

110

MICROBIOLOGICAL EXAMINATION
OF WATER CONTACT SPORTS SITES IN
THE RIVER THAMES CATCHMENT 1989

NRA Thames 73



ENVIRONMENT AGENCY

NATIONAL LIBRARY &
INFORMATION SERVICE

HEAD OFFICE

Rio House, Waterside Drive,
Aztec West, Almondsbury,
Bristol BS32 4UD

BIOLOGY (EAST)
THE GRANGE
CROSSBROOK STREET
WALTHAM CROSS
HERTS
EN8 8LX

TEL: 0992 645075
FAX: 0992 30707

BIOLOGY (WEST)
FOBNEY MEAD
ROSE KILN LANE
READING
BERKS
RG2 0SF

TEL: 0734 311422
FAX: 0734 311438

ENVIRONMENT AGENCY



042280

CONTENTS

	<u>PAGE</u>
SUMMARY	1
INTRODUCTION	2
METHODS	2
RESULTS	7
DISCUSSION	18
CONCLUSION	20
RECOMMENDATIONS	20
REFERENCES	21

MICROBIOLOGICAL EXAMINATION OF WATER CONTACT SPORTS SITES
IN THE RIVER THAMES CATCHMENT 1989

SUMMARY

Water samples were taken at sixty-one sites associated with recreational use throughout the River Thames catchment. Samples were obtained from the main River Thames, tributaries, standing waters and the London Docks. The samples were examined for Total Coliforms and *Escherichia coli* to give a measure of faecal contamination. The results were compared with the standards given in E.C. Directive 76/160/EEC (Concerning the quality of bathing water).

In general, coliform levels in river waters were higher than those in standing waters.

At present, there are three EC Designated bathing areas in the River Thames catchment, none of which are situated on freshwaters. Compliance data calculated in this report is intended for comparison with the EC Directive only and is not statutory. Most sites sampled complied at least intermittently with the E.C. Imperative levels for both Total Coliforms and *E.coli*. Most sites also complied with the E.C. Guide level for *E.coli* but the Total Coliform Guide level was failed by the majority of sites on the majority of sampling dates.

INTRODUCTION

During 1989 samples of water were taken at sites throughout the River Thames catchment associated with recreational use. The water samples were analysed for bacteria indicative of faecal contamination. Samples were obtained from the main River Thames, tributaries, standing waters and the London Docks.

At present, the only legislation dealing with microbiological water quality for recreational purposes is the E.C. Directive concerning the quality of bathing water, (76/160/EEC). This directive can apply to, 'All running or still fresh waters or parts thereof and seawater, in which:

- bathing is explicitly authorised by the competent authorities of each member state, or
- bathing is not prohibited and is traditionally practised by a large number of bathers.'

The directive sets microbiological standards for bathing waters, Imperative (I) values, which must be complied with and more stringent Guide (G) values. However, as there are currently no designated bathing areas within the freshwater River Thames catchment, there are no statutory requirements for the sites sampled to comply with the E.C. legislation.

METHODS

Sixty-one sites in total were sampled, the locations of which are given in Figure 1 and Tables 1 - 3. The sampling programme was designed to cover the period when water-based recreational activities were most popular. Sampling frequency varied between sites and details of the sampling programme are also given in Tables 1 - 3.

Samples for coliform determination were collected aseptically, from just below the water surface, in sterile glass bottles and transported to the laboratory under cool, dark conditions. Presumptive counts for Total Coliforms and *Escherichia coli*, (*E.coli*) were made using the standard membrane filtration technique with lauryl sulphate broth in accordance with HMSO Report on Public Health and Medical Subjects No. 71.

In addition, the Teddington site was sampled monthly during 1989 in conjunction with E.C. Directive 77/795/EEC, (Exchange of Information on the quality of surface fresh water in the Community). In this case, further samples were passed to Messrs Lyne, Martin and Radford, Public Analysts for determination of the number of potentially pathogenic *Salmonella spp* present.

Samples for *Salmonella spp* determination were collected as per those for coliform analysis except that a defined 1 litre sample is required. Enumeration of the *Salmonella spp* present in the sample was by the "most probable number" technique, as described in the HMSO Report on Public Health and Medical Subjects No. 71. Details of the *Salmonella spp* sampling at Teddington are given in Table 7.

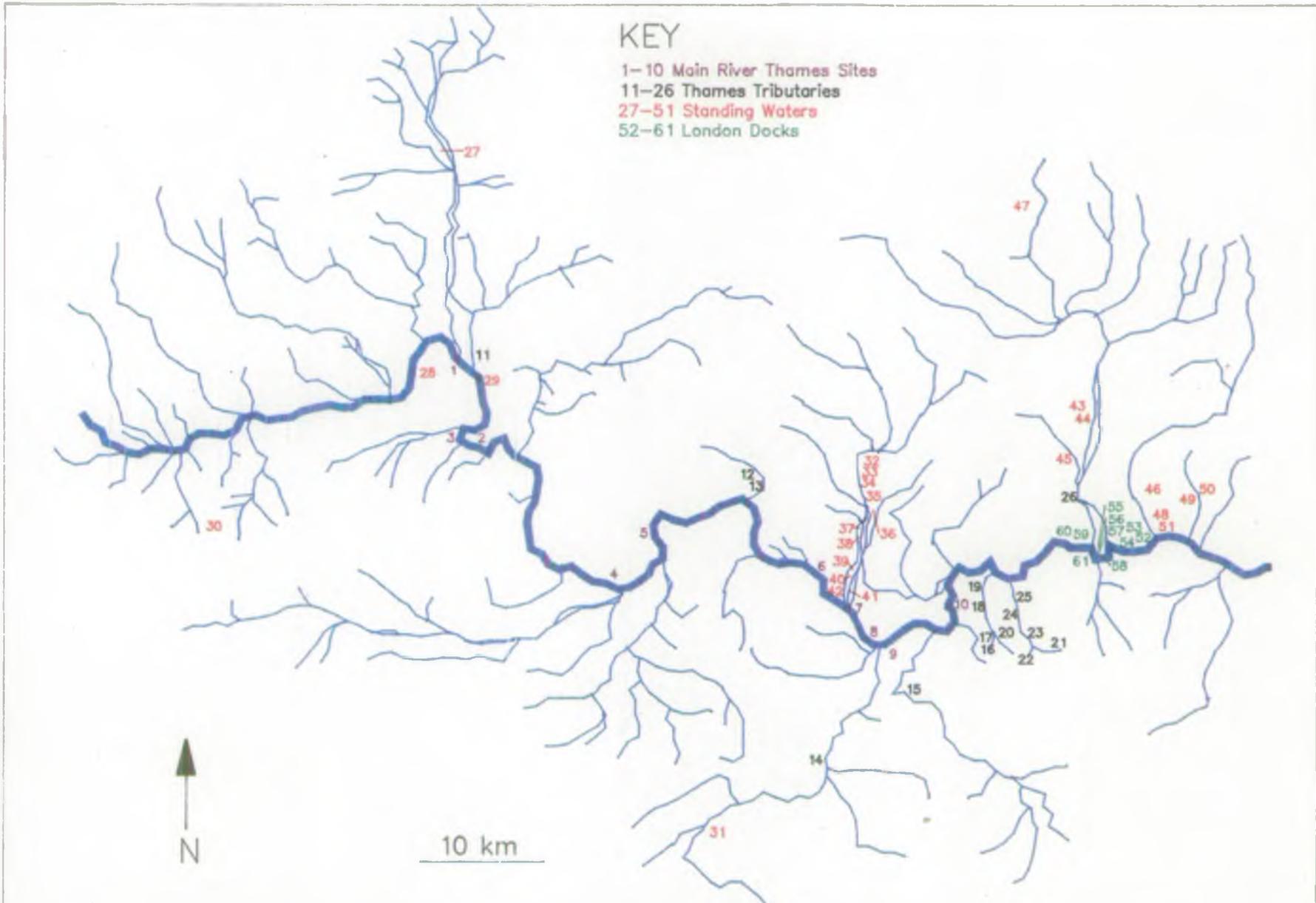


FIGURE 1: WATER CONTACT SPORTS BACTERIOLOGICAL SAMPLING SITES 1989

TABLE 1: WATER CONTACT SPORTS SITES; BACTERIOLOGICAL SAMPLING PROGRAMME 1989, RIVER SITES

SITE	N.G.R.	SAMPLING DATES				
		JUNE	JULY	AUGUST	SEPTEMBER	
<i>Main River Thames Sites</i>						
1	Oxford	SP 5120 0563	27/6	24/7	21/8	21/9
2	Culham	SU 5330 9735	20/6	24/7	21/8	21/9
3	Abingdon	SU 5005 9689	20/6	24/7	21/8	21/9
4	Reading	SU 7180 7405	26/6	26/7	23/8	19/9
5	Henley	SU 7635 8260	26/6	24/7	21/8	21/9
6	Sunnymeads	SU 9990 7580	12/6	25/7	23/8	19/9
7	Egham	TQ 0210 7194	12/6	25/7	23/8	19/9
8	Chertsey	TQ 0510 6830	12/6	25/7	23/8	19/9
9	Walton	TQ 0880 6630	12/6	25/7	23/8	19/9
10	Teddington	TQ 1678 7154	19/6	25/7	23/8	19/9
<i>Thames Tributaries</i>						
11	R. Cherwell, Oxford	SP 5220 0618	27/6	24/7	21/8	21/9
12	High Wycombe Dyke	SU 8750 9230	26/6	24/7	21/8	21/9
13	R. Wye, Wooburn Green	SU 9100 8795	26/6	24/7	21/8	21/9
14	R. Wey, Guildford	SU 9977 4899	22/6	25/7	23/8	19/9
15	R. Mole, Cobham	TQ 1128 5985	22/6	25/7	23/8	19/9
16	Beverley Brook, Pembury Ave	TQ 2247 6638			18/8	
17	Beverley Brook, Motspur Park	TQ 2244 6748			18/8	
18	Beverley Brook, Kingston Vale	TQ 2148 7232			18/8	
19	Beverley Brook, Priests Bridge	TQ 2148 7552			18/8	
20	Pyl Brook, West Barnes Lane	TQ 2272 6849			18/8	
21	R. Wandle, Beddington Park Gardens	TQ 2903 6531			18/8	
22	R. Wandle, Butterhill Bridge	TQ 2820 6512			18/8	
23	R. Wandle, Goat Bridge	TQ 2788 6693			18/8	
24	R. Wandle, Plough Lane	TQ 2609 7150			18/8	
25	R. Wandle, Causeway	TQ 2558 7484			18/8	
26	R. Lee, Springhill	TQ 3480 8760		18/7	15/8	

TABLE 2:

WATER CONTACT SPORTS SITES; BACTERIOLOGICAL
SAMPLING PROGRAMME 1989, STANDING WATERS

SITE	N.G.R.	SAMPLING DATES				
		JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER
<i>Standing Waters</i>						
27	Grimsbury Reservoir	SP 4587 4190	27/6	24/7	21/8	21/9
28	Farmoor Reservoir	SP 4511 0647	20/6	24/7	21/8	21/9
29	Hinksey Lake	SP 5139 0475	27/6	24/7	21/8	21/9
30	Coate Water	SU 1765 8239	27/6	24/7	21/8	21/9
31	Frensham Great Pond	SU 8460 4050	22/6	25/7	23/8	19/9
32	Batchworth Lake	TQ 0548 9410			23/8	
33	Bury Lake	TQ 0545 9396			23/8	
34	Troy Lake	TQ 0374 9066			23/8	
35	Broadwater Lake	TQ 0428 8979			23/8	
36	Hoveringham Lake	TQ 0543 8782			23/8	
37	Woodlands Park Lake	TQ 0418 8283			23/8	
38	Farlows Lake	TQ 0446 8091			23/8	
39	Kingsmead Lake	TQ 0085 7583			23/8	
40	Wraysbury Lake	TQ 0023 7487			23/8	
41	Heron Lake	TQ 0215 7263			23/8	
41	Hythe Lagoon	TQ 0180 7274			23/8	
43	Boxers Lake	TQ 3044 9613				11/10
44	Grovelands Park Lake	TQ 3073 9426				11/10
45	Pymmes Park Lake	TQ 3364 9275				11/10
46	Valentines Lake	TQ 4358 8743			21/8	
47	Fairlands Valley Lake	TL 2540 2426		25/7		
48	South Park Lake	TQ 4513 8635			21/8	
49	Wantz Boating Lake	TQ 4968 8713			07/8	
50	Raphaels Park Lake	TQ 5194 8956			07/8	
51	Barking Park Lake	TQ 4485 8521			21/8	

TABLE 3: WATER CONTACT SPORTS SITES; BACTERIOLOGICAL SAMPLING PROGRAMME 1989, LONDON DOCKS

SITE	NGR	SAMPLING DATES	
		JULY	AUGUST
<i>London Docks</i>			
52 King George V	TQ 4400 8020	27/7	29/8
53 Royal Albert	TQ 4360 8050	27/7	29/8
54 Royal Victoria	TQ 3910 8040	27/7	29/8
55 West India North	TQ 3750 8040	27/7	29/8
56 West India Middle	TQ 3750 8010	27/7	29/8
57 West India South	TQ 3750 8000	27/7	29/8
58 Millwall	TQ 3750 7900	27/7	29/8
59 Shadwell Basin	TQ 3520 8060	27/7	29/8
60 St Katherine	TQ 3390 8030	27/7	29/8
61 Greenland	TQ 3620 7920	27/7	29/8

RESULTS

Counts

The Total Coliform and *E.coli* counts for all samples taken at each of the sixty-one sampling sites are presented in Tables 4-6.

The results of the *Salmonella spp* determinations from Teddington are given in Table 7.

Main River Thames Sites

The Total Coliform counts for sites on the main River Thames varied considerably from site to site and between individual samples from each site. Total Coliform counts between sites varied from 500/100ml, (Reading, June) to 93000/100ml, (Sunnymeads, September). The maximum range of values between samples from the same site was at Sunnymeads, where the Total Coliform count varied from 2200/100ml in July to 93000/100ml in September. The smallest range of values between samples from the same site occurred at Chertsey, where the Total Coliform count varied between 2800/100ml in August and 7000/100ml in June.

The *E.coli* determinations for main River Thames sites showed less variability than those for Total Coliform counts. *E.coli* levels between sites ranged from 110/100ml, (Abingdon, June) to 2240/100ml, (Oxford, June). The maximum range of *E.coli* counts between samples from the same site was at Abingdon, where the *E.coli* level was 110/100ml in June and 2090/100ml in July. The smallest range of *E.coli* values between samples from the same site was at Walton, where counts varied from 240/100ml in August and 800/100ml in June.

Salmonella spp were detected at Teddington in only one of the monthly samples taken during 1989.

Thames Tributaries

Of the upper and middle Thames tributaries, sites on the River Cherwell, High Wycombe Dyke and the River Mole had bacterial counts of the same order as those of the main river sites, while samples taken from the Rivers Wye and Wey show consistently elevated levels of both Total Coliforms and *E.coli*.

Extremely high coliform counts were obtained from most sites on tributaries discharging into the tidal River Thames.

Standing Waters

Bacterial numbers isolated from the standing water sites were, in general, at least an order of magnitude less than those found at riverine sampling sites. Exceptions are at Pymmes Park Lake, Valentines Lake and Wantz Boating Lake where extremely high concentrations of coliform bacteria were found.

London Docks

The London Docks sites had uniformly low bacterial counts, except for St. Katherine where there appeared to be some faecal contamination.

TABLE 4:

WATER CONTACT SPORTS SITES; BACTERIOLOGICAL
SAMPLING RESULTS 1989, RIVER SITES

BACTERIAL NUMBER PER 100ml

SITE	SAMPLE		JUNE		JULY		AUGUST		SEPTEMBER	
	T.C.	<i>E. coli</i>	T.C.	<i>E. coli</i>	T.C.	<i>E. coli</i>	T.C.	<i>E. coli</i>	T.C.	<i>E. coli</i>
<i>Main River Thames Sites</i>										
1 Oxford	7300	2240	2700	620	16000	280	6300	300		
2 Culham	8300	740	4300	650	29500	1700	27900	1820		
3 Abingdon	2900	110	5100	2090	7400	140	9700	490		
4 Reading	500	220	21000	1700	25000	520	2300	520		
5 Henley	2500	340	15100	610	26700	540	20800	920		
6 Sunnymeads	39000	900	2200	160	18100	870	93000	1610		
7 Egham	5000	1000	7800	980	5000	260	36000	300		
8 Chertsey	7000	500	4900	1880	2800	250	6500	610		
9 Walton	10000	800	2100	380	3600	240	4500	770		
10 Teddington	10600	750	6100	480	13400	330	19400	1030		
<i>Thames Tributaries</i>										
11 R. Cherwell, Oxford	1400	160	300	140	9200	210	2300	420		
12 High Wycombe Dyke	4700	270	3300	200	4600	270	2600	220		
13 R. Wye, Wooburn Green	21300	870	12900	1570	96000	1500	25700	2700		
14 R. Wey, Guildford	21000	500	27600	2230	31400	1640	22400	2550		
15 R. Mole, Cobham	6000	800	4300	610	5100	840	15400	1700		
16 Beverley Brook, Pembury Avenue					560000	7000				
17 Beverley Brook, Motspur Park					450000	100000				
18 Beverley Brook, Kingston Vale					380000	31000				
19 Beverley Brook, Priests Bridge					270000	12000				
20 Pyl Brook, West Barnes Lane					550000	40000				
21 R. Wandle, Beddington Park Gdns					108000	7600				
22 R. Wandle, Butterhill Bridge					5000	300				
23 R. Wandle, Goat Bridge					15000	1400				
24 R. Wandle, Plough Lane					100000	5000				
25 R. Wandle, Causeway					30000	1000				
26 R. Lee, Springhill			620000	420000	1200000	110000				

KEY T.C. = Total Coliforms

TABLE 5:

WATER CONTACT SPORTS SITES; BACTERIOLOGICAL
SAMPLING RESULTS 1989, STANDING WATERS

BACTERIAL NUMBER PER 100ml

SITE	SAMPLE		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER	
	T.C.	<i>E.coli</i>	T.C.	<i>E.coli</i>	T.C.	<i>E.coli</i>	T.C.	<i>E.coli</i>	T.C.	<i>E.coli</i>	T.C.	<i>E.coli</i>
<i>Standing Waters</i>												
27	Grimsbury Reservoir	1200	44	290	147	240	141	1220	95			
28	Farmoor Reservoir	10	3	80	72	20	18	170	118			
29	Hinksey Lake	1000	41	40	10	50	2	180	26			
30	Coate Water	1700	472	310	170	580	107	290	74			
31	Frensham Great Pond	1200	10	110	70	400	20	160	34			
32	Batchworth Lake					8000	100					
33	Bury Lake					2000	<100					
34	Troy Lake					<1000	<100					
35	Broadwater Lake					1000	<100					
36	Hoveringham Lake					3000	<100					
37	Woodlands Park Lake					1000	<100					
38	Farlows Lake					2000	<100					
39	Kingsmead Lake					<1000	<100					
40	Wraysbury Lake					1000	<100					
41	Heron Lake					2000	<100					
42	Hythe Lagoon					1000	<100					
43	Boxers Lake									11000	1800	
44	Grovelands Park Lake									<1000	<100	
45	Pymmes Park Lake									930000	180000	
46	Valentines Lake					640000	89000					
47	Fairlands Valley Lake			10000	<1000							
48	South Park Lake					13000	900					
49	Wantz Boating Lake					150000	100					
50	Raphaels Park Lake					3000	100					
51	Barking Park Lake					<1000	<100					

KEY T.C. = Total Coliforms

TABLE 6: WATER CONTACT SPORTS SITES, BACTERIOLOGICAL SAMPLING RESULTS 1989, LONDON DOCKS

SITE	SAMPLE	JULY		AUGUST	
		T.C.	<i>E. coli</i>	T.C.	<i>E. coli</i>
<i>London Docks</i>					
52	King George V	<100	-	<100	<10
53	Royal Albert	<100	<10	<100	<10
54	Royal Victoria	100	<10	<100	10
55	West India North	300	10	400	30
56	West India Middle	900	140	300	90
57	West India South	300	90	700	60
58	Millwall	100	<10	<100	<10
59	Shadwell Basin	<100	<10	<100	<10
60	St. Katherine	8200	800	6300	790
61	Greenland	<100	<10	<100	10

KEY: T.C. = Total Coliforms

TABLE 7:

E.C. EXCHANGE OF INFORMATION DIRECTIVE;
SAMPLES FROM TEDDINGTON ANALYSED FOR THE
PRESENCE OF *Salmonella* spp

<u>Sample</u>	<u>Date of Sampling</u>	<u>Salmonella spp per litre</u>
January	24/1	< 1
February	20/2	< 1
March	21/3	< 1
April	27/4	< 1
May	30/5	< 1
June	19/6	< 1
July	25/7	1
August	23/8	< 1
September	19/9	< 1
October	30/10	< 1
November	20/11	< 1
December	5/12	< 1

Compliance

Comparison with the EC Guide and Imperative values for Total Coliforms and *E.coli* is given in Tables 8a - 10. The results are presented as percentage compliance per site over the sampling period and also as the percentage of sites complying per month.

Main River Thames Sites

The general pattern of compliance per site for the upper and middle Thames sampling points is that of zero compliance with the EC Guide values, variable compliance with the Total coliform Imperative value and almost total compliance with the *E.coli* Imperative value.

The pattern of sites complying per month is generally zero for the EC Guide values, with the EC Imperative value for Total Coliforms ranging from 40 - 80% compliance and almost total compliance with the *E.coli* Imperative value over the sampling period.

Thames Tributaries

Of the upper and middle Thames tributaries, the sampling points on the Rivers Cherwell and Mole and that on High Wycombe Dyke followed compliance patterns similar to those of sites on the upper and middle Main River Thames. However, the sites on the Rivers Wey and Wye did not comply at all with either both Guide levels or the Total Coliform Imperative value. The *E.coli* Imperative value was also complied with on fewer occasions.

Tributaries discharging into the tidal River Thames were sampled less often and with few exceptions tended to exceed both the EC Guide and Imperative values for both Total Coliforms and *E.coli*.

Standing Waters

Compliance per site with the EC Imperative levels for both Total Coliforms and *E.coli* was generally high. Compliance per site with the EC Guide value for *E.coli* was also generally high but in many cases the Total Coliform Guide value was exceeded.

Notable cases were Pymmes Park Lake and Valentines Lake which failed Guide and Imperative levels for both Total Coliforms and *E.coli*. Grovelands Park Lake and South Park Lake passed only the Imperative level for *E.coli*.

London Docks

Compliance with the Imperative value was 100% for both Total Coliforms and *E.coli*. Compliance was also high with the Guide level for both Total Coliforms and *E.coli* with the exception of St Katherine Dock which had a zero compliance for both.

TABLE 8a:

**WATER CONTACT SPORTS SITES 1989; BACTERIOLOGICAL
COMPLIANCE WITH E.C. BATHING WATERS DIRECTIVE,
RIVER SITES**

SITE	SAMPLE		JULY				AUGUST				SEPTEMBER				%Compliance per Site					
	JUNE		T.C.		E.coli		T.C.		E.coli		T.C.		E.coli		T.C.		E.coli			
	G	I	G	I	G	I	G	I	G	I	G	I	G	I	G	I	G	I		
<i>Main River Thames Sites</i>																				
1 Oxford	f	p	f	f	f	p	f	p	f	f	f	p	f	p	f	p	0	75	0	75
2 Culham	f	p	f	p	f	p	f	p	f	f	f	p	f	f	f	p	0	50	0	100
3 Abingdon	f	p	f	p	f	p	f	f	f	p	f	p	f	p	f	p	0	50	0	75
4 Reading	p	p	f	p	f	f	f	p	f	f	f	p	f	p	f	p	25	50	0	100
5 Henley	f	p	f	p	f	f	f	p	f	f	f	p	f	f	f	p	0	25	0	100
6 Sunnymeads	f	f	f	p	f	p	f	p	f	f	f	p	f	f	f	p	0	25	0	100
7 Egham	f	p	f	p	f	p	f	p	f	p	f	p	f	f	f	p	0	75	0	100
8 Chertsey	f	p	f	p	f	p	f	p	f	p	f	p	f	p	f	p	0	100	0	100
9 Walton	f	p	f	p	f	p	f	p	f	p	f	p	f	p	f	p	0	100	0	100
10 Teddington	f	f	f	p	f	p	f	p	f	f	f	p	f	f	f	p	0	25	0	100
Number of Sites Sampled	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10				
Number of Sites Complying per month	1	8	0	9	0	8	0	9	0	4	0	10	0	5	0	10				
% Compliance per month	10	80	0	90	0	80	0	90	0	40	0	100	0	50	0	100				

KEY

T.C. = Total Coliforms
 G = E.C. Guide levels for Bathing Water Quality, Total coliforms = 500/100ml
 E.coli = 100/100ml
 I = E.C. Imperative levels for Bathing Water Quality, Total Coliforms = 10000/100ml
 E.coli = 2000/100ml
 p = Pass
 f = Fail

TABLE 8b:

WATER CONTACT SPORTS SITES 1989; BACTERIOLOGICAL
COMPLIANCE WITH E.C. BATHING WATERS DIRECTIVE,
RIVER SITES

SITE	SAMPLE		JULY				AUGUST				SEPTEMBER				%Compliance per Site					
	JUNE		T.C.		E.coli		T.C.		E.coli		T.C.		E.coli		T.C.		E.coli			
	G	I	G	I	G	I	G	I	G	I	G	I	G	I	G	I	G	I		
<i>Thames Tributaries</i>																				
11 River Cherwell, Oxford	f	p	f	p	p	p	f	p	f	p	f	p	f	p	f	p	25	100	0	100
12 High Wycombe Dyke	f	p	f	p	f	p	f	p	f	p	f	p	f	p	f	p	0	100	0	100
13 River Wye, Wooburn Green	f	f	f	p	f	f	f	p	f	f	f	p	f	f	f	f	0	0	0	75
14 R. Wey, Guildford	f	f	f	p	f	f	f	f	f	f	f	p	f	f	f	f	0	0	0	50
15 R. Mole, Cobham	f	p	f	f	f	p	f	p	f	p	f	p	f	f	f	p	0	75	0	75
16 Beverley Brook, Pembury Avenue									f	f	f	f					0	0	0	0
17 Beverley Brook, Motspur Park									f	f	f	f					0	0	0	0
18 Beverley Brook, Kingston Vale									f	f	f	f					0	0	0	0
19. Beverley Brook, Priests Bridge									f	f	f	f					0	0	0	0
20 Pyl Brook, West Barnes Lane									f	f	f	f					0	0	0	0
21 R. Wandle, Beddington Park Gardens									f	f	f	f					0	0	0	0
22 River Wandle, Butterhill Bridge									f	p	f	p					0	100	0	100
23 River Wandle, Goat Bridge									f	f	f	p					0	0	0	100
24 River Wandle, Plough Lane									f	f	f	f					0	0	0	0
25 River Wandle, Causeway									f	f	f	p					0	0	0	100
26 R.Lee, Springhill					f	f	f	f	f	f	f	f					0	0	0	0
Number of Sites Sampled	5	5	5	5	6	6	6	6	16	16	16	16	5	5	5	5				
Number of Sites Complying per month	0	3	0	4	1	3	0	4	0	4	0	8	0	2	0	3				
% Compliance per month	0	60	0	80	17	50	0	67	0	25	0	50	0	40	0	60				

KEY

T.C. = Total Coliforms

G = E.C. Guide levels for Bathing Water Quality,

Total coliforms = 500/100ml

E.coli = 100/100ml

I = E.C. Imperative levels for Bathing Water Quality,

Total Coliforms = 10000/100ml

E.coli = 2000/100ml

p = Pass

f = Fail

TABLE 9:

WATER CONTACT SPORTS SITES 1989; BACTERIOLOGICAL COMPLIANCE
WITH E.C. BATHING WATERS DIRECTIVE, STANDING WATERS

SITE	SAMPLE		JULY		AUGUST		SEPTEMBER		OCTOBER		%Compliance per Site										
	JUNE		T.C.		E. coli		T.C.		E. coli		T.C.		E. coli		T.C.		E. coli				
	T.C.	E. coli	T.C.	E. coli	T.C.	E. coli	T.C.	E. coli	T.C.	E. coli	T.C.	E. coli	T.C.	E. coli	G	I	G	I			
<i>Standing Waters</i>																					
27 Grimsbury Reservoir	f	p	p	p	p	p	p	f	p	p	p	f	p	p	p			50	100	50	100
28 Farmoor Reservoir	p	p	p	p	p	p	p	p	p	p	p	p	p	f	p			100	100	75	100
29 Hinksey Lake	f	p	p	p	p	p	p	p	p	p	p	p	p	p	p			75	100	100	100
30 Coate Water	f	p	p	f	p	p	p	f	p	f	p	f	p	p	p			50	100	25	100
31 Frensham Great Pond	f	p	p	p	p	p	p	p	p	p	p	p	p	p	p			75	100	100	100
32 Batchworth Lake								f	p	p	p							0	100	100	100
33 Bury Lake								f	p	p	p							0	100	100	100
34 Troy Lake								f	p	p	p							0	100	100	100
35 Broadwater Lake								f	p	p	p							0	100	100	100
36 Hoveringham Lake								f	p	p	p							0	100	100	100
37 Woodlands Park Lake								f	p	p	p							0	100	100	100
38 Farlows Lake								f	p	p	p							0	100	100	100
39 Kingsmead Lake								f	p	p	p							0	100	100	100
40 Wraysbury Lake								f	p	p	p							0	100	100	100
41 Heron Lake								f	p	p	p							0	100	100	100
42 Hythe Lagoon								f	p	p	p							0	100	100	100
43 Boxers Lake														f	f	f	p	0	0	0	100
44 Grovelands Park Lake														f	p	p	p	0	100	100	100
45 Pymmes Park Lake														f	f	f	f	0	0	0	0
46 Valentines Lake								f	f	f	f							0	0	0	0
47 Fairlands Valley Lake					f	p	f	p										0	100	0	100
48 South Park Lake								f	f	f	p							0	0	0	100
49 Wantz Boating Lake								f	f	p	p							0	0	100	100
50 Raphaels Park Lake								f	p	p	p							0	100	100	100
51 Barking Park Lake								f	p	p	p							0	100	100	100

Continued/...

TABLE 9: Continued/...

WATER CONTACT SPORTS SITES 1989; BACTERIOLOGICAL COMPLIANCE
WITH E.C. BATHING WATERS DIRECTIVE, STANDING WATERS

SITE	SAMPLE		JULY				AUGUST				SEPTEMBER				OCTOBER					
	JUNE		T.C.		<i>E. coli</i>		T.C.		<i>E. coli</i>		T.C.		<i>E. coli</i>		T.C.		<i>E. coli</i>			
	G	I	G	I	G	I	G	I	G	I	G	I	G	I	G	I	G	I		
Number of Sites Sampled	5	5	5	5	6	6	6	6	21	21	21	21	5	5	5	5	3	3	3	3
Number of Sites Complying per month	1	5	4	5	5	6	3	6	4	18	17	20	4	5	4	5	0	1	1	2
% Compliance per month	20	100	80	100	83	100	50	100	19	86	81	95	80	100	80	100	0	33	33	67

KEY

T.C. = Total Coliforms

G = E.C. Guide levels for Bathing Water Quality,

I = E.C. Imperative levels for Bathing Water Quality,

p = Pass

f = Fail

Total Coliforms = 500/100ml

E. coli = 100/100ml

Total Coliforms = 10000/100ml

E. coli = 2000/100ml

TABLE 10: WATER CONTACT SPORTS SITES 1989; BACTERIOLOGICAL COMPLIANCE WITH E.C. BATHING WATERS DIRECTIVE, LONDON DOCKS

SITE	SAMPLE								% Compliance per Site					
	JULY				AUGUST									
	T.C.		E.coli		T.C.		E.coli		T.C.		E.coli			
	G	I	G	I	G	I	G	I	G	I	G	I		
<i>London Docks</i>														
52 King George V	p	p	-	-	p	p	p	p	100	100	100	100		
53 Royal Albert	p	p	p	p	p	p	p	p	100	100	100	100		
54 Royal Victoria	p	p	p	p	p	p	p	p	100	100	100	100		
55 West India North	p	p	p	p	f	p	p	p	50	100	100	100		
56 West India Middle	f	p	f	p	p	p	p	p	50	100	50	100		
57 West India South	p	p	p	p	f	p	p	p	50	100	100	100		
58 Millwall	p	p	p	p	p	p	p	p	100	100	100	100		
59 Shadwell Basin	p	p	p	p	p	p	p	p	100	100	100	100		
60 St Katherine	f	p	f	p	f	p	f	p	0	100	0	100		
61 Greenland	p	p	p	p	p	p	p	p	100	100	100	100		
Number of Sites Sampled	10	10	9	9	10	10	10	10						
Number of Sites Complying per month	8	10	7	9	7	10	9	10						
% Compliance per month	80	100	78	100	70	100	90	100						

KEY

T.C. = Total Coliforms

G = E.C. Guide levels for Bathing Water Quality,

I = E.C. Imperative levels for Bathing Water Quality,

p = Pass

f = Fail

Total Coliforms = 500/100ml

E.coli = 100/100ml

Total Coliforms = 10000/100ml

E.coli = 2000/100ml

DISCUSSION

In 1989, differing sampling philosophies were adhered to by the two biology laboratories responsible for carrying out the survey. Sites within the Biology (West) area were generally fewer in number but sampled more frequently than those sampled by the Biology (East) laboratory. There is clearly a balance to be struck between the number of sites sampled, the frequency of sampling and the resources allocated to the task. There is scope for the standardisation of bacteriological sampling methodology both regionally and nationally in preparation for possible future developments, e.g. Proposed EC Freshwater Habitat Directives.

The *E. coli* levels described for the main River Thames and the Rivers Mole, Wey and Wye were consistent with those of waters carrying treated sewage or equivalent contamination. *E. coli* was present at "background" levels in samples from the River Cherwell and High Wycombe Dyke.

The Beverley Brook was investigated in a survey which showed that the site at Pembury Avenue was slightly contaminated while those downstream of the Worcester Park STW effluent appeared to have bacterial levels commensurate with those of poorly treated sewage. At Motspur Park the *E. coli* level was equivalent to that of untreated sewage. It should be noted that the Beverley Brook at Kingston Vale is easily accessible to the public.

Coliform levels in the Pyl Brook were of the order of those found in inadequately treated sewage. There are apparently no direct STW inputs to the Pyl Brook and the contamination is assumed to come from urban runoff via the surface water drains in Sutton.

The survey performed on the River Wandle revealed that it also contained contamination equivalent to that of poorly treated sewage for most of its length.

Samples taken from the River Lee at Springhill revealed gross faecal contamination of the river. This pollution is thought to be due to the influence of Deephams STW which discharges into the River Lee Navigation where the effluent is retained for long periods by the lock systems.

Coliform bacteria were generally present in standing waters at low "background" levels. The results of the 1989 survey suggest that, in general, the standing waters sampled were only slightly-contaminated by faecal material. Notable exceptions occurred at Pymmes Park Lake, Valentines lake and Wantz Boating Lake where urban runoff is thought to contribute to the contamination at these sites.

Of the ten London Docks sampled in the 1989 survey, only St Katherine showed any significant concentration of faecal bacteria. It is thought that this may be related to recent development of the dock surroundings.

Bacteria of the potentially pathogenic genus *Salmonella* were isolated on only one occasion during the monthly sampling at Teddington. It is worth noting that this was recorded simultaneously with an *E. coli* level of 4800/100 ml, while *Salmonella spp* could not be isolated from other simultaneous samplings in June and September which contained greater numbers of *E. coli*.

Data from the 1989 survey was compared with the E.C. Directive and theoretical compliances calculated. The Directive is the only available E.C. legislation governing microbiological water quality but does not apply to any sites in the freshwater River Thames catchment.

It is unlikely that riverine sites will comply with the EC Guide values for either Total Coliforms or *E. coli* while they are used to carry STW effluent at current loadings. At present, however, the non-metropolitan tributaries are generally complying with at least the *E. coli* Imperative levels on most occasions. Most of the non-metropolitan rivers also passed the Total Coliform Imperative Level. Percentage Compliance for the metropolitan tributaries was calculated from only one sample in the majority of cases and is therefore of limited value.

Compliance with EC Imperative levels for both Total Coliforms and *E. coli* is often 100% in standing waters. In some cases this is also true of the Guide value for *E. coli*. However, in many areas the Total Coliform Guide Level is exceeded which suggests that, in the presence of low *E. coli* numbers, surface water runoff is responsible for the contamination of the lakes with faecal matter.

In general, the London Docks achieved compliance comparable to that of standing freshwaters and probably for the same reasons, ie no direct sewage inputs and long retention times.

CONCLUSION

There has been a suggestion that a statistically significant health risk is associated with water contact sports, even at sites complying with the E.C. Directive (in Jones 1988). Assuming that coliform bacteria are effective indicators of faecal contamination (and therefore the presence of potential pathogens) it follows that exposure to river water will generally carry a greater risk to health than exposure to standing water.

Several potentially high risk sites have been identified during the 1989 Survey.

RECOMMENDATIONS

1. Development of a Standard Sampling Protocol, both regionally and nationally.
2. The N.R.A. should actively discourage recreational use of waters in known high risk areas.

William E Yeomans and Janet F Moore (Biologists)

July 1990

REFERENCES

- Anon. (1983) The Bacteriological Examination of Drinking Water Supplies 1982. Reports on Public Health and Medical Subjects No 71, HMSO.
- Anon. - E.C. Council Directive (1975) Concerning the quality of bathing water. Official Journal of the European Community 76/160/EEC.
- Jones, F., ed (1988) Water Quality and Public Health Aspects of Surface Waters Used for Recreation. Oxford Conferences, Seminar Proceedings.
- Moore, J.F. and Logan, P. (1989) Microbiological Sampling of Water Sports Sites, Thames Catchment 1988. Thames Water Internal Report.
- Stott, D.A. (1988) Bacterial Contamination. Thames Water Internal Memorandum.