clubs report that exposure is limited to the arms and hands with splashing of the face occurring. Others report

that the whole body is exposed to contact with the water. Indeed, all except 3 of the 35 canoe clubs reported whole body contact or chance of swallowing or splashing of face.

A.

Whole body	**********
Chance of swallowing	**********
Splashing of face	**********
Up to neck	****
Up to waist	**
Feet and legs/arms	**********
Hands only	**********

B.

Club identification	123456789	123456789	123456789	12345
Whole body	* * *** *	*	**	* **
Chance of swallowing	** *	**	**** **	** * **
Splashing of face	*** * *	*********	********	** ***
Up to neck	*	*	*	* *
Up to waist			**	*
Feet and legs/arms	* *	*** *	* *	** ** * * *
Hands only	***	**	* * * * *	** ** ****

Five clubs note that the degree of contact depends on the type of canoeing. Thus slalom canoeists and those performing Eskimo rolls tend to get very wet whereas marathon and sprint canoeists tend to get more contact from splash. The following comments were noted from various clubs:

- The degree of water contact depends on the experience of the participant and the water and weather conditions;
- Beginners fall in the water a lot;
- Active immersion only occurs in training and teaching techniques in pools;
- Active immersion occurs all the time, although it is by choice and can be avoided;
- There is a chance of swallowing on capsize;
- Whole-body contact is not by immersion, but by splashing.

It would appear that assessing the actual degree of contact for canoeists is complex and is probably summarized best by one club which noted that, "the degree of contact varies between individuals".

3.4.2 Rowing

It would appear that the degree of water contact for rowers is restricted to hands, arms and feet, with accidental splashing being commonplace. Only five clubs reported contact to the whole body. Of these, one reported splashing to the whole body which depended on the conditions, another reported light spray over the whole body, a third reported accidental splashing to all parts of the body and a forth reported accidental contact to the whole body and up to the neck. A fifth club reported that whole body contact was extremely rare occurring only in the event of a capsize. Some 12 clubs reported negligible exposure or no exposure at all.

A.

Whole body	*****
Chance of swallowing	**********
Splashing of face	**
Up to neck	*
Up to waist	
Feet and legs/arms	**********
Hands only	**********
None	**********

3.4.3 Water skiing

The majority of clubs report that the whole body is exposed to water during participation in water skiing. With the exception of two clubs, all those clubs which did not report whole body exposure (see B), admitted there was a chance of swallowing the water.

A.

Whole body	**********
Chance of swallowing	**********
Splashing of the face	*******
Up to neck	*****
Up to waist	**
Feet and legs and/or arms	***
Hands only	*

B.

	123456789	123456789	12345678
Whole body	* *******	* ****	*** **** *
Chance of swallowing	*	*** * * *	** * *
Splashing of the face		** * *	** *
Up to neck		* * ** *	
Up to waist		*	*
Feet and legs and/or arms		* *	*
Hands only		*	

3.4.4 Sub-aqua diving

The questionnaire offered seven categories to quantify the degree of exposure of the body to the water. However, this caused some difficulty in the case of sub-aqua diving in that some participants wear wet suits and thus experience whole body contact, while others wear dry suits in which case only the hands and face are exposed. Without exception, and not surprisingly, diving clubs reported that the whole body was exposed to water during diving. However, views appear to be confusing as to the actual degree of exposure in that the presence of a neoprene suit, diving mask and demand valve clearly reduces exposure of the head and body to water. One club notes that with wearing of wet/dry suits, usually part of the face including the lips will be exposed to the water. This club advises its members not to swallow water and not to unnecessarily remove demand valves. Another club reports that "Fully kitted in dry suits and breathing from a valve we try not to take in water and certainly not to swallow it". Indeed, one club remarked that, "As divers, microbiological pollutants have little effect on us as, whilst participating in our sport, we are clad from head to toe in 8 mm of neoprene". According to one club, "Inland river diving is rare : about 3 - 4 individuals perhaps 3 - 4 times per year. When this is carried out, there is no facial contact with the water - special whole face mask is used." Another club stated that, "The nature of the sport is such that the vulnerable areas like the nose, mouth and eyes are protected by mask and demand valve." Only six of the 22 clubs thought members were exposed to a chance of swallowing the water.

A.

Whole body	**********
Chance of swallowing	******
Splashing of face	***
Hands and head	*****
Up to neck	
Up to waist	
Feet and legs and/or arms	*
Hands only	

B.

Club identification	123456789 123456789 12
Whole body	**********
Chance of swallowing	* * ** * *
Splashing of face	* * *
Hands and head	* * * **
Up to neck	
Up to waist	
Feet and legs and/or arms	*
Hands only	

3.4.5 Surfing

Surfing appears to be a high contact sport with six of the seven clubs reporting exposure to the whole body. The remaining club reported a chance of swallowing.

A.

Whole body	******
Chance of swallowing	****
Splashing of face	**
Up to neck	
Up to waist	
Feet and legs and/or arms	
Hands only	

B.

Club identification	1234567
Whole body	**** **
Chance of swallowing	** **
Splashing of face	**
Up to neck	
Up to waist	
Feet and legs and/or arms	
Hands only	

3.4.6 Sailing

Some 60% of the sailing clubs reported splashing of the face and 40% indicated a chance of swallowing water. Whole body contact is not reported by many of the clubs while exposure to the feet and legs/arms appears to be a regularly experienced degree of contact. One club notes that, "Splashing of spray (occurs) on the whole body, which would be covered by protective clothing". Another sailing club reports that whole body exposure occurs in the case of a capsized dinghy. Another club (dinghy sailing) indicates that the risk of swallowing is low. A dinghy sailing club reports that exposure to feet and legs and/or arms occurs on launch/recovery, a chance of swallowing occurs on capsize and splashing of the face occurs when conditions are windy but not when calm.

A.

Whole body	*****
Chance of swallowing	**********
Splashing of face	**********
Up to neck	******
Up to waist	*******
Feet and legs/arms	**********
Hands only	**********

B.

Club identification	123456789 123456789 123456789 123
Whole body	** * * *
Chance of swallowing	** *** * **** ***
Splashing of face	*** *** *** **********
Up to neck	* ** * * *
Up to waist	* * * * ** *
Feet and legs/arms	* * ** ** ** ***** * ** ****
Hands only	** * ** * * * * *

3.4.7 Windsurfing

The most common degree of water contact reported by the windsurfing clubs was exposure to the whole body (see A).

All windsurfing clubs report either whole body contact, up to neck contact or a chance of swallowing (see B). One windsurfing club indicated that splashing of the face and the chance of swallowing were high, although another club, while admitting splashing of the face, reports a low chance of swallowing. One club indicated that whole body contact was experienced by the less skilled participant while the skilled windsurfers were only exposed up to their necks.

A.

Whole body	********
Chance of swallowing	*****
Splashing of face	***
Up to neck	****
Up to waist	
Feet and legs and/or arms	**
Hands only	

B.

Club identification	123456789 12
Whole body	** * *****
Chance of swallowing	**** *
Splashing of face	** *
Up to neck	* * * *
Up to waist	
Feet and legs and/or arms	* *
Hands only	

3.4.8 Discussion of degree of body exposure to water

In Tables 3.10 and 3.11, the different water sports are organized into two categories as determined by assessment of the responses by the clubs. In the first category, which includes sub-aqua diving, surfing, water skiing and windsurfing, whole-body contact with the water appears to be the most common type of exposure. For the second category, which includes canoeing, sailing and rowing, splashing of the face is the major type of body exposure.

Table 3.10 Degree of body exposure to water for sports in which whole-body contact is ranked highest (positive responses from clubs shown)

SUB-AQUA	
Whole body	**********
Chance of swallowing	******
Splashing of face	***
Hands and head	*****
Up to neck	
Up to waist	
Feet and legs and/or arms	*
Hands only	
SURFING	
Whole body	******
Chance of swallowing	****
Splashing of face	**
Up to neck	
Up to waist	
Feet and legs and/or arms	
Hands only	
WATER SKIING	
Whole body	**********
Chance of swallowing	**********
Splashing of the face	*******
Up to neck	*****
Up to waist	**
Feet and legs and/or arms	***
Hands only	*
WINDSURFING	
Whole body	********
Chance of swallowing	*****
Splashing of face	***
Up to neck	****
Up to waist	
Feet and legs and/or arms	**
Hands only	

Table 3.11 Degree of body exposure to water for sports in which whole-body contact is not ranked highest (positive responses from clubs shown)

CANOEING	
Whole body	**********
Chance of swallowing	**********
Splashing of face	**********
Up to neck	****
Up to waist	**
Feet and legs/arms	**********
Hands only	**********
SAILING	
Whole body	*****
Chance of swallowing	**********
Splashing of face	**********
Up to neck	******
Up to waist	*******
Feet and legs/arms	**********
Hands only	**********
ROWING	
Whole body	*****
Chance of swallowing	**********
Splashing of face	**********
Up to neck	*
Up to waist	
Feet and legs/arms	**********
Hands only	**********
None	**********

For the four sports which rank whole-body contact most highly (Table 3.10), chance of swallowing is rated second. For surfing, water skiing and windsurfing a large proportion of clubs reported a chance of swallowing. However, chance of swallowing was reported less by sub-aqua diving clubs, presumably reflecting protection of the mouth by the demand valve. Thus, sub-aqua diving may predispose participants to healths risks to a lesser degree than surfing, water skiing and windsurfing.

The three sports which do not rate whole-body contact as the major exposure, may be ranked in terms of the relative degrees of whole-body contact, splashing of the face and chance of swallowing (Table 3.11). Thus, 31% of the canoe clubs reported whole-body contact in contrast to only 15% of sailing clubs and 7% of rowing clubs. Some 46% of canoe clubs and 39% of sailing clubs reported a chance of swallowing compared to only 16% of rowing clubs. The proportion of clubs reporting splashing of the face, however, were similar - 74% of canoe clubs, 60% of sailing clubs and 58% of rowing clubs. It may be concluded that canoeing in general predisposes participants to a greater degree of body exposure to water than rowing, with sailing probably in between the two.

However, it should be noted that assessing the degree of contact for canoeing is complex and may range from whole body exposure to mild splashing depending on the individual, the conditions and the type of canoeing being performed. Thus slalom canoeists and those performing Eskimo rolls will experience whole-body contact with a chance of swallowing the water, while tour canoeing or gentle paddling will perhaps only result in splashing.

The various sports may be ranked in order of decreasing degree of body exposure to the water as follows:

Surfing Water skiing Windsurfing Canoeing (Eskimo rolls and white-water canoeing)	>	Sub-aqua	>	Canoeing (touring, gentle paddling)	>	Sailing	>	Rowing

3.5 Proportion of clubs perceiving waterborne morbidity and nature of morbidity

Information on the proportion of clubs reporting illness and the nature of morbidity is analyzed for different water sports.

3.5.1 Proportion of clubs reporting occurrences of illness perceived to be contracted from exposure to the water

The questionnaire asked the club secretaries to indicate whether they were aware of any particular cases of illness contracted by members of the club through contact with the water during participation in the particular water sport at their club. It should be stressed that the results obtained have no epidemiological or medical backing and merely reflect opinions of the individual clubs. In Table 3.12, the number of clubs reporting perceived cases of waterborne illnesses are listed for each sport. The percentage of clubs reporting illness relative to the number of questionnaires returned is also calculated for each sport. This percentage, however, may overestimate the true proportion of clubs throughout the UK which have suffered morbidity, since those clubs which have not directly suffered illnesses may be less motivated to complete and return the questionnaire.

Table 3.12 Number of clubs reporting cases amongst their members of illnesses believed to be contracted from exposure to water during participation in particular water sports

Sport	Clubs returning questionnaire	Clubs reporting illness	Clubs reporting illness/ total returning questionnaire (%)
Rowing	70	6	9
Water skiing	27	3	11
Sailing	34	6	18
Windsurfing	14	4	29
Canoeing	35	19	54
Sub-aqua	22	12	55
Surfing	7	5	71

Table 3.12 shows that the relative ranking of water sports in order of decreasing perceived health risk is as follows:

Surfing > Sub-aqua > Canoeing > Windsurfing > Sailing > Water skiing > Rowing

Only six of the 70 rowing clubs reported cases of illness experienced by their members through contact with the water. All six of these clubs used rivers.

Of the 27 clubs which performed exclusively water skiing, only three reported occurrences of illness believed to be contracted through exposure to the water. One of these clubs used a river estuary while the other two clubs used lakes/gravel pits. The illness reported by one of the two clubs using gravel pits was relatively minor - one incident of swimmers' itch in the last ten years.

Twelve of the 22 sub-aqua diving clubs which responded to the questionnaire reported occurrences of illness believed to be contracted through their sport. In addition, a further club reported that there have been cases of mouth/nasal infections and stomach disorders, but none which could be specifically attributed to any particular water.

Five of the seven surfing clubs which responded by answering the questionnaire reported that they were aware of particular cases of illnesses perceived by their members to be contracted through contact with the water during participation at their club. One club reported that its members had experienced no ill effects and the seventh club failed to complete the relevant section of the questionnaire.

Of the six sailing clubs which reported cases of illness, four clubs performed 'sailing or dinghy sailing', one 'dinghy sailing/yachting' and one 'inland waterways cruising'. The 'inland waterways cruising' club case was skin irritation.

Three of the eight clubs which exclusively performed windsurfing reported cases of illnesses believed to be contracted through participation in the sport. These three windsurfing clubs used river estuaries and/or marine beaches. It should be stressed, however, that one of these clubs, which reported a case of viral kidney infection in a male and stomachache in a young female, also reported these two incidents in the questionnaire which it completed for sailing and no distinction is made whether the incidents related to windsurfing or sailing. Of the five clubs which performed windsurfing in conjunction with water skiing, sailing or canoeing, only one reported incidents of morbidity and again there is no indication as to which sport these related. In total, of the eleven clubs which performed on inland still waters, only one club reported any occurrences of illness.

3.5.2 Nature of the illnesses perceived to be contracted through exposure to water during participation

Some indication of the nature of the illnesses experienced may be obtained by scoring the type of illness(es) reported by each club. These are summarized pictorially for the various sports.

Canoeing

The occurrences of illness reported by canoe clubs in general are shown pictorially below. It would appear that eye, ear and skin complaints are relatively minor among canoeists. Sore throats and gastrointestinal symptoms account for the illnesses more commonly experienced by canoe clubs.

Eye complaints	**
Ear complaints	****
Sore throat	**********
Skin irritation	****
Acute diarrhoea	**********
Vomiting	**********
Stomachache/nausea with fever	**********

Rowing

Only six clubs indicated occurrences of morbidity. The complaints reported by each club are depicted below. Ear complaints and skin irritation cases were not reported.

Club identification	123456
Eye complaints	* **
Ear complaints	
Sore throat	* **
Skin irritation	
Acute diarrhoea	* *
Vomiting	* *
Stomachache/nausea with fever	** * *

Water skiing

The nature of illnesses experienced by each of the three water skiing clubs reporting morbidity is indicated below:

Club identification	123
Eye complaints	
Ear complaints	*
Sore throat	*
Skin irritation	*
Acute diarrhoea	*
Vomiting	*
Stomachache/nausea with fever	

Sub-aqua diving

The types of illness experienced by scuba-diving clubs are summarized pictorially below. The most common ailments experienced by sub-aqua divers appear to be ear complaints and sore throats. One club adds that ear complaints are believed to result from polluted waters rather than from water pressure. Two clubs instruct members to wash ears out in fresh clean water after activity especially in the sea. One sub-aqua diving club, which uses waters of all types, reports experiencing cases of all illnesses listed amongst its 57 members with 25 cases of sore throat, 15 cases of diarrhoea and 12 cases of ear complaints in one year. However, the marine waters, which they reported using, appear to be very polluted, with untreated sewage visible both above and below the sea surface.

Eye complaints	**
Ear complaints	*********
Sore throat	*********
Skin irritation	*
Acute diarrhoea	*****
Vomiting	*
Stomachache/nausea with fever	***

Surfing

The types of illnesses reported at five individual surfing clubs are depicted below. The surfers at four of the clubs appear to experience a wide range of illnesses.

	12345
Eye complaints	** **
Ear complaints	** **
Sore throat	** **
Skin irritation	**
Diarrhoea	** **
Vomiting	****
Stomachache/nausea with fever	* *

Sailing

The illnesses experienced by ' individual sailing clubs are depicted below. Stomachache/nausea with fever appears to be the most prevalent complaint among clubs. The number of cases of illness in the sailing clubs which reported morbidity appear to be very few. Thus one sailing club reported three cases of stomachache and a dinghy sailing club reported an incident of a young girl with stomachache and also that of a male contracting a viral kidney infection. An inland waterways cruising club reported one case of skin irritation. A dinghy sailing/yachting club reports occasional stomach upsets although the club secretary admitted it was "difficult to be certain of the cause". Another dinghy sailing club reported a case of skin irritation and less than one case of stomachache per year. Four of the six clubs reporting occurrences of morbidity used estuaries or rivers.

Club identification	123456
Eye complaints	*
Ear complaints	
Sore throat	*
Skin irritation	* *
Diarrhoea	*
Vomiting	
Stomachache/nausea with fever	** *?*
Viral kidney infection	*

Windsurfing

The complaints indicated by the three windsurfing clubs which performed exclusively windsurfing in marine waters or river estuaries are shown below. Club 3 (with 58 members) reported between five to ten cases of sore throat, skin irritation and acute diarrhoea, two cases of ear complaints and three to four cases of vomiting and stomachache/nausea with fever a year.

Club identification	123
Eye complaints	*
Ear complaints	**
Sore throat	*
Skin irritation	*
Diarrhoea	*
Vomiting	**
Stomachache/nausea with fever	***
Viral kidney infection	*

3.6 Relationship between degree of water contact to body, type of water used for particular sports and proportion of clubs reporting morbidity

The health risks associated with performing a water sport depend not only on the degree of water contact but also on the microbiological quality of the water. Different water types vary in the microbiological water quality (Gale 1992). Thus rivers and estuaries tend to be of lower quality than inland lakes and marine bathing beaches. Surfers, however, may venture further out from the bathing beaches towards seas where the slicks from the sewage outfalls circulate and where water quality will be much poorer.

Analysis of the proportion of clubs reporting cases of morbidity relative to the number of clubs returning the questionnaire produces the following ranking of increasing risk to health:

Rowing > Water skiing > Sailing > Windsurfing > Canoeing, Sub-aqua > Surfing

For water skiing, rowing and sailing, incidences of morbidity amongst the clubs targeted are very relatively low. However, for canoeing, sub-aqua and surfing they are much higher. Windsurfing is intermediate.

It is interesting to note that a high proportion of canoeing clubs reports cases of morbidity while water skiing clubs report low incidences of morbidity. Water skiing is a whole-body contact sport, while canoeing, in general results in a lower degree of contact, although the actual degree of body exposure to water during canoeing depends on the individual (mood and experience), water conditions and the type of canoeing being performed (e.g. slalom or touring). The difference in incidences of morbidity probably reflects the much higher water quality of inland lakes, where water skiers perform, compared to rivers, which canoeists favour. The low morbidity rates in rowers, despite the poor microbiological quality of lowland rivers, where the major proportion of rowing is performed, are consistent with the low degree of body contact with water. Surfing and sub-aqua diving, both ranked as typically whole-body contact sports are also performed in poorer quality waters, although for sub-aqua diving the demand valve may offer some protection. Thus, higher incidences of morbidity are expected. Of the sailing clubs targeted, approximately 40% used inland lakes and 40% river estuary/marine beaches. Sailing is not ranked in this report as a whole-body contact sport (splashing of the face being highly ranked by sailing clubs) and the incidence of morbidity among sailing clubs is low. Windsurfing, which is ranked as a whole-body contact sport, is performed either on inland lakes or river estuary/marine beaches and the proportion of clubs experiencing morbidity is intermediate.

3.7 Concerns expressed about cyanobacteria by clubs

Although the questionnaire did not specifically address the problem of cyanobacteria ('blue-green algae'), some club secretaries volunteered information. An indication of the extent of the concern among different water sports is obtained from the proportion of clubs which mentioned cyanobacteria (Table 3.13). The problem does not affect surfers, who use almost exclusively marine beaches or rowing clubs, which prefer to use rivers. Sailing clubs and water skiing clubs, which favour the use of still inland lakes, appear to be the most concerned. One sub-aqua diving club notes that stories of blue-green algae and Weil's disease are making divers more reluctant to dive in fresh water.

Table 3.13 Proportion of clubs expressing concern over cyanobacteria

Sport	Clubs returning questionnaire	Clubs mentioning cyanobacteria	Percentage mentioning cyanobacteria
Sailing	34	7	21
Canoeing	35	3	9
Water skiing	27	4	15
Surfing	7	0	0
Sub-aqua	22	2	9
Windsurfing	9	1	11
Rowing	70	1	1

3.8 Concern expressed about leptospirosis by clubs

Leptospirosis was listed as one of the possible causes of morbidity in questions 16 and 17 of the questionnaire (Appendix C). Some clubs offer advice to members on how to protect themselves from Weil's disease. In Table 3.14, the numbers of clubs mentioning either cases of leptospirosis or providing advice to their members to avoid contracting it, are presented.

Table 3.14 Proportion of clubs either mentioning cases of leptospirosis or offering advice to members to prevent it being contracted

Sport	Clubs returning questionnaire	Clubs mentioning leptospirosis	Percentage mentioning leptospirosis
Sailing	34	16	47
Canoeing	35	24	68
Water skiing	27	12	44
Surfing	7	0	0
Sub-aqua	22	3	14
Windsurfing	9	3	33
Rowing	70	41	59

Over half of the rowing clubs either mention Weil's disease directly, or specify that they give members information from Amateur Rowing Association or advise members to see a doctor, if falling into the water with an open wound. A considerable number of sailing clubs report that they display Royal Yachting Club posters or offer advice on avoiding contact of wounds with the water. Almost 70% of the canoe clubs either provide advice specifically on Weil's disease, or provide advice to reduce chance of contracting the disease or report cases of leptospirosis. None of the surfing clubs were concerned about leptospirosis.

3.9 Possible biases in data obtained by the questionnaire

There are several factors which could render the questionnaires returned in this study non-representative of the sport as a whole. These are discussed below:

1. Club members are likely to be more enthusiastic, more skilled and perform their sport more frequently than non-club members. Such active participants may be more immune to bacterial or viral pathogens in the water than the less regular participants. Skilled and competent participants may experience more or less exposure to the water than novice members.

2. Clubs who perform high contact sports in highly polluted waters and are more likely to experience cases of morbidity may perceive a greater necessity to complete and return the questionnaire.

3. A proportion of cases of illness may go unreported. As one canoeing club secretary notes in response to the number of cases of illness a year, "Young men do not advertise these 'signs of weakness' unless specifically asked!".

Furthermore conclusions drawn from responses in questionnaires may not be directly comparable across the different sports, since:

1. The socio-economic and education status of members in the different types of sports may vary and thereby affect both the real position, as well as the accuracy of reporting.

2. Club sizes, which vary between different sports, may influence the accuracy of the responses. Thus, for a small club (10 - 15 members) the club secretary who completed the questionnaire may know personally all the individual members and take interest in each member. In contrast, for a club with perhaps 200 or more members, the club secretary may not be aware of details of individual participants.

3. For sports where individuals may compete alone, e.g. canoeing, surfing and board-sailing, there may be a large proportion of participants who are not affiliated to a club. Thus, one surfing club notes that, "Although we have only 30 paid-up members, the surfing population of the area is about 250 - 300" and another that, "Over half the surfers at our regular surf spots are not club members". A third surfing club notes that, "The club does not meet or surf as a club. Surfing is an individual sport. The club is merely a meeting place/governing body for the local area ...". In contrast, sports such as rowing are almost exclusively participated at club level.

3.10 Conclusions

Questionnaires were sent to 604 individual water sports clubs including those performing rowing, sailing, windsurfing, canoeing, water skiing, sub-aqua diving and surfing. A total of 209 clubs completed and returned the questionnaire.

The conclusions are:

1. The numbers of active male participants exceed female participants by approximately twofold, although the difference appears to be greater for sub-aqua diving and surfing.

2. Most clubs, with the possible exception of rowing and surfing, show a decrease in popularity in the winter months, compared to the summer months. This is most notable for water skiing.

3. The modal frequency of participation for active members is 1 - 2 days per week for most water sports, although rowers appear to participate more regularly than this and sub-aqua divers less.

4. Some sports appear to be performed on all types of water, although rowing clubs, water skiing clubs and surfing clubs prefer rivers, inland lakes and marine beaches, respectively. Members of windsurfing, sailing and sub-aqua diving clubs participate on several types of water, although rivers are used the least.

5. The age distributions of active male participants vary for different water sports.

6. The different water sports may be ranked in order of decreasing degree of body exposure to the water as follows:

Surfing Water skiing Rowing Windsurfing Canoeing (Eskimo rolls and white-water canoeing)	>	Sub-aqua	>	Canoeing (touring, gentle paddling)	>	Sailing	>

It should be noted that assessing the degree of contact to water for canoeing is complex and varies depending on the type of canoeing being performed, the individual and the conditions.

7. For surfing, water skiing, windsurfing and sub-aqua diving, whole-body exposure is the most highly ranked category of water contact. For canoeing, sailing and rowing, however, splashing of the face is the major form of water contact. More detailed analysis of the canoeing questionnaires shows the degree of contact to be complex in that it depends on the individual and the nature of the canoeing.

8. Sub-aqua diving is classified in this report as a whole-body contact sport. However, the nature of the sport is such that vulnerable areas like the nose, mouth and eyes are protected to some extent by a mask and demand valve. However, 55% of the clubs responding to the questionnaire reported incidents of perceived waterborne illness.

9. The sports may be ranked in terms of the proportions of clubs (relative to the total number of clubs returning the questionnaire for each sport) reporting incidents of perceived waterborne illness as follows:

   Rowing < Water skiing < Sailing <Windsurfing < Canoeing, Sub-aqua < Surfing

   For water skiing, rowing and sailing incidences of morbidity reported by clubs are very relatively low. However, for canoeing, sub-aqua and surfing, incidences are much higher and windsurfing is intermediate.

10. Incidence rates of waterborne morbidity in different sports depend, not only on degree of body contact, but also on the type (and hence the degree of pollution and microbiological quality) of water used. For example:

    - Although water skiing is a high contact sport, the proportion of clubs reporting waterborne illness among members is low. This reflects the high proportion of water ski clubs favouring lakes or gravel pits which are usually of high microbiological quality.

    - Although rowing clubs favour using rivers, which are generally of poor microbiological quality, the incidence rate of waterborne illness is low, probably due to the small degree of body contact with water.

    - Canoe clubs, however, also prefer rivers and the higher degree of body contact with water is reflected in the high incidence of waterborne illnesses.

4. BEHAVIOURAL STUDIES OF PARTICIPANTS

4.1 Activities and sites

The recreational sites of Table 4.1 were chosen for study of a wide range of organized and adventitious activities at different levels of skill.

Table 4.1 A description of sites used for observing behaviour of participants in various water activities

Sites (and National Grid Reference)	Activities studied	Dates and times
1. Leisure Park 1 (not given):		
Lake D	Walking, illicit paddling, dogs, children's canoes	6 May 1990 (Sun), 0900-1900 27 May 1990 (Sun), 0900-1900
Lake E	Dinghy sailing, windsurfing	As Lake D
2. Leisure Park 2 (not given):		
Lake F	Rowing dinghy and children's canoe hire	27 May 1990 (Sun) 0900-1900
Lake G	Dinghy sailing, windsurfing	27 May 1990 (Sun) 0900-1900
3. National Water Sports Centre, Holme Pierrepont, Nottingham (SK 613 391)	White-water canoeing	27 April 1991 (Sat), 0930-1600
4. Canolfan Tryweryn, Bala (SH 889 297)	White-water canoeing	11 May 1991 (Sat), 0915-1600
5. Kirton's Farm gravel pits, Reading (SU 693 699)	European water-ski championships	26 May 1991 (Sat)
6. Theale gravel pits, Reading (SU 652 704)	Windsurfing	3 June 1991 (Sun)
7. Westhorpe Lakes, Little Marlow (SU 865 865)	Water skiing, windsurfing	10 June 1991 (Sun)
8. Towans beach, Newquay (SW 81 62)	Surfing	12 August 1991 (Mon), 1500-1700
9. Lepe Foreshore Country Park, New Forest (SZ 455 984)	Water skiing, windsurfing	25 August 1991 (Sun)

The physical features of Leisure Parks 1 and 2 were given in the second Interim Report (Gale *et al* 1990). Both are owned by 'new towns' in an eastern home county and were studied with the cooperation of the local authorities' officers, who requested anonymity of the locations.

Leisure Park 1 is situated in a dry valley where a series of five lakes have been created, fed by surface water from a separately-sewered residential suburb. The first lake is a stilling pond (working area 400 m^2) followed by grit and oil removal. The following lakes (with areas and uses are: B (0.12 hectare, footpath), C (0.71 hectare, footpath, waterfowl), D (1.2 hectare, footpaths, island with waterfowl, canoes for hourly hire) and E (4.3 hectare, footpaths, bankside angling, dinghy sailing, sailboarding).

Leisure Park 2 has two lakes, bounded by a river and fed by springs and surface water from a housing estate. Lake F (6.2 hectare) is used by the general public for activities requiring no previous skill with rowing dinghies for up to six people and children's canoes for hire. One end is reserved for radio-controlled model boats. Lake F also supports a large population of waterfowl. Lake G (7.1 hectare) is used for dinghy sailing and windsurfing, with club membership encouraged, and for angling.

The National Water Sports Centre's canoe slalom course was visited on the occasion of the last Midlands Canoe Tour event, for which 79 canoeists registered. The course is shown in Figure 4.1. The course is artificially constructed to provide conditions similar to a rocky upland stream in spate. The Holme sluice on the River Trent provides a fall of about 4 m over a course length of about 0.6 km. A weir, at the start of the course, at Bridge 1, can be raised or lowered to increase or decrease the height of water and the discharge rate. At maximum discharge, 18 m^3/s, Grade 3 - 4 conditions are provided. At point x, the whole course could be observed. Video tape recordings were made of particular activities from the path on the south side of the course. Pool P has a circulatory current. From 0930 - 1650 on the day, the course was used by club members for practising skills. Subsidiary events were a 'hot-dogging' contest, inflatable raft cruises down the course and canoe touring in the Trent and the pond. Canoeists were able to camp or to stay at the Centre.

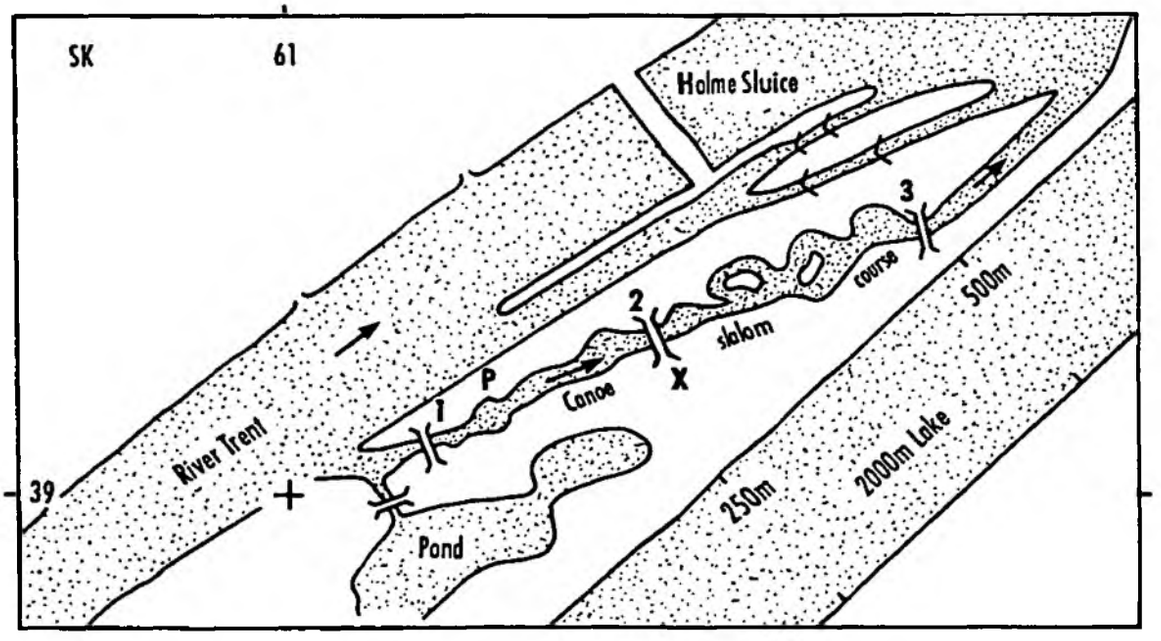


Figure 4.1 Canoe slalom course, Holme Pierrepont: National Grid km references shown

Canolfan Tryweryn is the Welsh Canoeing Association's National White Water Centre (Figure 4.2) located on the Afon Tryweryn, about 1 km downstream of Llyn Celyn dam, from which it receives compensation water. It is released on certain occasions for sporting events, on this occasion the Tryweryn Open Tour weekend. The course begins at the stilling pond and weir below the dam. There is a slalom course (Grades 3 - 4) at Canolfan Tryweryn. Canoeists are also able to use about 7 km of the stream down to the town of Bala. The course was used for white-water touring, practising skills, and for organized rafting. Observations were made at A, B and C, using notebook records and video recording. The visibility splay at each location was about 200 m, limited by topography and vegetation. Canoeists camped by the riverside or stayed at boarding houses in Bala.

Activities at Kirton's Farm, Theale and Westhorpe Lakes and at the EC-identified beaches at Towans, Newquay and Lepe were made by video recording. Except for the European water ski championships at Kirton's Farm, the activities were non-competitive or adventitious.

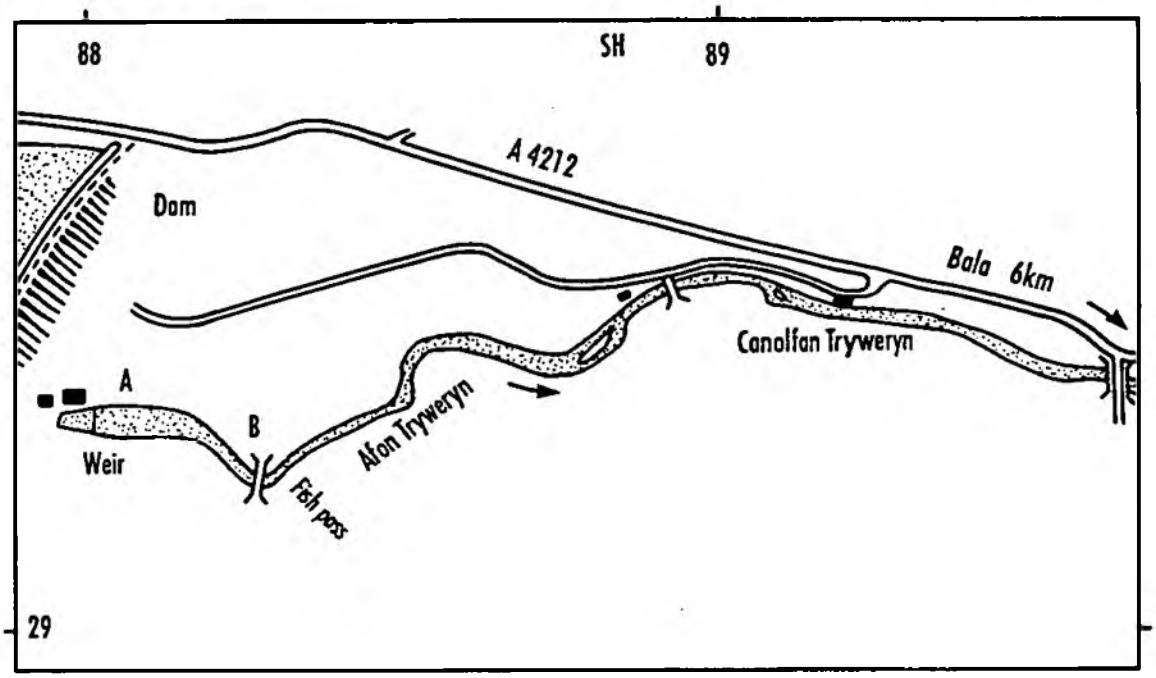


Figure 4.2 White-water canoeing course, Afon Tryweryn: National Grid km references shown

4.2 Methods

At Leisure Parks 1 and 2 (Lakes D - G), the objective was to observe through an entire Bank Holiday Sunday, the usage of the lakes, footpaths and banksides for various forms of leisure and to record it as total man-hours. At quarter-hourly intervals the number of persons indulging in each activity was recorded and plotted on a graph of time x members. The area under the curves for each activity was determined and expressed as user-hours.

At the canoe slalom course at Holme Pierrepont, canoeist-hours were similarly determined by observation from point X (Figure 4.1). Additionally, because the whole course was visible and because canoeists could be identified by bib numbers and colour of canoe and clothing, individual canoeists were followed from the time of launching to beaching their canoes. The duration of canoeing on the course and of immersion activities (Eskimo rolls, capsized and swimming) were recorded. The use of a video camera was investigated for 'time-shifting' activities of individual canoeists, so that times spent on these activities and the degree of contact with water could be analyzed at the laboratory.

On the Afon Tryweryn, notebook recording was used to assess degree of contact with water when different skills were practiced (locations A - C) and at location C to observe the rate of passage of canoeists through the section, the frequencies of immersion activities (Eskimo rolls, 'hot-dogs', capsizes) and mean transit period. With low densities of canoeists, this was done by observations of individual identified canoeists. With a high density of canoeists this was estimated at five-minute intervals by dividing the mean numbers of canoeists in the section (measured every minute) by the total number entering per minute.

Video recording was used at all the events in 1991 listed in Table 4.1. As a result of experience gained at the two canoe events, camera operators were told, as far as possible, to follow individual participants, from the time of entering the water or commencing the activity until leaving the water or completing the activity. The length of recording was determined by battery life (about 45 minutes). Analysis at the laboratory was determined by the nature of the visual information captured, but included noting water conditions, relative skill, clothing worn, nature of water contact, time in the water and duration of immersion.

4.3 Results and observations

4.3.1 Usage of Leisure Parks 1 and 2

A fuller account is given by Gale *et al* (1990). The total activities at Lakes D - G are given in Tables 4.2 and 4.3. The bankside activities, recorded on 6 May in Leisure Park 1, predominate over the organized water-based activities. Thus walking and sitting on the bank accounted for 68% and 86% of the total human activities at Lakes D and E, respectively. It also indicates that dogs, whether under control or not, were a significant user, amounting to 28% and 5% respectively of the human activity throughout the day. Paddling and swimming in the lakes were prohibited and indeed prevented on Lake E by the wardens. However, paddling and exploratory wading by children and teenagers accounted for 30% of the total human activity at Lake D. At Lake E, dinghy sailing and windsurfing amounted to 9% and 8% respectively of total human activities on 6 May 1990.

Table 4.2 Participation in various water and waterside activities (user-hours) at Leisure Park 1, Lakes D and E on Sunday 6 May 1990 between 9 am and 7 pm

Activity	Lake D	Lake E
Dinghy sailing	0	27
Windsurfing	0	24
Paddling - children and teenagers	88	2
adults	4	0
Walkers*	192	186
Sitting on bank	6	127
Dogs	82	18

Notes * Sponsored walk in progress 10 am - noon
No sailing, windsurfing or canoeing in Lake D. Closed season for angling. No picnickers seen

Table 4.3 Man-hours devoted to the various recreational activities on the lakes at Leisure Parks 1 and 2 on 27 May 1990, the Spring Bank Holiday Sunday

	Leisure Park 1		Leisure Park 2	
	Lake D	Lake E	Lake F	Lake G
Boating	0	37	440	65
Windsurfing	0	5	0	37
Canoeing	81	4	53	9
Bathing*	1	3	7	0
Total	82	49	499	111
Usage (man-hour/hectare)	293	40	434	66

Notes * Bathing includes both swimming and paddling in the water

At Leisure Park 2, 333 people were admitted on to Lake F, 236 into rowing dinghies and 97 into canoes. Reference to Table 4.3 shows that the average times spent were 0.5 hours for canoeing and 1.9 hours for rowing. This may reflect the hire periods, but verifies the accuracy of observation.

The types of use varied throughout the daytime. Dog-walking was carried out before 1030 at Leisure Park 1. The majority of bankside users arrived in the afternoon and 90% of the use

of Lake F occurred after 1300, with maximum usage (all 25 dinghies hired) between 1500 - 1700. At Lake G, where club activities were encouraged, 30% of the sailing and sailboarding activities occurred before 1300, doubtlessly because of the keenness of club members.

4.3.2 White-water canoeing - general observations

White-water canoeists wear wet suits, cagoules, buoyancy jackets and protective helmets, sometimes with face visors. A waterproof skirt seals the body to the aperture of the canoe, preventing flooding of the canoe. In slow-moving waters, the hands and forearms are wetted from water dripping off the paddles and there is splashing of the face. In rough water, the face, trunk and arms are splashed when going over weirs and rapids and on hitting standing waves below obstructions. In Eskimo rolls, the occupant is completely submerged. In a capsize, complete immersion is followed by swimming to retrieve the canoe and to reach the bank. Splashing will also occur during two stunts, which are often practiced. In 'sitting in a stopper', the canoe is manoeuvred sideways on to a standing wave, with the objective of staying there as long as desired. In the 'hot dog' stunt, the canoe is pointed upstream, with the bow beneath a cascade to induce the canoe to jump vertically, standing on end.

There is a strong emphasis on safety. The main hazards are drowning and injury caused by impact with rocks, tree roots and other obstacles. Lifeguards with buoyant lines were on duty, at both events, on the banks near critical points.

4.3.3 Observations at Holme Pierrepont canoe slalom course

At Holme Pierrepont on 27 April 1991, 79 canoeists registered for the event. The first three entered the course at 1030 and the course finally cleared at 1648. Twenty-one observations of numbers on the course were made, the highest being 16 at 1310 and the average 8.6, giving an estimated usage of 54.2 user-hours or an estimated 41 minutes on the course per canoeist.

Between 1030 and 1530, visual observations were made of 21 canoeists for the periods between entering and leaving the water (Table 4.4). The mean time spent per canoeist on the course was 21 minutes and 24 seconds, with a mean of 2.1 Eskimo rolls per canoeist. There were four capsizes and the average time in the water recovering from capsizing was 2 minutes and 18 seconds.

Table 4.4 Visual observations of the times spent by 21 canoeists in various activities on the canoe slalom course at Holme Pierrepont on 27 April 1991

Canoeist No. or colour	Time in water	No. of rolls (minutes-seconds)	Duration of capsize (minutes-seconds)
241	8-10		
239	16-05		
252	12-44		4-15
239			
137	16-25		
297	5-45		
?	12-20		
108	24-15	3	
166	24-10		
Y	2-55		2-10
102	11-45		
135	39-10	2	
RR	34-45	8	
YG	39-10	9	
261	7-50		0-40
RR	31-15	2	
135	29-00	1	
YG	21-30	3	
241	7-50		
11-	12-00		
B1 P/R	14-00		1-00
152	11-00		
251	11-00		
131	17-00	4	
135	18-45		
124	0-30	2	
RG	17-00	11	
241	2-55		
Total	449-14	45	8-05
Average per participant (21 canoeists)	21-24	2.1	0-23
Average per trip (28 trips)	16-01	1.6	0-17

Notes Observations were from Point X (Figure 4.1). Each event is for time of entering to time of leaving the water. Canoeists RR and YG entered the water twice; 135 and 241 three times.

During the day, there were 17 raft trips down the course, each carrying an average of 9.2 occupants. The transit time was estimated as 2 minutes and 40 seconds from the video recording, giving a total estimated usage of 6.95 rafter-hours. Seven rafters fell in the water. Two other activities were observed. A 'hot-dogging' contest occupied about an hour. After the course was cleared at 1650, 13 canoeists jumped in at Bridge 1 and floated down past Bridge 3 to conclude the proceedings, median transit time 3.0 minutes.

Table 4.5 summarizes the usage of the course during the day for the various activities.

Table 4.5 Usage of the canoe slalom course at Holme Pierrepont for various activities on 27 April 1991

Activity	Usage (man-hours)
Canoeing	54.2
'Hot-dogging' contest	14.0
Raft trips	7.0
Jumping in	0.7
Total activity	75.9
Total activity per participant	0.96 hours

Observation by video recording was less satisfactory, however, because it was not possible to follow individual canoeists all the time that their canoes were in the water. It was used successfully to analyze the time spent immersed while 11 canoeists were carrying out Eskimo rolls (Table 4.6). The average period of immersion was 3.1 seconds per Eskimo roll.

Table 4.6 Time spent immersed by canoeists carrying out Eskimo rolls, from video record

Canoe identification colour	Number of rolls	Total time under water (seconds)
R, RG	5	13
BL, RY	5	11
YW	1	4
G BK	1	2
BK R	2	4
-	3	8
-	5	13
R	1	5
GW	6	25
RBI	1	10
Total	30	95

4.3.4 Observations at Afon Tryweryn open canoe tour, 11 May 1991

Observations commenced at point B (Figure 4.2). Within view were a drowned weir, the stone bridge, a standing wave across the stream and a coarse screen across the river at the fish pass with entry for canoeists through an aperture by the left bank. Between 0927 and 1013 (46 minutes), 54 canoeists passed and there was one capsize.

Canoeists entered the course in the stilling pond below the dam and 38 passed point A in the 45 minutes from 1015 - 1100. All received considerable facial splashing at the first weir, the rapids, the second weir and the standing wave. Fifteen Eskimo rolls were noted.

The remaining observations were made at point C between 1155 and 1600, downstream from the start of the slalom course (Figure 4.2). From point C about 150 m of stream were in view and over this distance the stream falls by 10 m. There were two rapids, where participants received facial wetting.

In the period 1155 - 1423 canoeists arrived in small groups, travelling together. They tended to circulate and practice skills before moving on. It was possible to estimate the total time spent in the section individually. Analysis showed that transit times in the section were distributed approximately log-normally. The relevant statistics are frequencies of stunts are shown in Table 4.7.

Table 4.7 Analysis of transit times and stunts performed by canoeists at point C, Afon Tryweryn slalom course, 1155 - 1410 on 11 May 1991

Activity and statistics	Numerical value
Number of canoeists observed	99
Transit time:	
Geometric mean	3.9 minutes
Standard deviation of $\log_{10}$ values	1.11
Number of stunts:	
'Hot dogs'	16
Eskimo rolls	12
'Sitting in stoppers'	4
Capsizes	0

From 1430 - 1600, 221 canoeists arrived in the section and left at a faster and reasonably constant rate. The average number of canoeists (from 65 observations) was 14.96 and this, divided by the average rate of arrival, 2.46 canoeists per minute, gives an average transit time of 6.1 minutes. There were two capsizes, but stunts could not be counted.

These two observations of transit times yield a weighted average of 5.4 minutes and a corresponding velocity of 1.7 km/hour over the 150 m of section observed. If canoeists are assumed to have travelled the entire length of the river (7 km), the total time in the water would have been about 4.2 hours.

4.3.5 Observations of surfing at Towans beach, Newquay, 12 August 1991

Observations were recorded by video camera between 1500 - 1700 from the cliffs at each end of the beach. The conditions were light seas, swell period 10 seconds, maximum wave height, 1 m, sunny. The tide was coming in and all surfers had left the beach at 1700. The ability of the surfers was variable but mainly competent. Because the camera operator concentrated on surf rides, there was no information upon the period which the surfers spent in the water.

The activity consists of swimming out with the board, mounting the board in advance of a suitable wave and riding until the wave breaks or the surfer capsizes. Clothing worn is light wet suits.

The average frequency of splashing of the face was 0.86 times per minute and the average duration of immersion was 1.2 seconds per minute in the water.

4.3.6 Observations of water skiing

In water skiing, the skier either swims out or is taken by boat into deep water, fits his skis in the water and lies on his back holding the tow rope. The towing boat then picks up speed and the skier rises into the skiing position. While skiing there is frequent and copious splashing of the face from the wake of the boat and the leading edge of the skis. Immersion, when accidental is violent. At the end of runs, the skier sinks on to the surface of the water and swims until picked up.

In the European water ski championships at Kirton's Farm, Theale on 26 May 1991, 82% of competitors wore half wet suits (leaving forearms and legs below the knees exposed) and the remainder swimwear. The ability was expert.

Table 4.8 summarizes the water contact observed in the video recording for three types of event. Overall, competitors experience 10 face splashings per minute and 0.63 seconds of immersion per minute.

Table 4.8 Average water contact experienced by competitors in the European water ski championships at Kirton's Farm Lake, Theale on 26 May 1991

Event	No. of competitors observed	Time in water (min)	Immersion (sec) (and no. of times)		Swimming or standing (sec)(and no. of times)	
Stunts	6	3.50	3	(1.2)	50	(1.2)
Slalom	5	6.75	5	(5)	140	(5)
Jump	6	10.25	3	(1)	45	(2)

At Lepe Foreshore Country Park on 25 August 1991 the water skiers were competent and were carrying out practice runs on a fine day with a light swell. Clothing was full wet suits, with gloves, but heads uncovered.

Four persons were observed in the video recording and the degree of contact is summarized in Table 4.9. The average rate of immersion was 0.3 seconds per minute, i.e. about half that of the competitors at Kirton's Farm. There was negligible splashing of the face. However, accidental immersion at speed was violent and unexpected.

Table 4.9 Average water contact observed in water skiers at Lepe Foreshore Country Park on 25 August 1991

Skier Number	Time skiing (minutes)	Time immersed (seconds)	Time swimming (minutes)
1	2.25	<1	3.00
2	5.33	1	2.25
3	4.33	1	2.17
4	1.00	1	1.83

4.3.7 Observations of windsurfers

Windsurfers were observed from the video recordings made at Theale gravel pits (2 August 1991), at Westhorpe lakes (10 June 1991) and at Lepe Foreshore Country Park (25 August 1991). At the first two locations, the conditions were sunny, but windless and the participants were beginners. The water contact was that of wading out with the board into water of knee depth, before standing on the board and attempting to raise the sail. Once the sail was raised, there was little movement under the conditions. On landing, the sail is lowered and the participants wades ashore. Under the conditions, there was not accidental immersion or splashing of the face.

At Lepe, the seas were calm to light on a sunny day. Wet suits were worn by 45% of participants and the remainder wore shorts or swimwear. Most participants wore footwear and 5% wore life-jackets. The ability was low-beginner in nature. The participants waded out into knee depth water and sailed close to the shore in water less than about 2 m depth. While sailing, there was negligible splashing of the body. Seven of the 19 participants fell in the water, the immersion being gentle, but unexpected. Three failed to erect the sail. Their activities are detailed in Table 4.10. The rate of immersion was 0.3 seconds per minute of total activity and swimming or standing in the water occupied 54% of the total time spent.

Table 4.10 Activities displayed by windsurfers in the sea at Lepe Foreshore Country Park on 25 August 1991

Participant Number	Standing on board, sailing (minutes)	Immersed (seconds) (and number of times)	Swimming or standing in the water (minutes)
1	0.25	1	2.33
2	3.00		
3	2.75		
4	2.17		
5	1.50	1	3.33
6	5.42		
7	3.00		1.83
8	0.00		2.17
9	1.42		
10	1.00	4 (4)	2.75
11	4.58	7 (7)	0.92
12	2.50	1	0.25
13	0.92		0.77
14	7.33	2 (2)	1.08
15	6.92		0.58
16	2.67		2.00
17	0.00		4.17
18	6.42	2 (2)	1.42
19	0.00		2.50
Average	2.53	0.95 (0.79)	1.37

4.4 Analysis and discussion

4.4.1 Analysis of observational methods

Two methods of observation were used, visual with notebook records of timing and events and video recording. Neither was completely satisfactory. Both depended upon suitable vantage points being available, but serious difficulties were only found at Afon Tryweryn, where only 150 - 200 m of the course could be seen from any location.

Visual observation is limited by the intensity of activity and the skill of the observer to record events. The visual acuity of the eye is greatly superior to that of the video record on playback. It was found to be possible to follow the activities of about half a dozen participants at a time, with the assistance of coloured clothing or competitors' numbers. The quantitative techniques evolved for visual study were as follows:

1. Following and measuring activities of individuals whilst in the water.

2. Determining average duration and frequencies of contact with water, such as capsizes, stunts, swimming or splashing.

3. Measuring average times and their distributions for traversing the length of a course.

4. General observations of behaviour, clothing worn, violence of water contact and the layout and topography of the course.

5. Determining the total usage of a water-sports facility over a day, for different activities.

Visual observations were supported by photographic records, which enhanced the general observations (4).

Video recordings had the advantages of providing permanent records, which could be analyzed and referred to in the laboratory. They were found to be good for measuring the frequencies or duration of contact with water in the record. However, the acuity and angle of visibility are inferior to that of the eye. There is the temptation for the camera operator to concentrate on 'the action' or interesting events, ignoring the full scene or the total time spent by individuals in the water, including those periods when there is little activity or contact with water. Battery life, typically 45 - 90 minutes, limits the amount of an event which can be recorded.

4.4.2 Analysis of water contact

In Section 1.3, the duration, intensity and nature of contact with water have been identified as the main factors influencing the risk of illnesses among water sports participants. Table 4.11 details the degree of water contact observed visually for white-water canoeing and rafting at Holme Pierrepont and Afon Tryweryn. The numerical values are best estimates, using the data collected in Sections 4.3.3 and 4.3.4. The other values are assessments, which will be consistently used in Section 4.

Table 4.11 Measurements of the degree of water contact in white-water canoeing and rafting, from visual observations

Measurement	Canoeing		Rafting
	Holme Pierrepont	Afon Tryweryn	Holme Pierrepont
Duration of session (hours):			
Whole event	6.3	7.5	5.0
Individual average	0.7	4.2	0.1
Immersion:			
Number./person-session	4.8		0.04
Duration (seconds/person-session)	23	-	-
Force of immersion	Violent	Violent	Violent
Splashing of face and trunk	Frequent	Frequent	Frequent
Force of splashing	Violent	Violent	Violent
Wetting of limbs	Constant	Constant	Constant

Video recording provided a comparison of water contact across the four sports shown in Table 4.12. If the measurements are ranked in order of size by columns and the ranks summed by rows, the following overall assessment of degree of contact is obtained:

- Water skiing, championship (greatest contact);
- White-water canoeing;
- Surfing;
- Swimming in the sea;
- Water skiing, competent;
- Windsurfing.

However, it must be noted that this study did not call for more than a limited number of observational studies. It was apparent that as the level of competency increased, so would the violence of water contact, as participants became more adventurous. Contact is also influenced by location being least on lakes and greatest on fast-running streams and the open sea. Venturing into rough waters is, however, decided by competence.

No observations were made of bathers. In the national, Phase II studies of the Health Effects of Sea Bathing, 66% of adult subjects in the bathing cohort spent 10 - 14 minutes in the water at Moreton beach (Wirral) and were required to immerse their heads, three times. On a sunny day at Ramsgate, out of the total water activity, 60% was swimming, 14% diving in off inflatable rafts and 25% paddling and wading, with most of the activities by children (Pike 1991, Kay and Wyer 1992). If active swimming in the sea is included in the comparison of Table 4.12 as a convenient reference point, it will be seen to take up an intermediate position.

Table 4.12 does not show the average total time spent on, or in, the water. This is another factor deciding the time spent wet and hence the degree of chilling of the body.

Table 4.12 Measurement of water contact, estimated from video recording, for four sports, compared with swimming in the sea

Sport: level and location	Time immersed (s/min)	Swimming and immersed (% of time)	Violence of immersion	Frequency of splashing to face (min^{-1})
Water skiing:				
Championship, Kirton's Farm	0.6	76	Very violent, unexpected	10
Competent; low skill, Lepe	0.3	41	Violent, unexpected	Negligible
White-water canoeing:				
Regional, Holme Pierrepont and Afon Tryweryn	5.3	*2.8	Violent, unexpected	11
Surfing; competent, Newquay	1.2	c70	Moderate, predictable	0.9
Windsurfing; low-beginner, Lepe	0.3	35	Gentle, unexpected	None
Swimming in sea, holiday maker+	0.4	c50	Moderate, expected	0.4

Notes * From visual and video recorded information
+ Estimated from Pike (1991) and Kay and Wyer (1992), see Section 4.4.2 text, visual observations

4.4.3 Other factors influencing risk

Club-based activities, where participants congregate and share communal feeding, social, after-the-event activities and accommodation offer more opportunities for person to person or food-borne spread of illnesses, such as respiratory or gastrointestinal, which may also be spread by contaminated water. Gregariousness was particularly marked with the two canoeing events and where a significant proportion of the participants camped for the events.

At Leisure Park 1, it was noted that, despite prohibition, paddling and wading by children and teenagers accounted for 30% of the total activities measured during the day and that many of these were completely wet.

4.5 Conclusions

A limited number of observational studies were carried out to determine the degree of contact with water, and thus the risks to health from polluted water.

Studies of the usage of two purpose-made lake complexes over complete Summer Bank Holiday Sundays yielded the following conclusions:

1. Walking and sitting on the bank predominate over organized water sports activities in terms of total participation.

2. Exercising of dogs is a significant activity and is most common in the early part of the day.

3. Paddling and wading by children and teenagers, involving total wetting, can be a significant activity, when it is not effectively controlled.

4. Sailing and windsurfing by clubs takes place over most of the day, except for the lunch period, whereas sailing and boating provided for visitors is taken up mainly in the afternoons.

5. Contact with water in boating and dinghy sailing at these lakes is confirmed to occasional wetting of hands and feet, except when deliberately incurred.

Visual, photographic and video recorded records were used to analyze the degree of contact with water involved in various sports. The following conclusions were made concerning their usefulness:

1. Visual recording was used to estimate total activity over a complete session and, by selecting individual participants, the total contact activities while that person was on the water. It was also used to measure transit times over a course.

2. Visual recording became difficult or impossible when there were large numbers of competitors, unless individuals could be identified by colour or competition numbers.

3. Video records could be analyzed at the laboratory and enabled precise values to be obtained for frequencies of immersion or other contact. The records were biased if the records concentrated upon visually interesting shots.

Analysis was made of water contact at five freshwater and two marine locations used for water skiing, white-water canoeing, rafting, surfing and windsurfing. The following conclusions were made:

1. All these sports involved some risk of immersion, which was highest and most violent for championship water skiing, white-water canoeing and surfing.

2. Splashing of the face and trunk was most frequent in white-water canoeing and championship class water skiing. It did not occur in windsurfing by beginners on calm coastal and lake waters and was negligible in competent water skiers in coastal waters.

3. When compared with swimming in the sea the following ranked order of contact with water was obtained:

   - championship water skiing (greatest);
   - white-water canoeing;
   - surfing;
   - swimming in the sea;
   - water skiing (competent, low skill);
   - windsurfing (least).

4. Water contact increased with the level of competence and therefore, the degree of adventurousness, of participants.

5. Club-based activities offer, because of communal feeding and accommodation, greater opportunities, than individual participation, for person-to-person and food-borne spread.

5. GENERAL DISCUSSION

5.1 The aims of this report

It is convenient, at this stage in the report, to restate the original objectives (Section 1.1.2) and to consider by what means and by how far they have been achieved. The objectives and the means used were as follows:

1. Determine patterns of usage and risks, by collecting statistics on numbers of participants and frequency of participation from national sports organizations and clubs (Sections 2 and 3).

2. Establish degrees of water contact for various sports by conducting a limited number of observational studies (Section 4).

3. Develop a scheme for classifying the various recreational uses of water, according to exposure, body contact with water and the risk of water being swallowed, using a scientific assessment of risks (Sections 1.2 and 1.3).

So far the studies towards attaining these objectives have been considered in isolation. It is now intended to show how far the knowledge obtained is complementary and mutually consistent, so as to obtain consensus. Because data have been obtained in different ways and because the surveys of national controlling bodies and individual clubs will reflect their own views and policies there will be many minor divergences and lack of precision. However, the authors feel that the broad views of risk classification and of usage is the only practicable approach. It is not practicable to consider water quality standards being designated for every class of sport, since this would be impossible to administer in a scheme of statutory water quality objectives and because the degrees of water exposure and of risk would vary between individual sports, depending on age, competence, season and other factors. Such minutiae have already been discussed in the individual studies. The discussion which follows concerns broad issues and comparisons.

5.2 Participants and usage

National statistics upon participation in various sports are valuable, since by indicating popularity and frequency, they indicate the sporting public's investment and running expenditure in time and money on their pursuits. Such statistics will provide valid reasons for considering whether or not to designate particular zones of water for a class of recreation, with the implications that setting more stringent water quality objectives might have upon costs of regulation and compliance.

Statistics for participation were obtained from the survey of national governing bodies and British Waterways Board, supplemented by a published analysis of a variety of data (Leisure Consultants 1989). These three sources are complementary and overlap only in terms of the whole-body and incidental contact sports. Any discrepancies do not alter the overall conclusions that non-contact recreations such as walking, boating and angling are pursued by one-sixth of the population in England and Wales and account for three times the participation of the whole-body and incidental contact sports combined. Of the latter, the most popular, in terms of numbers, was sailing (1.5 million), followed by canoeing (1 million) and windsurfing (0.4 million).

In the club survey, it was apparent that there were strong preferences for particular types of water, doubtlessly because they provided ideal and congenial conditions. These needs also appeared to influence regional distributions of certain sports and any seasonal preferences. These needs, to some extent, appear to outweigh concerns about pollution of the water and health risks, because the responses from clubs indicated that members were knowingly using polluted waters although reluctantly (see Appendix D).

5.3 Risks to health

Risks to health from pathogens have been critically assessed in Sections 1.2 and 1.3 from medical and scientific considerations. Three classes of illness have been recognized in Table 1.1 and classified as follows:

- Waterborne - related to faecal pollution;
- Water contact - contact with pathogens or toxins, not related to faecal pollution;
- Water-washed - water comprises bodily defences and washes in opportunistic pathogens from the skin.

A priori, appropriate control measures and water quality standards were suggested in Table 1.1, using the knowledge already reviewed.

It is an extension of the arguments, used to produce Table 1.1, to consider that the risks to health from each of three classes of illness will increase with the duration and intensity of exposure to water containing the agent of disease. The two questionnaires have attempted to obtain views upon the degrees of contact with water and the behavioural studies to measure it quantitatively. Additionally the views of governing bodies and clubs were sought about perception and experiences of illness.

Table 5.1 compares the rankings of the information obtained from the sports clubs and the behavioural studies on degree of contact with water and reports of illness for various sports. There are few inconsistencies in the comparisons. Sailing and rowing were reported to involve the least body contact and whole-body immersion and show low perception of illness. The only inconsistency is water skiing, in which contact is rated highly, but illness is low, doubtlessly because water skiing is mainly carried out on lakes or at beaches, where water quality is generally good. Table 5.1 also shows that the degree of water contact varies within canoeing (white-water, touring) and water skiing (championship, club).

The responses from the national governing bodies upon water contact (Table 2.5) were categoric and not capable of being ranked. However, they show that long-distance swimming, surfing and water skiing all involve whole-body contact, water contact all the time, splashing of the face and swallowing of water and that canoeing, windsurfing and sailing involve swallowing and splashing of the face and canoeing, whole-body contact.

The classification of sports by contact in Table 2.10, from the survey of national governing bodies, is therefore supported by information obtained from clubs and behavioural studies.

Table 5.1 · Ranking of responses from sports clubs and behavioural studies on water contact and perceived risks to health

Sport	Immersion normal (Table 3.9)	Body contact (Section 3.4.8)	Clubs reporting illness (Table 3.2)	Contact observed (Section 4.4.2)
Surfing	6.5	6	7	4
Sub aqua	6.5	4	6	-
Water skiing	4.5	6	2	6, 2[b]
Windsurfing	4.5	6	4	1
Canoeing	3	6, 3[a]	5	5
Sea bathing	-	-	-	3
Sailing	2	2	3	-
Rowing	1	1	1	-

Notes
- No response
[a] White-water and tour canoeing respectively
[b] Championship event and club activity respectively
Ranking: 1 = lowest
Sea bathing included for comparison

In Table 5.2, the overall rank order in Table 5.1 is preserved, whilst showing the responses from clubs and national governing bodies about various illness. The relationships are less clear than in Table 5.2. Gastrointestinal symptoms feature in club reports for all sports except water skiing. This may reflect a choice of relatively unpolluted water, since, with sea bathing, there is evidence that these and, possibly, throat symptoms are associated with pollution. For the reasons given in Section 1.3, there are good reasons for supposing that complaints of the ears and eyes are 'water-washed', i.e. are caused by disturbance of the body's natural defences washing-in opportunist skin pathogens. Thus, it is reasonable to suppose that ear, eye, throat and gastrointestinal symptoms would results from body immersion, facial splashing and swallowing water. Skin irritations, which might be supposed to be caused by long contact with water, do not feature in clubs' responses.

Table 5.2 also shows some inconsistency between clubs' concerns about leptospirosis and cyanobacteria and advice given nationally.

It must be remembered that requesting perception upon what are perceived as health risks can only give poor quality information upon the true extent of medical risks. The relationships between water contact and water pollution and risks to health can only be answered by properly designed epidemiological studies.

Table 5.2 Responses from clubs and national governing bodies about illnesses and symptoms

Sport	Symptoms perceived by clubs[a]	Concerns[b] about: Leptospirosis	Cyanobacteria	Reports by individual clubs
Long-distance swimming	-	- Y	-	
Surfing	E Eye T G	1	1	
Sub aqua	E T G	2 Y	3.5	
Water skiing		4 Y	6	1 case swimmers' itch
Windsurfing	G	5	5	3 clubs; estuaries, marine. 1 case viral kidney infection
Canoeing	T G	7 Y	3.5	
Sea bathing	E Eye T G[c]	-	-	
Sailing	G	3	7 Y	6 clubs on inland waters
Rowing	Eye T G	6	2	
Angling	-	Y	-	

Notes [a] E ear, T throat, G gastrointestinal symptoms (diarrhoea, vomiting, stomachache/nausea with fever); responses in Section 3.5.2. Significant responses only.
[b] Ranked responses from clubs in Tables 3.13 and 3.14, Y = 'yes', advice given by national governing bodies.
[c] Symptoms recorded in literature survey and UK national study on health effects of sea bathing (Pike 1990, 1991).
- No data.

Meanwhile, the following general principles hold:

1. The incidences of all three categories of illness - waterborne, water contact and water-washed - can be expected to be greater in whole-body contact sports than in incidental contact sports.

2. The degree of faecal pollution of the water will influence the incidence of waterborne illness but not water contact or water-washed.

3. Microbiological standards are appropriate for controlling waterborne illnesses and particularly for whole-body contact sports. They are not appropriate for non-contact recreation.

The only regulatory classification of water recreations, according to risks to health, known to the Authors is that of the National Technical Advisory Committee to the US Department of the Interior (NTAC 1968). This distinguished between 'primary' and 'secondary contact recreation'. Primary contact recreation was defined as that in which there is:

> ".....prolonged and intimate contact with the water involving considerable risk of ingesting water in quantities sufficient to pose a significant health hazard. Examples are wading and dabbling by children, swimming, diving, water skiing and surfing. (Secondary contact sports include those in which contact with the water is either incidental or accidental and the probability of ingesting appreciable quantities of water is minimal.)"

Secondary contact recreation included angling, picnicking and other bankside activities, sailing and boating. This classification of recreation is therefore consistent with that introduced in this report.

It is noteworthy that the observations at Lake E (6 May, Section 4.2.1) showed that 30% of the total activities were illicit paddling and wading by children, many of whom were thoroughly wet. It is therefore logical to consider wading and dabbling by children as a whole-body contact recreation and to consider it as a likely category of use in public places where children play near water, out of sight of official control and supervision.

5.4 Drowning

Deaths by drowning are a serious and readily quantifiable risk for certain water sports. They also serve to put into perspective mild and poorly quantified risks to health. The national governing bodies, representing surfing, sailing/windsurfing and canoeing reported drowning as a hazard, amounting to about 20 cases yearly. A report by the South-Western Regional Health Authority (SWRHA 1991) shows, from OPCS data for 1986 - 1988, that:

- Drowning accounts for 40% of all recreational deaths;
- Most drownings concern swimming (40%), fishing (25%) and canoeing and boating (12%);
- Recreational drownings occur mainly in males (90%).

In 1987 - 1990, recreational drownings in the counties of Avon, Gloucester, Somerset, Devon and Cornwall involved the following numbers of cases:

Swimming	25
Fishing	21
Boating	17
Sub-aqua	9
Surfing	5
Diving	2
Rescue attempt	1
Playing in water	1

These incidences are considerably greater than the 20 and 29 cases of leptospirosis reported in England and Wales for contact with water and for canoeing, respectively, in the five years 1985 - 1989 (Ferguson 1990).

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6. CONCLUSIONS

In this report, patterns of usage, water contact and risk have been determined and a scheme for classifying recreational uses of water proposed, as a result of the following studies:

- Literature survey;
- Questionnaire to national governing bodies for sports;
- Questionnaire to 604 individual clubs (209 responding);
- A limited number of observational studies.

Particular conclusions derived from these studies are given at the ends of the respective sections of this report. The overall conclusions of this report follow, with references to the Tables or Sections where they are introduced.

1. Three classes of illness are associated with water recreation (Table 1.1):
   - Waterborne, caused by faecally-derived pathogens. To control these, microbiological standards and control of discharges are appropriate.
   - Water contact, caused by agents not directly to pollution, e.g. leptospirosis, cyanobacterial toxins, swimmers' itch. For control, ecological and biological standards and managerial awareness and control are appropriate.
   - Water-washed, caused by opportunist pathogens from the skin and body surfaces being washed in and by water compromising the body's defences. Only curtailment of activity will reduce risk.
2. The risk of contracting any of these illnesses would appear to be related to duration and intensity of contact with water (Table 5.1). However, only the waterborne class of disease can be controlled by improving microbiological quality of water.
3. Three classes of recreation have been recognized (Section 2.3.2):
   - Whole-body contact, in which the whole body, or the face and trunk are frequently immersed or the face is wetted by spray and where it is likely that water will be swallowed. Examples are long-distance swimming, surfing, sub-aqua, water skiing, white-water canoeing, windsurfing and sea bathing, in decreasing order of contact. Wading and dabbling by children should be included.
   - Incidental contact, in which only the limbs are wetted and greater contact is not a normal feature. Examples are rowing, canoe touring and sailing.
   - Non-contact - those where there is normally no contact with water and where water is incidental to enjoyment of the activity. Examples are walking, boating under power and angling.

4. The most popular forms of recreation are the non-contact, which are carried out by about one-sixth of the population of England and Wales and which amount to twice the combined activities of the other two classes (Table 2.10).

5. Because the two surveys show that participants and clubs tend to select types of water, locations and seasons which best meet their needs (Sections 2.4, 2.5), there is merit in taking pre-existing use of particular water by clubs or the public into consideration, when defining uses to which waters may be put under statutory water quality objectives.

6. Concerns about leptospirosis, or advice, have been noted in the case of the national governing bodies for long-distance swimming, sub-aqua, water skiing, canoeing and angling and about cyanobacterial toxins for inland sailing. Significant concern was also voiced by rowing clubs for leptospirosis and for cyanobacteria by water ski clubs (Table 5.2).

7. Apart from water skiing clubs, which may tend to use lakes or beaches, which tend to be of good quality, clubs for whole-body or incidental contact sports tend to report gastrointestinal symptoms and often those of the ears, eyes and throat (Table 5.2).

8. It is considered that the information obtained in the surveys upon symptoms is unreliable, being based upon perception. It is unquantifiable and the true relationships between water contact and water pollution and risks to health can only be answered by controlled epidemiology (Section 5.3).

9. The only quantifiable information upon risks to health exists for leptospirosis, for which 20 cases involving contact with water and 20 involving canoeing were reported to the Communicable Disease Surveillance Centre in the five years 1985 - 1989 (Section 5.4)

10. Drowning accounted for 40% of all recreational deaths in England and Wales in 1986 - 1988, mostly in males (90%) and in swimmers (40%), those fishing (25%) and canoeing and boating (12%) (Section 5.4).

APPENDIX A

COPY OF QUESTIONNAIRE SENT TO NATIONAL GOVERNING BODIES FOR AQUATIC SPORTS

CONFIDENTIAL

NATIONAL SURVEY ON PARTICIPATION IN WATER SPORTS

Questionnaire

Dear Participant

The National Rivers Authority has commissioned WRc to carry out a three-year study for developing microbiological standards for water-based recreation. A key part of this study is to obtain national statistics upon the number of people who regularly follow certain sports, the frequency with which they take part and the extent to which they come into contact with water. This questionnaire will help us to compile this information. At the same time, we wish to learn your views upon the quality of water which you consider to be desirable for your sport and whether you are aware of any cases of illness which have arisen in participants in your sport which have been attributed to pollution of the water.

Thank you for your assistance.

1. Response made on behalf of (please name your organisation).

   .....

2. Type of sport considered in this questionnaire (please photocopy and complete copies if your organisation represents several sports).

   .....

3a. How many people in the UK take part in this sport?

   .....

3b. Could you give some indication of regional variations in the numbers of people participating in this sport?

   Scotland

   .....

   Northern England: Northumberland, Tyne & Wear, Cumbria, Durham, Cleveland, Yorkshire, Humberside, Lancashire, Greater Manchester, Merseyside.

   .....

   Central England: Cheshire, Stafford, Derby, Notts, Lincolnshire, Salop, West Midlands, Leicester, Hereford & Worcester, Warwickshire, Northants.

   .....

East England: Norfolk, Suffolk, Essex, Cambridgeshire, Bedfordshire.

.....

London & South East: Oxon, Buckinghamshire, Hants, Surrey, Greater London, Kent, Sussex.

.....

South West England: Gloucestershire, Wiltshire, Avon, Somerset, Dorset, Devon, Cornwall.

.....

Wales

.....

Northern Ireland

.....

4. What is the proportion of men to women?

Men ..... %

Women ..... %

5. Could you indicate on the list opposite the relative age distribution of active members?

5-14 ..... %

15-24 ..... %

25-34 ..... %

35-44 ..... %

45-54 ..... %

55+ ..... %

6a. Please mark with a tick those seasons in which the sport is carried out.

All the year round .....

Spring .....

Summer .....

Autumn .....

Winter .....

6b. Is there any regional variation within the UK in the seasons in which the sport is carried out?

Yes/No

If yes, could you indicate below. Counties for each region as shown in Question 3.

	All year	Spring	Summer	Autumn	Winter
Scotland	.....	.....	.....	.....	.....
Northern England	.....	.....	.....	.....	.....
Central England	.....	.....	.....	.....	.....
East England	.....	.....	.....	.....	.....
London & South-East	.....	.....	.....	.....	.....
South West England	.....	.....	.....	.....	.....
Wales	.....	.....	.....	.....	.....
Northern Ireland	.....	.....	.....	.....	.....

7. Is active immersion or complete wetting of the body including the head a normal (rather than accidental) feature of the sport (please delete inapplicable answer).

Yes/No.

8. If no, can complete immersion occur accidentally, or is it part of a training routine (eg capsize drill, swimming requirement)

Accidental? Yes/No.

Training requirement? Yes/No.

9. If the answer to 7 is yes please indicate how often complete immersion normally occurs in the case of competent participants (please tick).

All the time .....

Once every outing .....

Once every other outing .....

Very infrequently .....

10. What degree of contact with water normally occurs in the case of competent participants (please tick).

    Whole body .....

    Up to neck .....

    Up to waist .....

    Feet and legs

    and/or arms .....

    Chance of swallowing .....

    Splashing of the face .....

11. Do you know of any standards or guidelines concerned with microbiological or sanitary quality of water used for your sport? Yes/No.

    If yes please give details opposite or separately.

12. Do you consider that the European Community Directive concerning the quality of bathing water 76/160EEC adequately covers quality of water for your sport?

    Yes/No/Don't know.

13. Do you provide any advice to your Members and/or Clubs upon quality of water or microbiolgical requirements for protecting amenity and health? If yes, please give details separately.

    Yes/No.

14. Do you give advice to your Members and/or Clubs on how to protect themselves from the risk of infection from contact with water? If yes, please give details separately.

    Yes/No.

15. Are you aware of any particular risks to participants in your sport from water-borne infection or illnesses?

    Yes/No.

16. If Yes to Question 15, please tick those illnesses which you think are relevant in the case of your sport.

    Eye complaints .....

    Ear complaints .....

Sore throat .....

Skin irritation .....

Acute diarrhoea .....

Vomiting .....

Stomachache/nausea with fever .....

Leptospirosis (Weil's disease) ....

17. For each of the illnesses which you have ticked in Question 16, can you give some comment separately upon the frequency of attack or the circumstances in which they have occurred.

18. Among participants in your sport, how many cases of drowning occur annually?

..... cases.

19. Do you know of any similar research being undertaken upon water quality and health aspects of water sports? If yes, could you please attach details.

Yes/No.

Please give:

a. Your name .....

b. Your position .....

c. Your signature .....

d. Date .....

Thank you very much for taking part in this survey. The results of the study will be reported to the National Rivers Authority and may then be published in a general way in the scientific literature. We will seek your prior approval for publication but otherwise, information you give will be treated confidentially.

Yours faithfully

Dr E B Pike
Principal Microbiologist

29 January 1991

APPENDIX B

ADVICE ISSUED BY THE ROYAL YACHTING ASSOCIATION UPON RISKS FROM CYANOBACTERIAL BLOOMS

BLUE – GREEN ALGAE
THE FACTS

A Code of Practice to minimize the risks for dinghy sailors on inland waters affected by Blue–Green Algae

ROYAL YACHTING ASSOCIATION

MAY 1990

WHAT IS BLUE-GREEN ALGAE?

The water at your club may be identified as being contaminated by potentially toxic 'Blue Green Algae'. This is not a new problem, in fact the RYA has been advised by experts that this algae has been recorded in fossil remains and has probably been present in some inland waters since that time.

It is probable that the current increase in algal levels results from generally warmer weather conditions and increased farming nutrients entering reservoirs and lakes. There are no easy options for the removal of these nutrients; addition of chemicals such as copper-to-kill-the-algae would require subsequent expensive removal at water treatment plants. Sludge pumping the sediment from the bed of reservoirs would be impractical, and the present nutrient levels already in silt deposits could last many years into the future.

Although scientific understanding of the problem is not complete, we know that the organism can be toxic, and that the level of complexity of toxicity testing means that it is not practicable to take daily tests as the results can take some days to assess. The Organism should be regarded as a form of Bacterium rather than a 'plant'. In its most dangerous form, in quantity, it has caused death in cows, sheep and dogs drinking significant concentrations at the waters edge by reason of its toxins.

These toxins have been identified as a Neurotoxin (Anatoxin A) attacking the nervous system, a Hepatotoxin causing acute liver damage (Microcystin) and an Endotoxin causing skin rash (Contact Dermatitis).

The greatest danger is in shallow water where wind or current-driven concentrations of algae have built up. The scum on the waters edge is a particular source of toxic material. Although death has been recorded in animals venturing into thick concentrations of algae to bathe or drink the water, or licking the scum and deposits off their fur when coming ashore, effects on humans to date have been limited to illness rather than death.

Adherence to the simple precautions detailed opposite can reduce the risk of health involved in sailing on contaminated water to an acceptable level.

THOSE WHO ARE MOST AT RISK

The risks of exposure to toxic algae, if present, in descending order are:-

1. Swimmers, paddlers, dogs, children playing at waters edge, windsurfers.
2. Dinghy and catamaran sailors, canoeists.
3. Fishermen, pleasure cruisers.

Dr Frank Newton (RYA Hon-Medical Adviser)

PRACTICAL POINTS TO REDUCE THE RISK

Your Club Committee has been advised that, if your water is affected by Blue Green Algae, dinghy sailing activities can still take place provided certain conditions have been met.

- To avoid any legal liability on the club in the event of any damage, illness or death, every person wishing to sail on potentially affected water may be required to sign the declaration below attached to this information sheet at least once in each sailing season.
- When water is affected by this algae the following categories are at particular risk - peddlers, trainees doing capsize drill, swimmers (including immersion sports), small children, pregnant women, domestic animals (if allowed to play in the water, or to drink it).
- On a lee shore on a windy day algae and scum can be found at some distance from the water - keep animals and children away from these areas.
- Dinghy sailors should wear clothing which is close fitting at the wrists and neck, also boots and sailing suits which fit into the tops of their boots to minimise contact with algae or algal scum.
- Minimal time should be spent in shallow water launching and recovering boats, and launching/recovery should be in areas away from thick aggregations of algae or scum.
- Consult the club notice board before sailing for detailed information as to areas of the water to be particularly avoided.
- After coming ashore sailors should hose themselves down to avoid bringing scum and algae into the changing rooms. All clothing should be washed and thoroughly dried on returning home. Do not store wet clothes.
- If taking part in working parties in or close to the water do not strip off, even on hot days, to do so risks contact dermatitis.
- Avoid horseplay in or near water.

DECLARATION to be signed by all helms, crews and others intending to go in or near the water at [ ] (name of club).

I, (name) declare that I have read and fully understood the information leaflet "Blue Green Algae - The Facts" and that in the event of any loss, damage, personal injury or death arising from contact with the water I understand that the club will not be liable for costs or damages because I have voluntarily accepted the risks associated with water containing blue-green algae.

Signed:..... Date:.....

Royal Yachting Association
RYA House, Romsey Road
Eastleigh, Hampshire SO5 4YA
Tel: 0703 629962
Telex: 47393 BOATIN G
Fax: 0703 629924

ROYAL YACHTING ASSOCIATION

INFORMATION

BLUE-GREEN ALGAE

Advice to those teaching sailing to children

The presence of potentially toxic algae on sailing waters presents particular problems to those concerned about the possibility of incurring legal liability when teaching sailing to children and young people.

We offer the following additional advice to that already issued to Clubs on this subject.

1. By 'children' we mean those who would be regarded in law as too young to make a valid judgment about whether to accept the risk of injury by participating in a hazardous activity.

   Although sailing is a safe sport and most risks associated with it are self-evident, this is not the case with potential dangers arising from water pollution or blue-green algae growth.

   By 'young people' we mean those old enough to be able to make a valid decision for themselves as to whether to accept any risks involved in sailing, provided the nature of these risks has been fully explained to them.

   In our view it is realistic to treat those of 14 years of age and older as being able to make such decisions. It is therefore convenient to adopt the statutory definition of children (those under 14) and young people (those over 14).

2. Our advice to clubs is set out in the Code of Practice, entitled 'Blue-Green Algae - The Facts'. This is based on the principle that if those responsible for the management of sailing waters:

   - take the steps necessary to help sailors avoid the worst areas of contamination; and

   - fully explain to sailors the possible risks and the personal safety precautions that should be taken

   then those who choose to sail will have voluntarily accepted such risks as there may be.

   This principle of 'acceptance of risk' would be an effective defence against a legal claim in a situation where, had the sailor not been made aware of the possible risk, liability might otherwise exist. It will not be effective against a claim by a child, because a child cannot be expected to assess the risks of sailing on waters affected by algal growth.

3. An instructor in charge of a group of children must provide the standard of care that would be given by a responsible parent having the same number of children under his or her supervision.

   Instructors must therefore to try an judge what a parent (having the same information on algae problems that the instructor has) would do when deciding whether to allow their child to use the water for sailing. If an instructor makes a sensible decision on this basis then no legal liability should arise in the event of some ill effects being felt by one or more trainees.

4. We are often asked 'should I obtain the written consent of a child's parent before allowing the child to have sailing instruction?'. Our view is that while it not essential to do so, it is good practice to obtain a parent's consent. It is important to realise however that such consent does not operate as an effective disclaimer of responsibility. The legal rights of a child will not be affected by a disclaimer made either by the parent or made directly by the child. Neither will those of a young person. The significance of the consent of the parent is that it indicates that you are behaving towards the child as they would do. It follows that you must make the <u>parent</u> aware of problems such as the presence of blue-green algae, so that they are giving you an informed consent. We suggest therefore that a copy of the Code of Practice is given to parents of child trainees, together with an invitation for them to discuss problems with you.

SUMMARY

Once you have identified a potential risk to sailing from blue-green algae you should:

1. Follow the Code of Practice issued by the RYA.

2. Explain the problem to the parent(s) of young people in your care for sailing, and provide them with a copy of the Code.

3. Invite the parents concerned to give their consent for their child to sail.

4. Using your own judgment on how this can best be done, explain the problem to the youngsters involved, and stress the personal safety precautions to be followed.

5. Finally: make sure your club or teaching establishment is insured against the possibility of a legal claim by anyone who does suffer harm from contact with toxic algae.

J.M.C. 7/90

Dear Secretary

BLUE-GREEN ALGAE

The RYA, under the guidance of our Honorary Medical Officer Dr Frank Newton, has drawn up a Code of Practice for dinghy sailors at clubs wishing to continue sailing upon waters affected by blue-green algae.

Each club is of course responsible for making its own decision as to the use of its water, according to the exact circumstances of its case and level of contamination and the RYA can do no more than advise generally on this part medical, part scientific, and part legal problem.

The basic principle to be borne in mind is that if sailors of sufficient maturity to understand and accept the dangers involved decide that they wish to continue to sail at their own risk, they may be permitted to do so by the club without the danger of legal liability to the club arising provided they have been fully appraised of the risks.

The RYA can make available to affected clubs, at cost, supplies of information sheets which should be read by all helms, crews and others going on or near the water. As an additional legal precaution, all those who have received and read the information sheet can be asked to sign and detach a declaration to that effect which should be kept by the club secretary. This could be useful evidence, in the unfortunate event of a casualty, that the victim had been aware of the dangers and had voluntarily assumed the risk. For this reason it is regrettably advisable to limit sailing on badly contaminated waters to adults and 'young persons' (who are statutorily defined as those aged 14 years and over). For clubs deciding to require a declaration a single form completed by each individual would suffice for each sailing season.

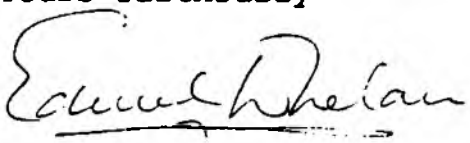
Visitors to the club, and participants in open meetings, may also be asked to read the information sheet and sign the declaration (or a sheet carrying the declaration) on the occasion of each visit to the club. Here again it would be advisable to limit admission to those aged 14 and over.

So far as day to day operations are concerned, on each racing day an appointed club officer should inspect the shore to note collections of thick aggregations of algae or scum. If present, launching from or returning via these areas should be discouraged.

For future reference a record book should be kept to commence the recording of data relating to toxic algae, including the quantity of algae noted, its position, the weather and water temperatures. Records should also be retained of any illness reported by sailing club members subsequent to that days sailing. In this way a responsible monitoring and caring attitude can be demonstrated to club members, and used in future seasons to aid decisions and to work in a responsible cooperative manner with NRA and Water Plc's and owners. In the event of dead fish or animals being found, these must be reported to the NRA regional office. A record should also be kept of the build-up of scum.

For further information and supplies of leaflets for circulation to members, please contact June Palmer at the R.Y.A.

Yours faithfully



EDMUND WHELAN
General Services Manager

May 1990

APPENDIX C

COPY OF QUESTIONNAIRE SENT TO INDIVIDUAL WATER SPORTS CLUBS

CONFIDENTIAL September 1991

QUESTIONNAIRE TO INDIVIDUAL SPORTS CLUBS

Dear Participant

The National Rivers Authority has commissioned WRc to carry out a three-year study for developing microbiological standards for water-based recreational activities including sailing, surfing, rowing, canoeing, water-skiing, wind-surfing, sub-aqua swimming and other activities. A key part of this study is to obtain national statistics on the number of people who participate in each water sport, the number of times a year which they take part, which months of the year they take part and the extent to which they come in contact with the water. As a preliminary part of this study we sent questionnaires to the national governing bodies for each of the various water sport activities. These have now been analysed. To obtain more detailed information we are approaching individual water sports clubs throughout the country with the questionnaire below. At the same time we wish to learn your views regarding the quality of water which you consider to be desirable for your sport and also whether members of your club have experience of illness attributed to pollution of the water.

Thank you for your assistance.

1. Details of your club.

   Name of Your Club .....

   Location (Town/County).....

2. Please indicate the type of water sport (eg water skiing, sailing, canoeing) considered in this questionnaire. Please photocopy and complete copies if your club performs more than one type of sport.

   NB Wind-surfing and sailing/yachting are two different sports for our study.

   .....

3. How many members are there in your club at present? .....

   Could you give more accurate details as outlined below.

	Male	Female
Active Participants	....	....
Non-active members	....	....

4. Age Distributions of Members

Please could you indicate the NUMBERS of ACTIVE participants in each age category for your club.

Age (Years)	MALE	FEMALE
5 - 14	.....	.....
15 - 24	.....	.....
25 - 34	.....	.....
35 - 44	.....	.....
45 - 54	.....	.....
55 - 64	.....	.....
65+	.....	.....

5. Seasonal Participation

Please indicate the NUMBERS of people actively participating in the considered water sport within your club for the different seasons of the year.

Summer (June,July,Aug)	.....
Autumn (Sept,Oct,Nov)	.....
Winter (Dec,Jan,Feb)	.....
Spring (March,Apr,May)	.....

6. Number of times a year individuals perform the considered water sport in your club.

Ideally we would like to know how many days a year each of your members actively participate in the water sport. If you record such data perhaps you could list the number of days in ONE year each individual member performs the sport. There is no need to name or in any way identify the individuals although their age and sex would be useful.

For example

	Number of times a year	Age	Sex
Individual 1	43	30	male
Individual 2	60	21	female
: :			
Individual 97	11	38	male

We realise that a record of each day an individual performs the sport may not be maintained by your club and we have therefore provided a table for you to enter approximate numbers of individuals falling into each category (see overleaf).

Number of individuals in your club who perform:-

Six or seven days a week	.....
Five days a week	.....
Four days a week	.....
Three days a week	.....
Two days a week	.....
One day a week	.....
One day a fortnight	.....
One day a month	.....
Twice a year	.....
Once a year	.....

7. Is active immersion or complete wetting of the body including the head a normal (rather than accidental) feature of your water sport (please delete inapplicable answer).

Yes/No

---

8. If no, can complete immersion occur accidently, or is it part of a training routine for your club (eg capsize drill, swimming requirement).

Accidental? Yes/No.

Training requirement? Yes/No.

9. If the answer to 7 is yes, how often does complete immersion normally occur in the case of competent participants (please tick).

All the time.....
Once every outing.....
Once every other outing.....
Very infrequently.....

10. What degree of contact with water normally occurs in the case of competent participants (please tick) performing the considered water sport at your club.

Whole body.....
Up to neck.....
Up to waist.....
Feet and legs and/or arms.....
Hands only.....
Chance of swallowing.....
Splashing of the face.....

11. What type of water does your club provide for its members to perform this water sport (please tick)

Inland freshwater lake.....
Gravel pit.....
Reservoir.....
Canal.....
Inland river.....
River estuary.....
Marine beach.....

12. Microbiological quality of the water used by your club.

Do you know if the quality of the water (Question 11) which your club uses for the considered water sport has been or is regularly analysed for microbiological organsims of faecal origin eg counts of total coliform bacteria, E.coli bacteria or faecal streptococci bacteria per 100 ml of water?

Yes/No

If yes, could you provide us with this information. Please give details separately.

We should stress that for the analysis we wish to perform, all the bacteriological count data from all clubs performing your sport will be pooled and analysed together thus masking data from individual clubs. Individual clubs will not in any way be identified in this analysis and your data would be treated as highly confidential. This information would be particularly useful for the purposes of our project in that the GENERAL bacteriological quality of waters in which your sport is performed may be assessed statistically.

13. Does your club provide any advice to its members upon the quality of water or microbiological requirements for protecting health. If yes, please give details separately.

Yes/No

14. Does your club give advice to your members on how to protect themselves from the risk of infection from contact with the water. If yes, please give details separately.

Yes/No

15. Are you aware of any particular cases of illnesses contracted by your members through contact with the water during participation in the considered water sport at your club?

Yes/No

16. If yes to question 15, please tick those illnesses believed to have been contracted by your members through contact with the water at your club.

Eye complaints.....
Ear complaints.....
Sore throat.....
Skin irritation.....
Acute diarrhoea.....
Vomiting.....
Stomachache/nausea with fever.....
Leptospirosis (Weil's disease).....

17. Please indicate the number of cases a year for each category of illness contracted through participation of the water sport by members in your club.

Eye complaints.....
Ear complaints.....
Sore throat.....
Skin irritation.....
Acute diarrhoea.....
Vomiting.....
Stomachache/nausea with fever.....
Leptospirosis (Weil's disease).....

18. Any other comments you may like to add that you think we have overlooked.

Thank you very much for taking part in this survey. The results will be treated with the utmost confidence and names of participating clubs will not be revealed.

Yours faithfully

Dr P Gale
Microbiology

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APPENDIX D

VERBATIM COMMENTS RECEIVED FROM SPORTS CLUBS IN RESPONSE TO QUESTIONNAIRE

APPENDIX D

VERBATIM COMMENTS RECEIVED FROM SPORTS CLUBS IN RESPONSE TO QUESTIONNAIRE

ROWING

"Pollution due to outboard engines."

"You may like to consider the amount of oil and diesel in the river."

"This (questionnaire) is a good idea. We would welcome any official information on illnesses and how to avoid them."

Referring to degree of water contact, "None unless it's raining."

"Currently we use the River Ouse. However, we are hoping to start rowing on the River Aire, where water quality is much lower."

SAILING

"The lake... is so pure that they make lager out of it and the scousers drink it."

"This questionnaire is far too complicated for most voluntary organizations."

"We sail on an open sewer.... Our moorings are on probably the most polluted river in the country (i.e. River Alt) which empties into the tidal Mersey, which is probably the second most polluted river. The situation is a national disgrace. We should be able to bathe from our boats without fear."

"Very difficult questionnaire to answer."

CANOEING

"I'm sure more could be well spent cleaning up, educating people that these waterways are not convenient dumps, and catching those who flount these rules and making fines large enough for them to be a deterrent."

"We were disturbed last year when a nearby lake was closed because of blue-green algae then because of financial consideration (i.e. recovering money for leisure activities) reopened without being cleared."

"It's reassuring that someone is protecting our interests and our rivers - Thank you."

"The National slalom course at Nottingham (Holme Pierrepont) on the Trent is particularly badly polluted. We advise members not to paddle there but if they must to drink a can of Coke before and after. (It seems to work!)"

"If swallowed drink a can of Coke (NOT DIET) immediately as this can help."

"Canal has seen an increase in boat usage and as a result diesel on surface has now become a problem causing slippery hands on paddle shafts. Diesel fumes at face level can also be a problem."

"Canoeists hang around weirs a lot where more debris is churned so cuts can get infected (go septic - take longer to mend)."

"Beginners fall in the water a lot."

"I would like more information on waterborne bacteria (in both sea and freshwater) to sports organizations and clubs."

"The message from the surfing hard-core is: 'Keep your mouth shut!!'"

SUB-AQUA DIVING

"In this sport, visibility underwater is most important, and unfortunately it is very rare that we get more than 5 metres round this area due to pollution, so please do something about this so we can see the fish and marine life...."

"We feel that the discharge of raw untreated sewage into the sea along the south coast by Wessex and South West Waters should be stopped as soon as possible."

"I have noticed an increasing reluctance to dive in fresh water. Stories of Weil's disease and poisonous freshwater algal blooms have definitely made their mark."

A major concern of the sub-aqua divers appears to be the effects of sewage pollution on the flora and fauna and reduction in visibility under water. Two clubs report reductions in the numbers of wild life species over recent years. Furthermore one club notes an increasing reluctance amongst its members to dive in fresh waters.

WATER SKIING

"Does it look clear? - NO, brown - can see to depth of approximately 1 ft."

"Does it support fish? - YES."

"We would welcome advice on where we may have the water tested and for what bugs..."

"We have asked for an analysis of the water though the local authority does not seem to want to respond to our request."