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Severn-Thames Transfer. A Review of Biological Data.
Volume 2 - Appendices.

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APPENDIX 2.1 The title page, executive summary and/or conclusions and key tables of references cited in Chapter 2: Fish of the main report.

RIVER THAMES ADULT FISH SURVEY

FINAL REPORT

JULY - OCTOBER 1991

ENVIRONMENTAL
ADVISORY
UNIT
LTD.

The issues addressed in this report are dealt with in greater detail in later documents and are not summarised here.

1992
RIVER THAMES JUVENILE FISH SURVEY

Royal Holloway and Bedford New College
University of London

UNIVERSITY OF LONDON

ROYAL HOLLOWAY AND BEDFORD
NEW COLLEGE

1992

RIVER THAMES JUVENILE FISH SURVEY

Royal Holloway and Bedford New College
University of London

by:

Dr.Nan Duncan
Dr.Jan Kubecka
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Steve Kett
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EXECUTIVE SUMMARY

RIVER THAMES JUVENILE FISH SURVEY 1992

(1) This reports on a fry survey undertaken in July/August 1992 by Royal Holloway & Bedford New College (RHBNC) in that part of the River Thames between Oxford and Days Weir where the outlet of a new reservoir proposed by Thames Water Utilities is likely to be sited. The location of the thirteen sites sampled were specified and overlapped with a first fry survey conducted in 1991 by the Environmental Advisory Unit Liverpool (EAU). It is noteworthy that 1992 and 1991 represented the fourth and third years of drought and low river flows.

(2) The RHBNC survey sampled each site with three seine hauls. The three seine hauls per site were used to study the influence of the nature of three kinds of microhabitats on the fry community: (1) shallow sites with water lilies, (2) shallow sites without aquatic plants and (3) deep sites without aquatic plants. The net used was 25 m long made of micromesh with 3 mm mesh size.

(3) The baseline fry stocks of the River Thames in July/August 1992 compared with July 1991 from the EAU Report were as follows:

	1992 RHBNC	1991 EAU	1991 EAU
Number of sites	13	13*	36
Number of seinings	38	13	36
Fry density per m^2	3.72	4.07	3.07
Catch per unit effort (= fish per net haul)	706	607	490

*same sites as in 1992

This shows very similar fry densities and catch per unit effort in the two years.

(4) It is also important to sample different microhabitats because the densities of fry inhabiting them varies greatly:

Nature of microhabitat	Deep	Water-lily	Shallow
Mean 0+ fry density (fish/m^2)	0.082	10.07	5.38

This shows that the two very common fry microhabitats in the River Thames (deep and lilies) vary in 0+ fry densities by two orders of magnitude and differ in species diversity and body size. There are probably about seven important microhabitat categories in the River Thames in addition to these three which need to be studied and characterised.

(5) Our recommendations for improving baseline estimates of fish fry stocks are to improve our knowledge of the fish fauna of the River Thames along the lines listed in Recommendations. We offer some comments on impacts of the proposed reservoir and on least damaging designs for reservoir operation.

4. The species diversity and composition of fry fish was different in the three microhabitat categories. There were fewer species in the 'deep' category and fry from rheophilous species of fish favoured the 'shallow' category.

5. There is some evidence that the sizes of some species of fry differ in the different microhabitats but this needs further analysis.

7. CONCLUSIONS

1. The baseline fry stocks of the River Thames in July/August 1992 compared with those recorded for July 1991 in the EAU Report were as follows:

	1992	1991	1991
Number of sites	13	13*	36**
Number of seinings	38	13	36
Fry CPUE (fish per haul)	706	607	490
Fry density (fish/m^2)	3.72	4.07	3.07

* comparable sites to the 1992 survey

** includes the intermediate sites and sites above Oxford.

This shows very similar levels of catch-per-unit-effort and mean fry densities in the two survey years. The mean netted area was larger in the 1992 survey (190 m^2) compared with 149 m^2 in 1991 which affects the CPUE figures. About 50% of the 36 sampled sites in 1991 were 'shallow with no macrophytes' compared with 33% in 1992 which affects the mean densities for combined microhabitats.

2. It is important to sample different microhabitats because the densities of fry inhabiting varies greatly:

Nature of microhabitat	'deep'	water-lily'	'shallow
0+ fry density/m^2	0.082	10.07	5.38

This shows that the two commonest category of microhabitats in the River Thames ('deep' and 'water-lilies') vary in 0+ fry densities by two orders of magnitude. There is also a difference in species diversity, species composition and body size. There are probably about seven additional fry microhabitats in the River Thames which need a similar study.

3. Our main recommendation for improving baseline estimates of fish fry stocks are to improve our knowledge of the fish fauna of the River Thames along the lines listed in section 4.3 Recommendations. A very limited analysis of individual angler catches suggests that angling is a selective mode of sampling the species composition of the river fish fauna.

4. We offer some comments on impacts of the proposed reservoir and on least damaging designs for reservoir operation.

Table 5

Summary of fish densities in different microhabitats of the Sutton Pools compared with the 1991/1992 results for the River Thames

Nr.	Site Description	n/m^2	n/m^3	replicates#	nettec area m^2	netted volume m^3
	Sutton Pools					
I	Scirpus	65.1	76.3	2	92	78.5
II	Scirpus + Typha + little lilies	22.6	33.7	2	89	59.7
III	W. lilies in Sutton Pools	3.6	3.6	1	157	157
IV	Deep site in Sutton Pools	0.13	0.12	1	100	106
V	Sparse S. emersum	9.5	7.9	1	160	192
VI	Bank with fringing herbs	5.1	4.9	3	69	72.4
VII	Strong flow. Gravel bottom	0.13	0.17	1	30	23
VIII	B 5 Gravel spit	0	0	1	70	28
IX	deep base bank	0	0	2	96	44
X	Shallow base bank	3.6	6.9	2	58	30.4
	River Thames 1992					
	Deep sites in River	0.94	0.78	13	2260	2719
	Shallow sites in River	4.47	5.08	13	3048	2682
	W. Lily sites in River	8.7	8.57	12	1883	1913
	River Thames 1991					
	1991 Survey (EAU)	3.07	?	37	*5515	?

*Our rough estimate of EAU sampled areas

#Replicates come from sites belonging to each microhabitat category (Table 3)

Table 6

Percentage frequency of fish fry species (0+ & 1+) at sites sampled with a fry seine in the River Thames during the 1991 EAU and 1992 RHBNC surveys

	1992 13 sites	1992 11 sites	1992 13 sites	1992 13 sites	1991 36 EAU sites	1991 13 sites*
	Microhabitats					
species	Deep	Lily	Shallow	Combined		
pike	0.05	0.03	0.04	0.04	0.03	0
gudgeon	3.33	8.03	14.86	10.82	22.43	11
silver bream	0	0	0.01	0.003	0	0
bream	1.22	0.29	0.77	0.46	0.63	1.01
bleak	6.39	7.27	17.84	11.69	4.76	6.7
minnow	0	0.76	0.07	0.42	0	0
roach	80.18	77.2	53.23	67.13	44.9	72.4
chub	2.58	1.45	7.36	4.03	18.89	3.5
dace	0.33	0.97	3.26	1.9	6.03	3.93
stoneloach	0	0	0.01	0.003	0	0
stickleback	0.33	0.14	0.1	0.13	0.34	0.41
perch	5.35	2.27	2.37	2.51	1.9	1.1
ruffe	0.19	0.03	0	0.03	0.012	0.03
bullhead	0	0.01	0.01	0.01	0.094	0.1
Ro/Br. Hyb	0.05	1.56	0.07	0.83	0	0
barbel	0	0	0	0	0	0.013

Percentage frequency was calculated from the sum of fish of all sampled sites.

* This was calculated from only those 1991 sites which were also sampled in 1992

TABLE 7

THE DENSITIES OF FRY BELONGING TO DIFFERENT AGE GROUPS CAUGHT BY SEINING IN DIFFERENT MICROHABITAT CATEGORIES IN SUTTON POOLS

MICROHABITAT CATEGORY		FISH DENSITY PER METRE SQUARE BELONGING TO THE AGE GROUPS		
		0+	1+	>1+
I	Scirpus	63.70	1.10	0.00
II	Scirpus+Typha+lilies	21.50	0.95	0.20
III	Water-lilies only	3.60	0.03	0.01
IV	Deep bank with Nostoc	0.10	0.00	0.03
V	Sparse Sparganium emersum	9.08	0.09	0.31
Vi	Shallow; fringing border	4.70	0.60	0.30
VII	Shallow with strong flow	0.00	0.00	0.13
X	Shallow,sandy + no plants	3.30	0.10	0.30

MICROHABITAT CATEGORY		FISH DENSITY PER CUBIC METRE BELONGING TO THE AGE GROUPS		
		0+	1+	>1+
i	Scirpus	74.60	1.30	0.00
II	Scirpus+Typha+lilies	32.00	1.40	0.30
III	Water-lilies only	3.60	0.03	0.01
IV	Deep bank with Nostoc	0.09	0.00	0.03
V	Sparse Sparganium emersum	7.57	0.08	0.26
VI	Shallow; fringing border	4.70	0.60	0.30
VII	Shallow with strong flow	0.00	0.00	0.17
X	Shallow,sandy,no plants	6.20	0.10	0.50

No fish were caught in microhabitat categories VIII and IX.

TABLE 9

DENSITIES OF FRY BELONGING TO DIFFERENT AGE GROUPS CAUGHT BY ELECTROFISHING IN DIFFERENT MICROHABITAT CATEGORIES IN SUTTON POOLS

MICROHABITAT CATEGORY	MICROHABITAT ABUNDANCE*	FISH DENSITY PER METRE SQUARE BELONGING TO THE AGE GROUPS		
	%	0+	1+	>1+
Scirpus	11.1	5.20	0.90	1.60
Water-lilies	11.9	14.60	0.10	0.10
Lilies+S.emersum	12.4	3.10	0.40	0.60
Mixed monocots.	18.5	5.80	0.80	0.60
Overhanging trees	14.4	3.90	0.20	0.00
Stony area	8.2	6.00	0.50	0.30
Weirs	6.6	3.75	1.04	2.90
Shallow,fringing	7.0	24.50	0.00	0.00
Deep, fringing	4.1	0.30	0.00	0.00
Glyceria maxima	3.3	0.00	0.00	1.30
Reed Canary grasses	1.7	0.00	0.00	1.70

* Microhabitat abundance was calculated as the number of point samples per microhabitat category as a percentage of the total number of point samples taken. This is possible as the total point samples were spread uniformly throughout the littoral circumference of the Sutton pools at approximately 1 point per 5 m of shoreline.

1992
SUTTON POOLS FISHERY SURVEY

Royal Holloway and Bedford New College
University of London

by:

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EXECUTIVE SUMMARY

1. Nine sites in Sutton Pools were sampled quantitatively by a 10x2 m fry seine net and seven other sites by a 25x3 m fry seine net during July/August 1992. In addition, 243 point samples were taken by electrofishing in all four Sutton pools, using a battery-operated portable electrofisher. The total number of fry caught was 11,245.

2. The Sutton Pools Report emphasises that it is essential to have a fry microhabitat classification for reliable estimates of the baseline of juvenile fish populations.

3. The most important nursery microhabitats were: (a) those with *Scirpus* beds (65.1 fish/m^2); (b) shallow sites with fringing vegetation (24.5 fish/m^2) and (c) mixed Monocotyledons *Scirpus* + *Typha* with some water lilies (22.6 fish/m^2). The roach appears to be ubiquitous as it was always present as over 90 % of the fish catch from the above habitats and between 30-70% of the other categories.

4. Other types of microhabitats in Sutton Pools, such as shallow and deep unvegetated sites and sites with water-lilies, support a similar species composition and similar or lower level of fry density to comparable microhabitats in the River Thames.

5. The special feature of Sutton Pools is the presence of microhabitats like the three weir pools. These are sites with strong water currents and a much greater relative proportion of shallow bare shores than in the River Thames. None of these microhabitats seems to provide important nursery areas.

6. Apart from the weir pools and sites with strong water currents, all other microhabitats are present in both the River Thames and in the Sutton pools. In the River Thames, the areas of each microhabitat category are far more extensive.

7. From this brief study during July/August 1992, there is no strong evidence for the Sutton Pools to be considered as an outstanding nursery area for fry living near shore. There is still the possibility that they constitute a good spawning area because of absence of disturbance by navigation which is a major influence upon the ecology of the River Thames and its fish stocks.

portable electrofisher. The total number of fry caught was 11,245.

2. Different kinds of fry microhabitats with and without aquatic vegetation were sampled by seining and electrofishing. The highest catches were found in vegetated sites with *Scirpus* beds (65.1 fish/m^2) and in weed beds of mixed aquatic monotylendons with some water-lilies (22.6 fish/m^2) but also in non-vegetated sites with a terrestrial fringing border (24.5 fish/m^2). The roach was ubiquitous both in the above sites (90% of the fish) and in other sites (30-70%).

3. Other microhabitats sampled were shallow and deep non-vegetated sites and sites with water-lilies which were similar to those sampled in the River Thames, both in species composition and density levels.

4. The presence of microhabitats such as the weirs and weir pools were a special feature of the Sutton Pools, with strong water currents and hard bottoms. There was also a greater proportion of the littoral with shallow bare shores than in the River Thames.

5. CONCLUSIONS

1. From this brief study during July/Augsut 1992, there is no strong evidence for the Sutton Pools to be considered as an outstanding nursery area for fry living near the shore.

2. The Sutton Pools study shows that (a) it is essential to develop a fry microhabitat classification for reliable estimates of the baseline stocks of juvenile fish and (b) that this categorization is applied in the River Thames itself.

3. There is still the possibility that the Sutton Pools constitute a good spawning area because of the absence of disturbance by navigation which is a major influence upon the

ecology of the River Thames and its fish stocks.

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ADULT FISH COMMUNITIES
OF THE
RIVER THAMES
BETWEEN SANDFORD AND BENSON LOCKS
1993

NRA

National Rivers Authority
Thames Region

SOUTH WEST OXFORDSHIRE RESERVOIR PROPOSAL STUDY
A REPORT FOR
NRA THAMES REGION
AND
THAMES WATER UTILITIES LTD.

ADULT FISH COMMUNITIES OF THE RIVER THAMES BETWEEN SANDFORD AND BENSON LOCKS 1993

Compiled by Simon Hughes
Hydroacoustic data analysis by J Kubecka and A Duncan, RHUL.
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Table 1. Total Values of Density and Biomass by Reach and Phase.

	Density	Echo Counting	(Fish $100m^{-3}$)	Density	Echo Integ.	(Fish $100m^{-3}$)	Biomass	(Kg $100m^{-3}$)	
Phase	I	II	Mean	I	II	Mean	I	II	Mean
Reach									
1	2.198	3.800	2.999	2.052	2.272	2.162	0.159	0.256	0.208
2	5.709	3.961	4.835	6.561	1.746	4.154	0.430	0.388	0.409
3	7.790	6.138	6.964	11.908	3.365	7.637	0.407	0.505	0.456
4	2.371	6.989	4.680	1.232	5.120	3.176	0.206	0.698	0.452
5	2.115	4.550	3.333	1.553	2.653	2.103	0.263	0.286	0.275

1.3 Potential Impacts.

Potential impacts from the reservoir scheme may be divided into two categories:

a) Direct impacts likely to occur in the short term and involving large changes in water or habitat quality, possibly resulting in significant and rapid changes in fish populations. This type of impact may well be mitigated by reservoir management and operating agreements.

b) Indirect impacts involving subtle changes to the ecosystem and evinced as a change in selection pressure on fish populations, possibly resulting in changes of fish population abundance and species composition. There is insufficient understanding of the critical pathways involved to model the resulting changes in fish populations.

1.4 Recommendations For Future Work

Continued monitoring of adult and juvenile fish populations comprising similar components as this study, for at least two further consecutive years to begin establishing levels of variation in fish population abundance, including an intensive study of one reach to measure diurnal and seasonal variability in hydroacoustic results.

Identification of critical physical and chemical parameter limits together with food and habitat requirements at different life stages for key fish species identified in this survey.

Further comparisons of hydroacoustic measures of fish population abundance with results from catch depletion methods applied to the same site will add weight to the results of future surveys.

Electric fishing equipment should be modified in time for future surveys to allow effort to be quantified.

Options for gauging the extent and significance of fish migration should be explored.

4.0 RESULTS

4.10 Introduction.

Results from the studies described in this report are presented in this section; the data upon which they are based are appended where appropriate.

4.20 Electric fishing Results.

Electric fishing operations were carried out between 21:00 and 07:30 on 20, 21, 22 and 23 September 1993, from downstream of Sandford Weir to upstream of Benson Lock; a total river length of over 30 km. Twelve principal coarse fish species (Table 4) and 2109 individuals were sampled in the five reaches. One roach/bream hybrid was caught. Table 5 shows the number of fish sampled by electric fishing in each reach.

Table 4. Fish Species Sampled (All Reaches Combined).

Common Name	Generic Name
Barbel	*Barbus barbus*
Bleak	*Alburnus alburnus*
Bream (Common)	*Abramis brama*
Chub	*Leuciscus cephalus*
Dace	*Leuciscus leuciscus*
Gudgeon	*Gobio gobio*
Perch	*Perca Fluvitalis*
Pike	*Esox lucius*
Roach	*Rutilus rutilus*
Ruffe	*Gymnocephalus cernua*
Silver Bream	*Blicca bjoerkna*
Tench	*Tinca tinca*

the difference in mean FL, which is significant at $p = 0.02$ (Reach 4) and $p = 0.001$ (Reach 5).

Roach length frequency for margin zones in Reach 4 (Fig 28) shows a marked bias towards smaller fish (Mean FL = 98.87mm) than for the centre channel zones (Mean FL = 149.51mm). The difference between these means is significant at $p = 0.001$. This is reflected, although to a lesser extent, by the length frequency for margin zones in Reach 5 (Fig 29), in which mean lengths (centre = 130.13mm, margin = 110.58mm) are significantly different at $p = 0.002$.

Length frequencies for perch between Reaches 4 & 5 (Figs 30 and 31) appear to be almost identical, with marked modes of 120mm and very similar mean lengths.

Population length frequency also provides a tool for comparison between hydroacoustic and electrofished samples, which is presented elsewhere in this report.

4.22 Species Percentage Abundance in Samples.

Species percentage abundance for all centre channel zone samples in each reach are presented in Figures 32 to 36 and for all margin zone samples in Figures 37 and 38. Table 6 below provides a summary of this information.

Table 6. Species Percent Abundance by Reach and Sample Zone.

Species	Reach 1	Reach 2	Reach 3	Reach 4		Reach 5	
Zone	Centre %	Centre %	Centre %	Centre %	Margin %	Centre %	Margin %
Barbel	0	0.66	0	0	0	0	0
Bleak	32.76	51.50	59.58	26.82	13.26	67.97	18.60
Bream (Common)	2.69	3.99	3.75	2.35	0.55	0.78	0.41
Chub	1.96	1.66	10.83	4.47	0	4.30	1.24
Dace	1.22	0.66	1.25	4.71	0.55	0	1.24
Gudgeon	0.73	0.33	0	3.76	2.21	1.17	0.83
Perch	4.89	0.66	1.67	4.00	23.20	3.91	19.42
Pike	3.67	4.65	3.33	1.18	2.21	0.78	1.65
Roach	50.86	35.55	19.58	52.71	56.91	21.09	54.55
Ruffe	0	0	0	0	0.55	0	1.24
Silver Bream	0.98	0.33	0	0	0.55	0	0.41
Tench	0.24	0	0	0	0	0	0.41

Table 35. Total Values of Density and Biomass by Reach and Phase.

	Density	Echo Counting	(Fish 100m⁻³)	Density	Echo Integ.	(Fish 100m⁻³)	Biomass	(Kg 100m⁻³)	
Phase	I	II	Mean	I	II	Mean	I	II	Mean
Reach									
1	2.198	3.800	2.999	2.052	2.272	2.162	0.159	0.256	0.208
2	5.709	3.961	4.835	6.561	1.746	4.154	0.430	0.388	0.409
3	7.790	6.138	6.964	11.908	3.365	7.637	0.407	0.505	0.456
4	2.371	6.989	4.680	1.232	5.120	3.176	0.206	0.698	0.452
5	2.115	4.550	3.333	1.553	2.653	2.103	0.263	0.286	0.275

These three figures give a good summary of quantitative results collected, and they all show a generally increasing trend in biomass and density towards Reach 3 in phase I and Reach 4 in Phase II, with a decline in values in Reach 5 evident from the results for both phases.

These densities are similar to results for hydroacoustic surveys carried out on the River Thames at Cherstey (3.9 fish $100m^{-3}$), The River Wey (6.5 fish $100m^{-3}$), and the River Vltava at Prague (6.6 fish $100m^{-3}$) (Duncan and Kubecka, 1993).

6.0 CONCLUSIONS

- Populations of similar length distribution were sampled in all five reaches.

- Bleak and roach populations sampled in margin zones from Reaches 4 & 5 have a significantly smaller mean size than populations sampled in centre channel zones for the same reach.

- Reaches 1 & 2 samples contained a greater number of species than Reaches 3 to 5. Margin zone samples contained more species than centre channel zones.

- Populations in Reaches 1, 2 and 4 show a similar relationship between length and weight.

- Pooled results for roach from all reaches shows an age length relationship similar to a nationally derived standard.

- Fish densities show scattered zones of high fish density in all reaches.

- Mean values of fish density and biomass are similarly low in Reaches 1 and 5 and similarly high in reaches 2, 3 and 4, although variation about the mean of results from both phases is relatively high.

- Populations sampled by both methods have similar length frequency distribution.

- Abingdon Marina provides an important habitat for smaller fish.

Figure 2. The Five Study Reaches.

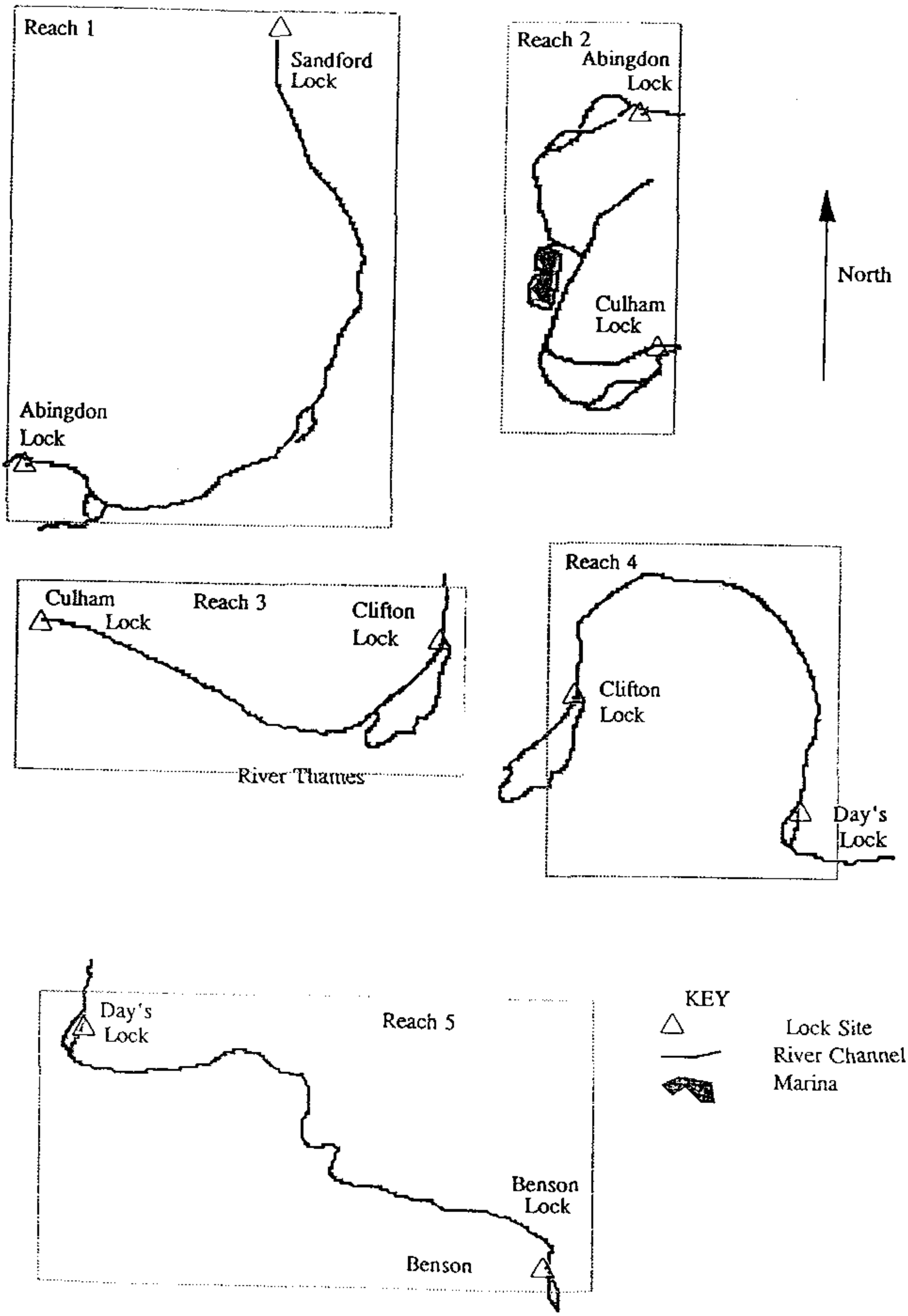


Figure 64. Total Fish Density (Echo Counting) by Reach

Phase I, Phase II and Mean of Both.

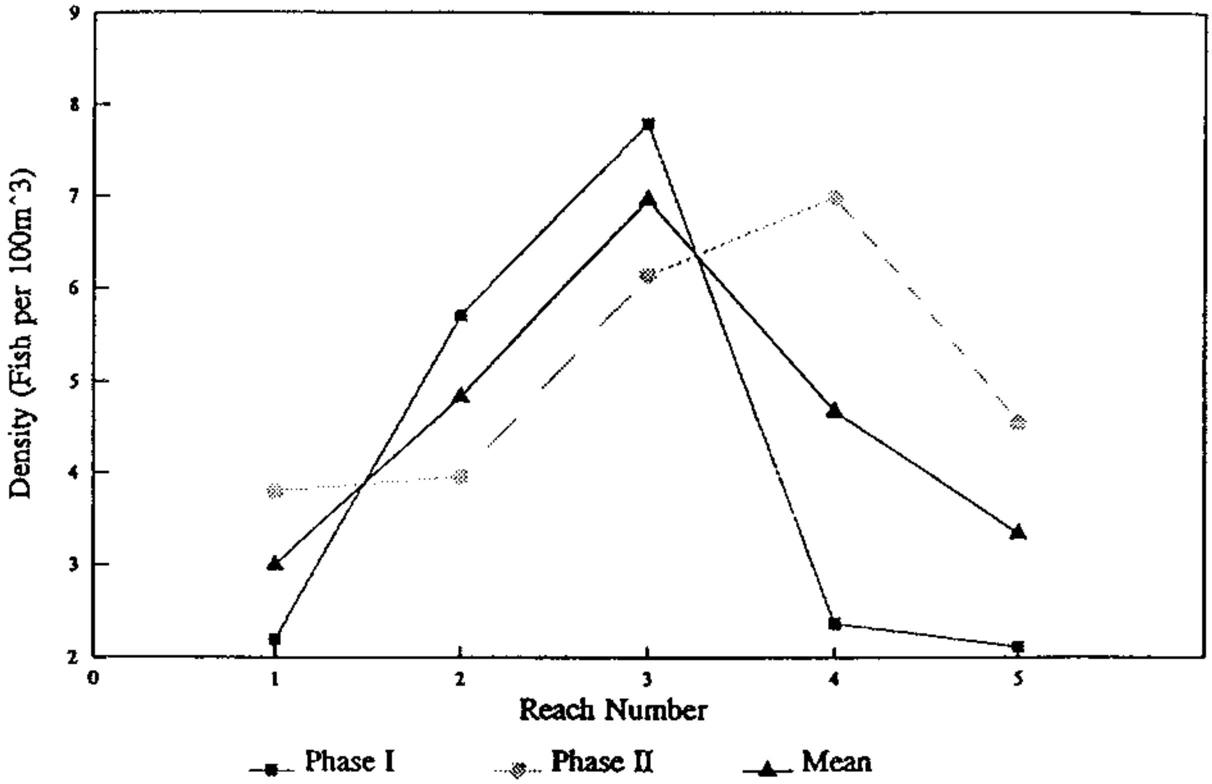


Figure 65. Total Fish Biomass by Reach

Phase I, Phase II and Mean of Both.

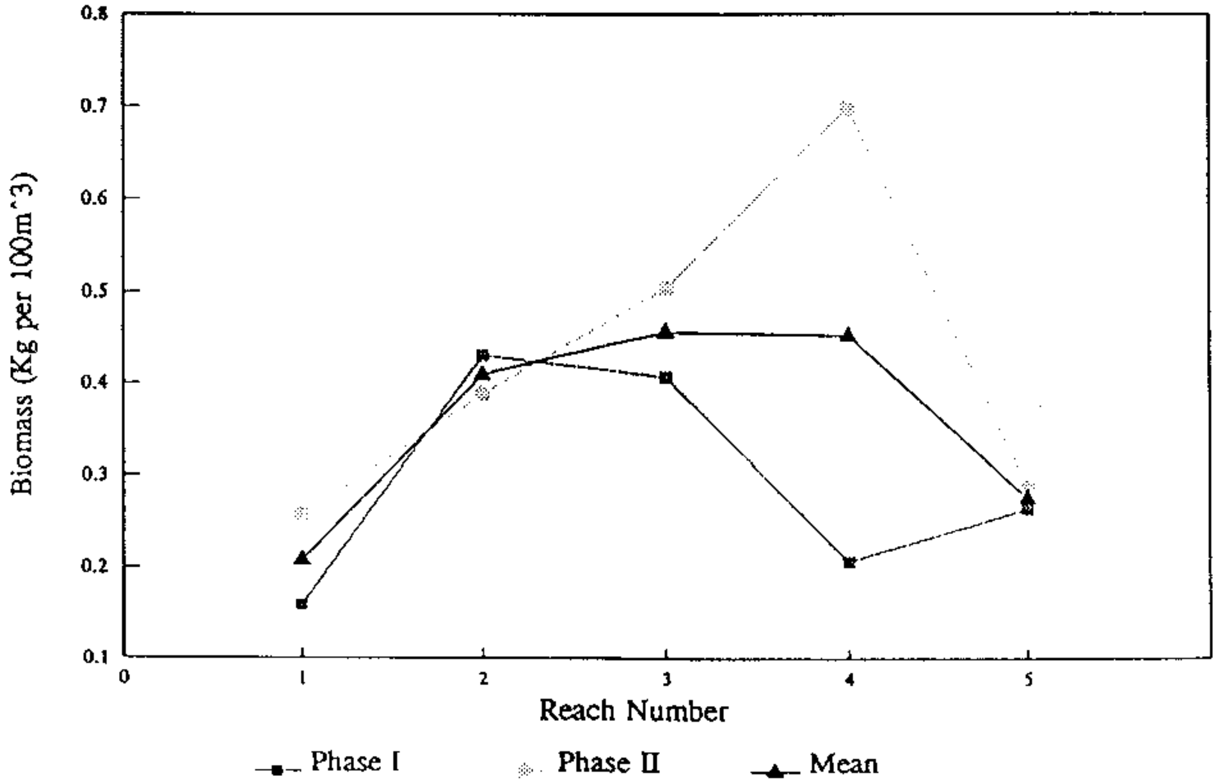
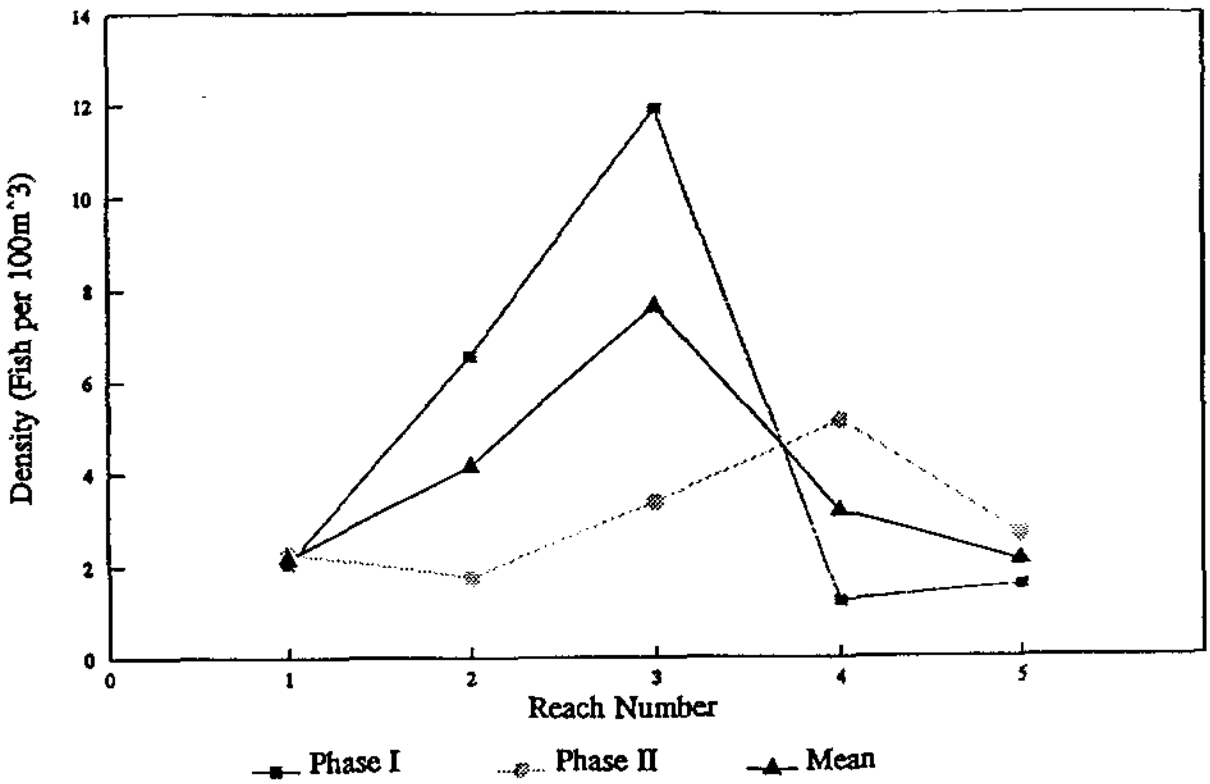


Figure 66. Total EI Fish Density by Reach
Phases I, Phase II and Mean of Both.



ABINGDON RESERVOIR: FISH STOCK ASSESSMENT

FRY SURVEY

FINAL REPORT

JUNE - SEPTEMBER 1991

ENVIRONMENTAL
ADVISORY
UNIT
LTD.

It therefore appears that there may be important differences in the distribution of species which are apparent when 0+ and 1+ age groups of fish are considered.

It was noted during sampling that more fry and older groups seemed to be captured on sunny days and were not present on the shallows in the evening. This possibly reflects a movement on to shallow water habitats to take advantage of the different spatial thermal regime available (O'Hara et al. in prep). Abundance data and field records were of insufficient rigour to test this hypothesis.

5. AGE AND GROWTH

Mean lengths of fish at age 1 were calculated from the June sample on the assumption that their birthdate was 1st June. The analysis of growth in the subsequent samples from July and September concentrated on the size of the 0+ fishes since the objective of the study was to investigate the characteristics and vulnerability to capture of fry. Older fishes were generally aged as 1+ and older because the length distributions overlapped. The results are presented in tables 6, 7 and 8. There is perhaps some evidence of variation in the mean length of fish between sites but without detailed statistical analysis and confirmation of ages by scale reading particularly for 1+ and older fish this cannot be confirmed as significant. It should also be noted that variation in measurement by different operatives has not been accounted for, to overcome this potential problem the measuring team should be kept consistent and should be experienced in the identification of juvenile stages.

The mean length of fish achieved at the end of their first year of life was toward the mid-range of results from other rivers in Britain (see Williams 1967, Mann 1976 & 1982, Weatherley 1986). However it should be noted that there is some discussion over the accuracy of some studies because small fishes may not have been representatively sampled or aged accurately. In contrast to other methods of capture, we consider that micromesh seine netting does provide an accurate estimate of fish growth rates for young of the year.

6. CONCLUSIONS AND RECOMMENDATIONS

1. On the basis of this year's work we consider it is possible to capture most of the recreationally important species in their year of hatching by late July. The exception to this appears to be bleak and this may reflect a naturally late spawning time for this species.

2. Fish hatched in the previous year remained vulnerable to capture by micromesh seine netting until late July.

3. For most species of fish, and assuming normal climatic conditions, it is possible to obtain relative abundance data and thereby information on year class strengths for fish from 2 years by sampling in late July. This would enable not only an estimation of spawning success but also overwinter survival and mortality.

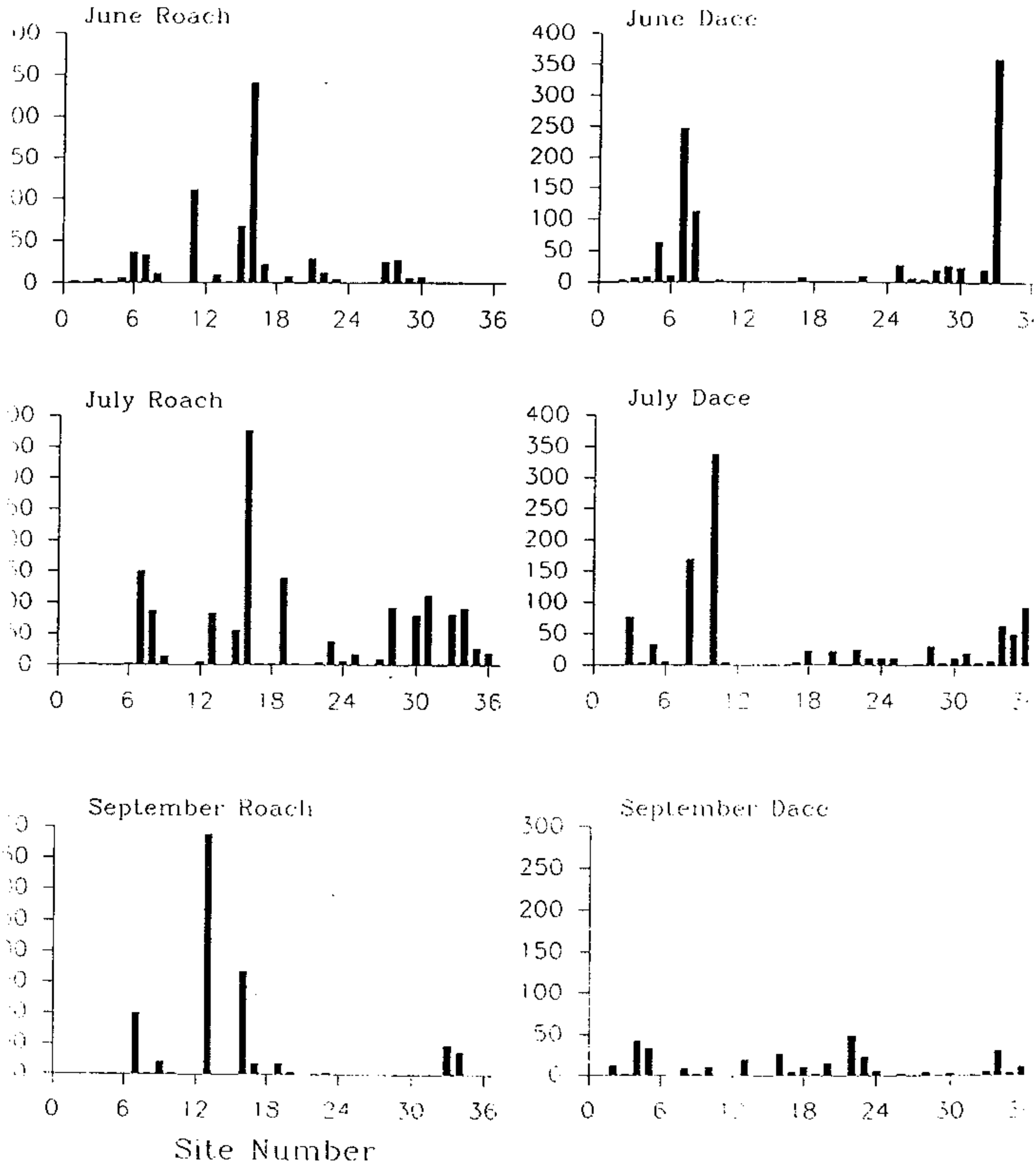
4. Ideally a thorough appraisal of the causes of variability in catches between months, between sites and within and between days should be undertaken. However, in the absence of such a rigorous strategy, the use of more samples taken over a restricted single time period, possibly at a limited number of sites, may provide a better database of relative abundance than sampling over three time periods. This would give a more accurate estimate of the relative abundance but would not give such good information on distributions along the length of the river. This may be important, particularly if the observed differing distributions of age classes is a real phenomenon that is repeated in future years.

It was suggested that there is an indication of reduced abundances in the more "channelised" areas of river but this may reflect difficulties in sampling rather than species abundance. Further work would be needed to validate this observation but it may be advantageous to establish a sampling strategy to include areas along the river where the banks shelve gently. It would prove possible with this sampling regime to retain sites above and below the projected location of the reservoir.

5. Any sampling programme should be conducted in the most appropriate month to sample and from the present study this appears to be late July possibly extending into August. This period would combine the likely time of warm weather with that when most species are of a sufficient length in their first year to be vulnerable to the capture method.

6. Ageing of 1+ fish from scales should be undertaken to validate the age structure of the population. For younger fish, length frequency analysis is a satisfactory method of ageing.

7. It is important to maintain a strict quality assurance when measuring and identifying small fish to prevent errors developing. Personnel experienced in the identification of juvenile stages should undertake sample processing.



Numbers of fish (<10cms)
caught by site and month

ANGLER CATCHES IN THE RIVER THAMES

BETWEEN SANDFORD LOCK AND DAY'S LOCK

1993 - 1994

S N Hughes.

NRA

National Rivers Authority
Thames Region

TR44

SOUTH WEST OXFORDSHIRE RESERVOIR PROPOSAL STUDY
A REPORT FOR
NRA THAMES REGION
AND
THAMES WATER UTILITIES LTD

ANGLER CATCHES IN THE RIVER THAMES

BETWEEN SANDFORD LOCK AND DAY'S LOCK

1993 - 1994

S N Hughes.

1.0 EXECUTIVE SUMMARY

The aims of this study were to identify and measure catches of match and non-match anglers during the coarse fishing season within the SWORP study area and to quantify use of the fishery by anglers and thereby gauge the importance of the study reach of the River Thames as an angling resource.

1.1 Methods

The study reach of the River Thames was divided into three subsections, each forming a standard walk of between 3 and 4 km and assigned a colour code:

Blue - Sandford Mill to Radley, Right bank
Red - Abingdon Bridge to Culham, Left bank
White - Clifton Hampden Bridge to Day's Lock, Right bank

Each reach was walked by a member of NRA Fisheries staff at monthly intervals on Sundays between 20/6/93 and 13/3/94 inclusive. Anglers encountered on the walk were divided into two categories:

Match anglers - Involved in an organised angling match.
Non-match anglers - not involved in an angling match.

Non-match anglers were interviewed and the following information recorded:

a) Distance (m) to the nearest access point.
b) Distance & time travelled to site.
c) Length of time spent fishing prior to interview.
d) Number of fishing rods in use.
e) Method used (ie float, leger, lure etc).
f) Bait used.
g) Species targeted.
h) Number of days in the week and which days normally fished.
i) Number of times fished the reach during the current season.
j) Number of years fishing experience.
k) Rating of own experience (Novice/Intermediate/Very experienced).

Total weight of any catch was estimated and species composition noted by NRA staff on examination of catches retained in keepnets. A tally of numbers of principal species in 50 mm fork length (FL) size classes were recorded. If an organised match was encountered, anglers were not interviewed but match results were obtained at a later date. Total catch (kg), effort (rod hours) and catch per unit effort (CPUE) in grammes per rod hour were calculated.

Attempts to collect match angler catch information from large matches were unsuccessful due to poor weather and river conditions.

Match CPUE results were classified using the NRA National Fisheries Classification Scheme.

1.2 Results.

Species occurrence in non-match angler catches differ between reaches, bleak are dominant in the Blue reach catch, roach are dominant in catches from the other two reaches.

Maggots are the most common bait, the most common fishing method is the swimfeeder, followed by

float and leger in most reaches.

The majority of non-match anglers do not target specific fish species.

Anglers in the Red and White reaches tend to be within 250m of the nearest access point.

The majority of anglers interviewed had between 15 and 20 years angling experience.

The Red reach is principally used by local anglers, the Blue reach is equally used by local and non local anglers and the White reach is principally used by non local anglers.

Each reach achieves Class A rating (in the upper quartile of national results) for the match fishery.

The greatest total angling effort (Match and Non-match anglers combined) is concentrated on the White reach, followed by the Blue and Red reaches.

1.3 Recommendations for Future Work.

Further studies of this kind are essential to fully describe this important and valuable fishery resource. Future studies should make collection of match angler catch information a priority, and should investigate alternative methods of data collection if necessary.

5.0 DISCUSSION.

5.10 Methods.

5.11 Angler Categories.

The main reasons for the division of anglers into two groups was principally undertaken to reflect the different needs for data collection in the field. There is also some evidence to suggest that match anglers actively target particular species (Steele, pers.comm.) which may influence some of the results.

5.12 Non-match Angler Sampling.

The standard walk creel census is widely used in the USA and is a very successful means of collecting information on both the biological and recreational aspects of the fishery (Bayley, pers.comm.) Building upon the experience of North American exercises, and drawing from work being carried out in the UK for the NRA as part of the research and development programme, a questionnaire was designed to fit the requirements of this investigation. Sunday was selected as the most suitable day on which the maximum number of anglers would be fishing, based upon the experience of the NRA TR Water Bailiffs. As such, all the results of this study relate to data collected on Sundays, and may not accurately reflect use of the resource at other times.

The majority of anglers interviewed were very cooperative and welcomed the opportunity to actively contribute to the study.

Quality assurance checks on fieldwork were carried out by Fisheries Officers, and no problems were identified. A planned exercise to compare estimated to actual catch weights was inadvertently not completed, however this is planned to be carried out during the 1994/5 survey, and the findings retrospectively applied to this study.

5.13 Match Angler Catch Sampling.

A method was developed to collect this information with as little disturbance to anglers as possible. In order for the method to succeed, a large number of Fisheries personnel were required to assemble at a weekend to collect catch data. This inevitably required a long time to organise and resulted in a fairly inflexible sampling strategy. In order to justify this mobilisation of resources, it was planned that only large matches would be targeted in order to collect as large a sample as possible. On each occasion that the numbers of staff were available and sufficiently large matches were planned, the weather conditions deteriorated and very high river flows resulted in extremely low catches.

5.20 Non-match Angler Results.

5.21 Species Composition.

The results presented for the Blue reach are based upon catches from only 10 angler's catches, compared with around 50 in both the other reaches. There is therefore little value in comparing these species occurrence results with those from the other two reaches.

Species composition of catches in any fishery is a function of many different factors, including the method and bait used, species targeted and species composition of the fish population. It is possible to account for some of these factors in this survey.

Results from previous electric fishing surveys (Hughes, 1994) indicate that the species composition of the fish populations in each reach are broadly similar. Anglers were using similar methods and baits in both reaches, and the majority of anglers were not targeting any particular species.

In general terms, the species occurrence in catches from the Red and White reaches show a similar range of species, with roach as the most abundant and perch and bream contributing a significant proportion. The difference in contribution of other species to the catch make up is difficult to explain and is probably due to a combination of many subtle selection parameters, which may include gear and bait selectivity, time of day fished and river flow, temperature and turbidity conditions.

5.22 Length Distribution.

Length distribution data were collected to provide a guide to the length composition of catches, rather than identify individual year classes, which are likely to be masked by the relatively large class width employed.

The results show fish over a wide range of lengths are caught in both the Red and White reaches. (results for the Blue reach are not presented for the reasons outlined above). The length ranges and clear modes for roach and perch appear to be similar to those described for fish sampled by electric fishing in the same reach (Hughes 1994). This evidence suggests that fish from across the whole population are being caught by anglers.

This is further confirmed by the length selection ogives which demonstrate the similar length (and age) structure of roach perch and bream captures in both reaches. It is apparent that roach and bream do not become vulnerable to angling before reaching an approximate age of 1+.

The apparent difference in length structure of chub catches between the two reaches may well be anomalous due to the small proportion of chub in sampled in the Red reach. If not, it indicates a greater selection for smaller fish in this reach, the reasons for which are unclear.

5.23 Fishing Methods.

Fishing methods were divided into a number of categories to reflect the range of methods used by anglers. Conventional methods suited to the relatively deep, slow flowing River Thames were by far the most popular within each reach, with legers, swimfeeders and float being the three most common. These methods are selective for certain species over others, and are suitable for the most common small fish species found in the river. A similar range and number of each method in each reach reflects the similar nature of the river and fish populations within it, and must be a large factor in determining the catch species content.

Maggots formed the principal bait item, worms and caster were secondary, reflecting the wide availability of these baits and the general acceptance by anglers of their efficacy.

5.24 Reach Use and Angler Experience.

In the Red and White reaches, the number of days fished by the large majority of anglers was two or less and this is probably a reflection of a need to restrict fishing to weekends. The relatively low sample size for the Blue reach may have biassed the results. Anglers who fished most often (5 days a week) were found in this reach.

The distance of anglers from the nearest access point is an indicator of how evenly spread anglers are along a reach, and highlight areas where effort is concentrated. The equipment-conscious modern angler may be less willing to transport a large amount of fishing gear any significant distance along a river bank, especially where access paths are not good. The red reach results show the greatest amount of clumping around access points, and this may be a reflection of the reach passing through the town of Abingdon and the presence of Abingdon Town Council fishery - a reach of the Thames that is covered by a general licence and free to residents of Abingdon. The White reach shows a similar but less marked concentration of anglers, despite having a excellent bankside path along the whole reach.

The results show that anglers in these reaches tend to remain relatively close to the access points, and similar results have been demonstrated for rivers in the NRA North West Region (Steele, pers. comm.).

In the Blue reach, anglers are much more widely distributed along the whole length. Again this reach has an excellent footpath and access to a large car park at the upstream extent of the reach. There is, however, no evidence to suggest why the pattern of the other two reaches should not be repeated. It is possible that with much more frequent matches on this reach, non-match anglers were forced to travel further before finding a suitable spot.

Information on angler experience is important as it provides an insight into the commitment and ability of anglers utilising a reach. Both of these factors may have some influence on catching ability and therefore on CPUE values. The results show that there is not a great difference in the experience profile (in terms of years involved in the sport) of anglers between reaches, and reflect the vast resource of experience that exists on the river bank. It is interesting to compare this information with a self assessment of experience, which showed a great deal of variation between reaches, and is probably not an objective measure. One angler who had been fishing for over 50 years rated his own experience as "Novice". For the purpose of this type of study, the number of years an angler has been involved in the sport is sufficient, and a self assessment of experience should not be collected in future surveys.

The distance travelled by anglers to a fishery is one means of assessing its financial worth, assuming that there is a relationship between distance travelled and cost to the angler. In other words, a greater distance travelled to the fishery will, in general, reflect a greater cost incurred by the angler to reach that fishery. There are a number of reasons why anglers may wish to travel a greater distance; the lack of suitable venues near to home for example. These results highlight the relative importance of a fishery to local and outside anglers. Information on time spent travelling provides a useful check against these results; the distribution of each should be similar.

Results for the Red reach demonstrate that the fishery is principally used by local anglers, with half of the anglers travelling less than 5 km and for less than 10 minutes to the fishery. This is likely in part to be due to the Abingdon Town fishery described above.

The Blue reach appears to be used principally by anglers living within 15 km of the reach and travelling for less than 30 minutes, and these anglers probably come from Oxford and the surrounding towns. There was, however a fairly large proportion of anglers (about 30%) who had travelled for 80 km or more.

The white reach is a further distance from towns with Oxford, Abingdon and Didcot between 1 - 15 km distant. This is partly reflected in the distance travelled by anglers to the reach, with a greater proportion travelling further than to the other reaches.

5.25 Catch, Effort and CPUE.

On their own, catch and effort results provide an insight into the frequency and scale of angling in a reach, and therefore a means to gauge its importance as a recreational resource. CPUE gives an indication of anglers' rate of success in a reach, and therefore a means to gauge the quality and value of the biological resource.

Total catch and effort values for each reach place the Red reach highest on terms of effort, meaning that this reach is the most frequently used by non match anglers during the sampling period. The White reach was the second and the Blue reach the least frequently used by this group of anglers.

Peaks in effort were seen in the summer months, between June and September and are probably the result of the generally more comfortable weather conditions at this time of year.

Catch per unit effort results rank the Red reach highest, followed by the Blue reach and the White reach. This does not reflect the different population abundance figures measured in each reach (Hughes 1994), and there is still some question over the validity of angler catches as indicators of fish population abundance in UK rivers (Steele, O'Hara and Aprahamian, 1994).

If these CPUE values were for match anglers, they would place the reaches in class A, B and C of the National Fisheries Classification for match fisheries. This scheme was not developed for non-match angler catches, and there is some evidence to suggest in this study that they are not comparable. In this case, these classifications should therefore not be treated as definitive.

5.30 Match Angler Results.

Match angling represents an important component of the total fishing effort applied and is greater than non-match angling effort in each reach. The distribution of match effort throughout the season varies between reaches, the Blue reach experienced fairly constant and relatively low levels of effort to the White reach which had a few very high levels of effort in the season. Results for the total effort (by both groups of angler combined) applied to each reach place the White reach as the most significant, followed by the Blue and Red reaches.

CPUE results for match anglers consistently place all reaches in the highest category for match fisheries nationally, confirming their excellent quality. CPUE values follow the ranking for total effort above; Red reach with the highest value, followed by Blue and White reaches.

5.31 Historical Match Data.

The CPUE data again confirm the consistently excellent quality of match fisheries in the White and Blue reaches of the Thames since 1989. The lower values noted in 1993 reflect feedback from angling clubs whose members have noted a reduction in match catches over the 1993/4 season, which they largely attributed to the perceived higher flows experienced this year making match angling more challenging.

6.0 CONCLUSIONS

- Species occurrence in non-match angler catches differ between reaches.
- Bleak are dominant in the Blue reach catch, roach are dominant in the other two.
- More young chub are caught in the Red reach than the White reach.
- 50% of roach caught in each reach were aged 3+ or less.
- Maggots are the most common bait.
- The most common fishing method is the swimfeeder, followed by float and leger in most reaches.
- The majority of non-match anglers do not target specific fish species.
- Anglers in the Red and White reaches tend to be within 250m of the nearest access point.
- The majority of anglers in each reach have between 15 and 20 years experience.
- The Red reach is principally used by local anglers.
- The Blue reach is equally used by local and non local anglers.
- The White reach is principally used by non local anglers.
- The order of recreational value for the three reaches to non match anglers is (best first) Red, White, Blue.
- The order of fishery quality for non-match anglers is Red, Blue, White.
- The order of recreational value to match anglers and both groups combined is White, Blue, Red.
- The order of match fishery quality is Red, Blue, White.
- Each reach achieves Class A rating for the match fishery.

ADULT FISH COMMUNITIES
OF THE RIVER THAMES
BETWEEN SANDFORD AND BENSON LOCKS
1994
VOLUME 1 - EXECUTIVE SUMMARY

Simon Hughes
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National Rivers Authority
Thames Region

TR44

SOUTH WEST OXFORDSHIRE RESERVOIR PROPOSAL STUDY
A REPORT FOR
NRA THAMES REGION

ADULT FISH COMMUNITIES OF THE RIVER THAMES BETWEEN SANDFORD AND BENSON LOCKS 1994

VOLUME 1 - EXECUTIVE SUMMARY

Simon Hughes
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Compiled by Simon Hughes
Hydroacoustic data analysis by Simon Hughes.
Fish Pathology Report by Dr Ian Hirst.
Fieldwork by: A Killingbeck
A Irvine
E Hopkins
J Perkins
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A Butterworth
J Sutton
R Preston
S Hughes

1.0 EXECUTIVE SUMMARY

1.1 Study Area and Methods.

Adult fish populations in five contiguous reaches of the River Thames separated by locks between Sandford and Benson Locks were surveyed as a repeat of the SWORP 1993 Adult Fish Communities investigation. Hydroacoustic methods were used to provide a quantitative assessment of fish populations in two phases of field work during mid July and late November, electric fishing (July only) provided a sample of 3943 fish from all five reaches which provided comparative species specific information. Electric fishing samples were taken separately from the centre channel zone and the margin zone; both electric fishing and hydroacoustic work was carried out at night.

The methods and equipment used were the same as employed in the 1993 study, and catches by each method were validated by comparison of length frequency results; they seem to be sampling statistically similar populations.

Results from Phase II hydroacoustic work were hampered by gear failure and a reduction in the vulnerability of fish to sampling by the equipment through a seasonal reduction in activity observed by other workers in mid autumn.

1.2 Results and Conclusions.

A total of fourteen coarse fish species and roach/bream hybrids were sampled - two more species (carp and eel) were found this year. Bleak and roach were the most abundant species in both centre and margin zone samples. Species composition was similar to samples taken in 1993 with small changes in some reaches, and shows parity with a sample of fish taken from the River Thames at Reading in 1958/59.

Age frequency results provide a comparative index of year class abundance, although for bleak and bream there is evidence to suggest incorrect ageing of some length classes. Results for other species appear to be of good quality and provide key information on their population dynamics.

Recruitment to the adult bleak population appears to be excellent in the past few years, but may be independent of 0+ densities of a given cohort, although possible errors in assigning age to length classes may have masked a relationship. The lack of older year classes may be due to incorrect ageing, but could also be a demonstration of the sensitivity of this population to environmental change, although growth is normal.

The bream population has missing cohorts, which may be a sampling artefact, a problem with the ageing process, or a reflection of recruitment success. Extremely successful cohorts illustrate the potential for change in this population. Results indicate that factors affecting growth do not limit this population's balanced development.

Chub populations are generally stable but appear to be able to exploit favourable circumstances , resulting in some successful cohorts. Growth does not appear to be a limiting factor.

Dace populations have reduced since 1993, but are not widely distributed in the study area in either year.

Pike populations show a sensitivity to change that may be related to a reduced rate of growth, although food items (ie roach) are plentiful. There is supporting evidence that pike are poorly represented within the study area, which may be a function of the influence of bioaccumulant pollutants upon the balanced development of this population.

The roach population is susceptible to enormous changes in cohort abundance, although in the last four years, recruitment to the adult population has been very good. A depressed growth rate is evident possibly due to intraspecific competition for food, and may be a factor in population change. The variability of growth with age may be a result of changes in preference or availability of diet items. The limited evidence available does not suggest a relationship between 0+ abundance and cohort success.

All species have acceptable levels of parasite infestation that would be expected from a river of this type.

There is evidence to suggest that electric fishing catch per unit effort (CPUE) is closely related to acoustic density for each reach. Even if electric fished samples are not fully quantitative, they do provide an index of relative change between years.

A summary of hydroacoustic density by reach is shown in Table I.

Table I. Fish Densities and CPUE by Reach and Year.

Reach	Density (n 100m^{-3})			CPUE (n min^{-1})
	1994 (July)	1993 PI (July)	1993 PII (September)	1994
1	3.87	2.20	3.80	2.77
2	3.38	5.71	3.96	3.30
3	10.36	7.79	6.14	6.78
4	8.27	2.37	6.99	3.80
5	4.83	2.12	4.55	4.81

The results show a degree of consistency between years with a close relationship to electric fishing CPUE. Increases in density over time appear to be related to a reduction in mean FL, suggesting a recruitment of smaller fish to the population. It is difficult to suggest reasons for the difference in fish density between reaches, although it is likely to be a function of available habitat, water and habitat quality.

There is considerable spatial variability in fish density, but little evidence for the key factors influencing fish aggregation about a given point.

The fisheries status of the study area appears to be very good in some reaches, but only moderate to good in others. It is comparable to other reaches of the River Thames, and slightly better than parts of the River Ouse.

Most of the conclusions from this investigation relate to aspects of fish population dynamics and development that are likely to be strongly influenced by interactions within and changes to the trophic links of the river ecosystem, possibly initiated by environmental change. Some parts of the population have been shown to be extremely sensitive and capable of conspicuous change, which could be related to change in growth characteristics. Given the potential for the proposal to impinge upon the ecosystem of the river, it is essential that we understand as much as possible, the mechanisms and links within this system.

1.3 Recommendations.

Further studies of this type are important in allowing us to compare spawning success and subsequent recruitment to adult populations in the study reach; cohorts that were assessed in 1992/3 are only now being fully sampled by the equipment we have available. The comparison of juvenile abundance to cohort success is important in identifying a number of factors, principally the influence of spawning success, environmental factors, juvenile fish growth and survival on cohort success. A description of these relationships may allow prediction of the impact of the proposal on fish populations. The best sampling methods available can only sample a cohort fully about two years after hatching, so this type of survey must continue for a minimum of two years after the final juvenile fish survey.

The results of future studies will allow us to identify any trends in the changes fish populations are undergoing, and will begin to identify the background or natural variability in these populations. A robust statistical investigation of the principal factors affecting observed variance in results will describe the degree of change to the population that we will be able to detect with the methods available.

A study of the status of bioaccumulant pollutants in pike (as a top predator) in the study reach should be carried out to assess whether this is a factor affecting the balanced development of this population.

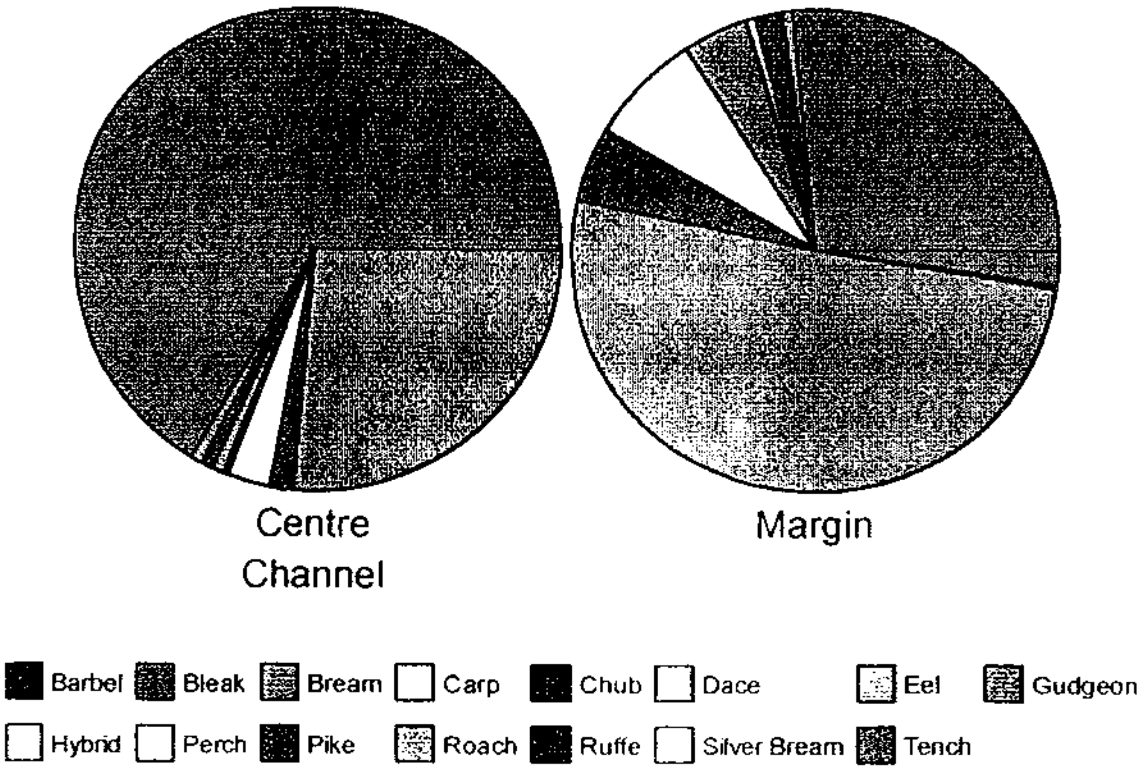
An assessment of the preferred food items of 0+ and 1+ dace (and potential competitor species) should be made to identify whether food availability is a limiting factor to the success of this species in the study reach.

All field work in studies to be compared with this one should be carried out in July to allow more robust comparisons of length and growth data. (A study of the influence of sampling time season on hydroacoustic measures of fish abundance should be made to determine whether July is the optimum sampling period.)

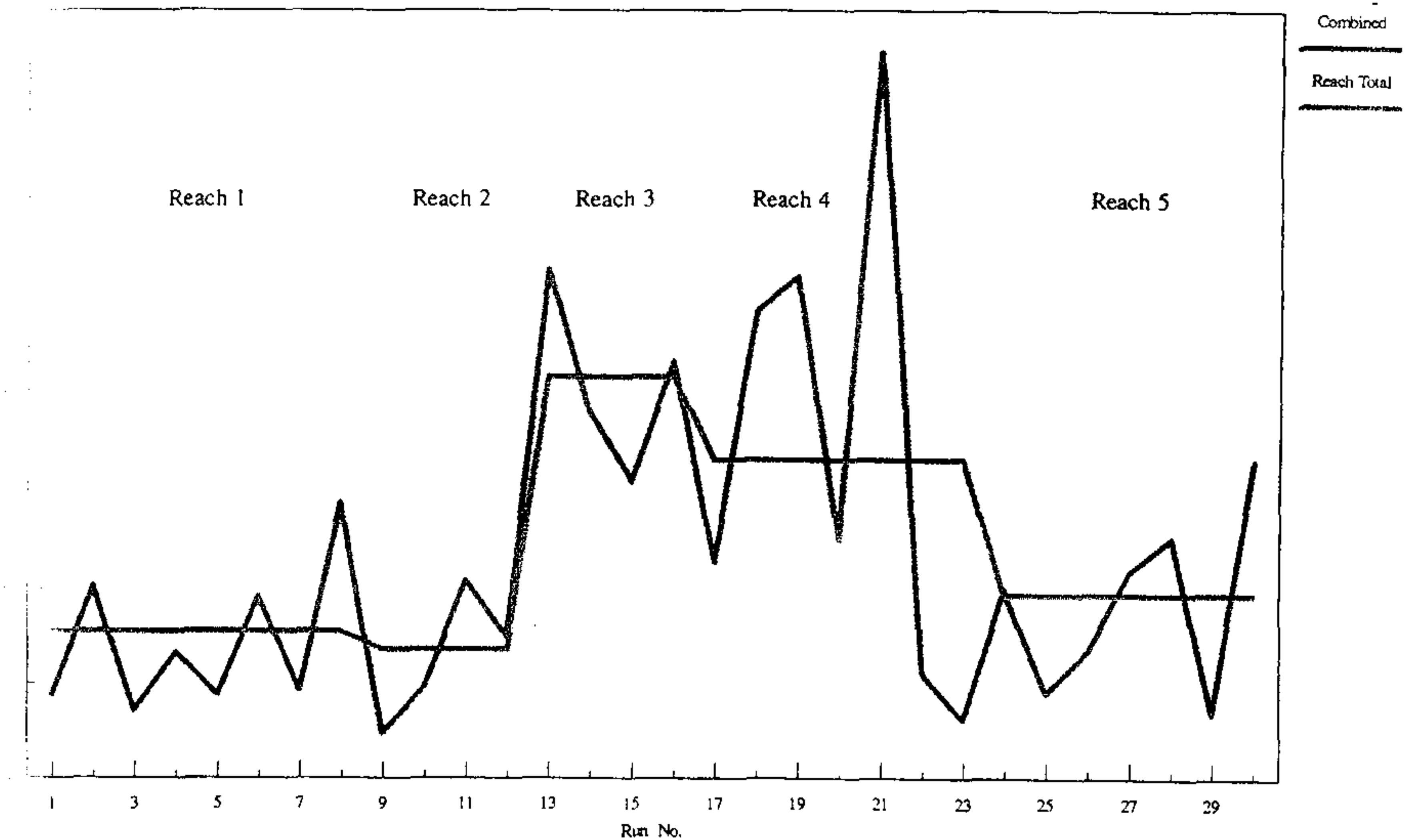
A quality audit of scale age data provided by NRA Anglian Region should be carried out.

Figure II. Species Percent Occurrence.

Reach 1



igure VI. Fish Density by Reach.



ADULT FISH COMMUNITIES
OF THE RIVER THAMES
BETWEEN SANDFORD AND BENSON LOCKS
1994
VOLUME 2 - MAIN REPORT

Simon Hughes
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SOUTH WEST OXFORDSHIRE RESERVOIR PROPOSAL STUDY
A REPORT FOR
NRA THAMES REGION

ADULT FISH COMMUNITIES OF THE RIVER THAMES BETWEEN SANDFORD AND BENSON LOCKS 1994

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6.0 CONCLUSIONS

The results presented and discussed in this report lead us to draw a number of conclusions about the status and sensitivity to change of fish populations in the study reach, as well as about how they appear to have changed in the period of one year. We cannot yet identify trends in these changes, but a number of recommended future studies should allow this.

6.1 Methods.

The methods used provide statistically similar samples of the fish population and there is some positive correlation between hydroacoustic densities and electric fishing catch per unit effort.

Electric fishing is more effective in the shallower margin zones than the deeper centre channel zones, but it is important to sample both areas to minimise sampling bias.

6.2 Species Occurrence, Population Dynamics and Health.

Species diversity provides a basic assessment of fishery quality and the relatively small variability between reaches and years is probably a product of the sampling methods used. The difference in species composition between the margin and centre channel samples is probably due in part to species habitat preference.

Bleak and roach are the most abundant species in all reaches, and perch are the third most abundant species in many margin samples.

Recruitment to the adult bleak population has been good in the past although possible errors in assigning age to length classes may have given misleading results. The lack of older year classes may be a result of this error, but could also be a demonstration of the sensitivity of this population to change.

Missing cohorts in the bream population may be an artefact, however if this is not the case, age frequency results suggest a population that is relatively sensitive to change, but that does not appear to be limited by growth. It will be possible to relate juvenile abundance to year class success in this species from the results of future surveys.

Dace populations have reduced since 1993, but are not widely distributed in the study area in either year.

Chub populations appear generally stable with some variability in year class abundance. Growth does not appear to be a limiting factor, and the relationship between juvenile abundance and cohort success should be possible to describe with results from future surveys.

Pike populations show a sensitivity to change that may be related to growth although their preferred food items (roach) are abundant. There is evidence that pike are poorly represented in the study area compared to other large lowland rivers, which may be a function of the influence of bioaccumulant pollutants upon the balanced development of this population.

The roach population is susceptible to enormous changes in cohort abundance, although in the last several years recruitment to the adult population has been good. A depressed growth rate is evident, possibly due to intra-specific competition for food, and may be a factor in population change. There is a marked variability in growth rate with age which may be a result of changes in preference for or availability of diet items. The limited evidence available does not suggest a relationship between juvenile abundance and cohort success.

All species have acceptable levels of parasite infestation that would be expected from a river of this type.

6.3 Population Abundance.

There is evidence to suggest that electric fishing catch per unit effort (CPUE) is closely related to acoustic density for each reach. Even if electric fished samples are not fully quantitative, they do provide an index of relative change between years.

The results show a degree of consistency between years with a close relationship to electric fishing CPUE. Increases in density over time appear to be related to a reduction in mean FL, suggesting a recruitment of smaller fish to the population. It is difficult to suggest reasons for the difference in fish density between reaches, although it is likely to be a function of available habitat, water and habitat quality.

There is considerable spatial variability in fish density, but little evidence for the key factors influencing fish aggregation about a given point.

6.4 Denouement.

Most of the conclusions above relate to aspects of fish population dynamics and development that are likely to be strongly influenced by interactions within and changes to the trophic links of the river ecosystem, possibly initiated by environmental change. Some parts of the population have been shown to be extremely sensitive and capable of drastic change, which could be related to change in growth characteristics. Given the potential for the proposal to impinge upon the ecosystem of the river, it is essential that we understand as much as possible, the mechanisms and links within this system.

Institute of Freshwater Ecology

Strategic Water Resources Assessment: Review of Great Ouse (1988-1993) and River Thames (1958-1973) Fisheries Community Data

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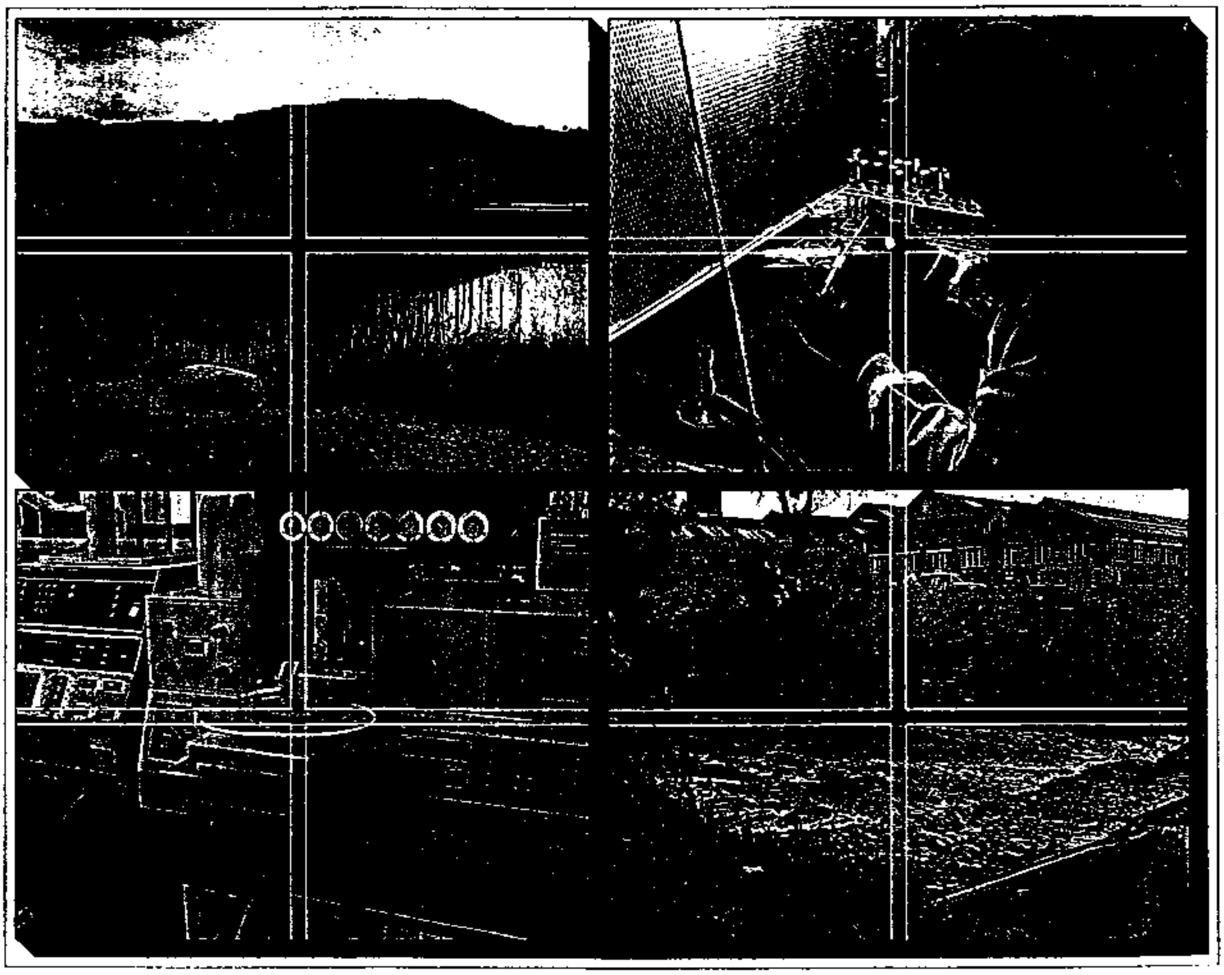

Natural Environment Research Council

EXECUTIVE SUMMARY

The report reviews studies of coarse fish communities undertaken on the River Thames (Dreadnought Reach) during 1958-73 and on the River Great Ouse since 1988. The results are examined together with a wide range of other relevant studies to identify the main environmental influences on the fish communities of rivers like the Thames, and to comment on the sensitivity of fish to these influences. The review is intended for comparison with current studies on the Thames and to highlight requirements for further, focused studies.

Habitat requirements change as fish grow and develop. Changes are particularly rapid during the first year of life and it is important to maintain habitat diversity in the river. Young fish need cover to provide protection from predation and from high water velocities (over 2 cm s^{-1}). Beds of water lilies and other areas of slack water are important habitats.

Lily beds are also important feeding areas because they contain large populations of small invertebrates during the summer months. Small invertebrates may be a limiting resource for the growth of some species, such as roach, dace and small perch.

Older fish have greater ranges of habitat tolerance but, in all species, the requirements for successful spawning are shown to be more precise than those for feeding and refuge.

Water temperature, current velocity, food availability, refugia and spawning habitats are identified as key factors for the fish community.

It is recommended, in order of priority, that:

1) Further studies should be made of the habitat preferences and diel movements of 0 group fish and of the requirements for successful over-wintering.

2) Data collected from the Dreadnought Reach of the Thames in 1970-71 should be analyzed more fully to show the effects of a large reduction in the roach population during the 1960s, and to provide information intermediate between 1958-59 and current studies.

3) Sonar detection and sonic tags should be used to provide information on the spawning (and other) movements of adult fish, and on the effect of locks and weirs on such movements.

4) An assessment should be made of the availability of spawning habitats for selected fish species from the high priority Category A list (barbel, common bream, chub) that appear to have limited recruitment in the Thames.

group fish can feed and find cover from predation and high water current velocities. The young fish need areas with a flow <2 cm s^{-1}. Nuphar beds and other areas of slack water are important habitats, which need to be maintained in the river.

The studies of 0 group fish in the Great Ouse confirm the importance of water temperature in determining growth rates, especially in the first two or three months of life. However, they also showed evidence of food limitation in mid/late summer, when most if not all the fish species had spawned and the eggs had hatched. Changes in river temperatures induced by anthropogenic changes could add to the year-to-year variations that occur naturally though climatic influences.

Much of the food taken by young fish is cladocerans and chironomid larvae known to be in the Nuphar beds. There is evidence of scarcity of invertebrate food for several species of fish. Nuphar beds are the richest areas for invertebrates during the summer months and more food would be available during the main growth season of the fish if there was a greater area of Nuphar in the Thames. Although the data from rivers other than the Thames provide strong indications of the optimum environmental conditions for most species, they also show the need for local knowledge concerning the river and its fish community.

The studies on the Thames, based at the University of Reading, continued from 1958 to 1972. However, the study of the growth, survival and population densities of larger fish were based on samples taken in 1958-59, and those of juvenile fish were based on samples taken in 1967 and 1968. Studies on the energetics and production of the fish and of the ecosystem as a whole are based on these two sets of samples. The study of larger fish was repeated in 1970-71 but the data were never fully analyzed because Dr Berrie left the University to take up another post before this had been achieved. These data are still of considerable interest because of the changes that took place in the structure of the fish community between 1958-59 and 1970-71.

5.2 Summary of key factors

The key environmental factors influencing critical life stages of coarse fish are summarized below. Note that these factors do not operate in isolation; they are often interrelated and may act on fish in a synergistic manner.

5.2.1 Water temperature

Above average temperatures decrease egg incubation periods, increase fish growth rates and improve the swimming ability of 0 group fish. All these elements lead to higher 0 group survival rates and to improved year-class strength. The timing of spawning is partly temperature controlled, and some species require high temperatures (>18°C) before spawning occurs (e.g. tench, carp). Sudden decrease in water temperature during the spawning period can inhibit spawning activity and may cause egg resorption.

5.2.2 Water velocity

Velocities > 2 cm s^{-1} can lead to the displacement of 0 group fish, especially during their first two or three weeks of life. Hatching of the different fish species may extend from April to July in many rivers, including the Thames. Consequently, newly-hatched fish are present throughout this period and will require suitable refugia.

Most fish species require some flow of water over their spawning substrata to enable the eggs to be well aerated. The flows observed for the target species are indicated in Table II,; they range from near zero in backwaters (tench, pike) to c. 50 cm s^{-1} on gravel beds (dace, chub, barbel).

5.2.3 Food availability and fish refugia

These two elements are often related, especially with respect to 0 group fish. Marginal vegetation and/or backwater areas provide shelter from high water velocities for 0 group fish, and also constitute feeding areas.

O group fish require small food particles when they start feeding on external food sources (as opposed to feeding on yolk sac supplies). Synchronisation of the phytoplankton and zooplankton cycles with hatching sometimes occurs but is not consistent between species or between years. The phytoplankton cycle is influenced by river discharge rates in the early spring and on the light regime. The timing of this cycle influences that of the zooplankton population (especially the rotifers), which eats the phytoplankton.

There is evidence from the Great Ouse studies that food supplies for 0 group fish can be limited and that this can override the influence of water temperature on growth rates. This may cause some species to switch to other food sources. Thus, roach in the main river channel switch to a detritus diet in July, but continue with a zooplankton diet in marina backwaters. Similarly, roach, dace and young perch in the Thames appeared to be short of small invertebrate food at the time of the studies. This led to a high dependence on organic detritus and to low rates of growth. The effect on survival is not known.

5.2.4 Spawning habitats

Older fish have a wider range of general habitat preferences than 0 group fish, but the spawning requirements for each species are defined more narrowly. Gravel beds washed by fast-flowing water are needed by barbel, dace and chub, whereas most other species spawn on various plant substrata in more slow-flowing areas of the river. These include submerged and emergent aquatic plants, and the submerged tree roots of willow and alder trees. Pike, tench and carp generally prefer vegetated areas with water velocities < 5 cm s^{-1}.

Access to spawning areas is vital, but little is known concerning the extent of coarse fish spawning migrations and how these may be affected by locks, weirs and sluices (see below).

5.3 Recommendations for future research

5.3.1 General

The review highlights the need for more information on the habitat selection and diel movements of different species of 0 group fish, although it is known that habitat preferences vary between species and with the growth and development of individual species. Also, very little is known about the requirements for successful over-wintering, although the Great Ouse studies point to the importance of backwater areas such as marinas. The growth and early survival of 0 group fish are critical aspects in the life stages of coarse fish, and are those most likely to be affected by changes to the river environment and hydrological regime.

Age determinations on the scales and further analyses on the 1970-71 data from the Dreadnought Reach of the River Thames will show whether the large reduction in the roach population during the late 1960s produced other effects on the fish community. The growth rate and food of roach could have changed and there could be consequential effects on other species. This study will also provide growth and age structure information for the fish community that is intermediate in time between the 1958-59 data and any recent studies by the NRA. As the material has already been collected, the cost of the study will be much smaller than if field work was involved.

Further information is needed on the movements of adult fish, particularly for spawning but also at other times of the year. The role of locks and weirs in relation to fish movements is unknown and may be of considerable importance. The use of sonar detection and sonic tags in these respects should be considered, especially for the major fish species.

Information from the 1970-71 studies indicates that, of the nine Category A species, the roach, bleak, dace, gudgeon and perch all spawn successfully in the Thames (Dreadnought Reach). Progeny of barbel, common bream, chub and pike were less numerous, which may point to restrictions in the spawning habitats. Emphasis on the spawning movements of barbel, common bream and chub would be valuable if it is intended to enhance the stocks of these species.

5.3.2 Priorities for River Thames studies

The following recommendations are placed in order of priority, but it should be noted that many aspects are interrelated.

a) Determine the distribution of suitable marginal, vegetated refuge areas for 0 group fish, especially areas where the flow velocities are less than 2 cm s^{-1} under most summer

Table I. Summary of the spawning habitat requirements of 13 species of freshwater fish. Ind = indifferent.

Species	Depth (cm)	Flow (cm s^{-1})	Substratum diam. (cm)	Vegetation
Category A				
Barbel	14-22	35-49	2-5	Absent
Bleak		< 20		Scirpus & filamentous algae.
Bream (common)	15-120	< 20		Glyceria, Sagittaria, Scirpus & filamentous algae, Salix roots, Veronica, Myosotis, Phragmites, Elodea.
Chub	10-30	20-50	> 0.5	Occasional
Dace	25-40	20-50	3-25	Occasional
Gudgeon	1-8	2-80	5-30	Fontinalis, tree roots, Potamogeton pectinatus.
Perch	Variable			Submerged Salix & Alnus roots.
Pike		< 5	Ind.	Myriophyllum, flooded riparian vegetation.
Roach	5-45	> 20	5-15	Fontinalis, Elodea, Scirpus, Salix roots.
Category B				
Carp	Variable	< 5	Ind.	Submerged riparian vegetation, Carex, Glyceria, Phragmites, Rorippa, Scirpus & filamentous algae.
Ruffe			< 5	Plants/moss.
Bream (silver)	Variable	< 20	Ind.	Variety of aquatic plants.
Tench		< 5	Ind.	Myriophyllum & Lemna

References: Baras 1992, Baras & Philippart 1993, Bastl 1969, Copp & Mann 1993, Diamond 1985, Fedorova & Vetkasov 1971, Grandmottet 1983, Hancock et al., 1976, Holcik & Hruska 1966, Kaufmann et al., 1991, Kennedy 1969, Kennedy & Fitzmaurice 1968, 1972, Kovaleva 1967, Lelek 1987, Mann 1978, 1993, Mills 1981 a,b,c, Sych 1955, Vollestad & L'Abée-Lund 1987.

Table II. Published spawning times and water temperatures for 13 species of freshwater fish, and including published (1) and unpublished (2) data from the Thames and unpublished data from the Great Ouse (3).

Species	Months	Temp. °C	References
Category A			
Barbel	VI	13.5	Hancock et al. 1976
Bleak (1,3)	V-VII	> 12	R. Stour (Mann, unpublished) Leeming 1963, Mackay & Mann 1969
C. Bream (3)	V-VI	12-18	Hartley 1947, Leeming 1963, Holcik & Hruska 1966, Kennedy & Fitzmaurice 1968
Chub (3)	V-VII	> 12	Cragg-Hine 1963, Leeming 1963, Hellawell 1971, Mann 1976b, Krupka 1988
Dace (2,3)	II-IV	8-12	Cragg-Hine 1963, Kennedy 1969, Mann 1974, Hellawell 1974 Mills 1981 a,b
Gudgeon (1,3)	V-VII	13-17	Hartley 1947, Mathews 1971, Kennedy & Fitzmaurice 1972, Penaz & Prokes 1978, Mann 1980a
Perch (1,3)	IV-V	8-14	Hartley 1947, Williams 1963 Thorpe 1977, Mann 1978, Zeh et al. 1989
Pike (3)	III-V	6-14	Mann 1976a, Raat 1988
Roach (1,3)	V-VI	7-17	Hartley 1947, Mackay & Mann 1969, Hellawell 1972, Mann 1973, Diamond 1985, Vollestad & L'Abée-Lund 1987
Category B			
Carp (3)	VI-VII	> 15	Crivelli 1981
Ruffe (3)	III-VII		Leeming 1963, Bastl 1988
S. Bream (3)	V-VII		Hartley 1947, Leeming 1963
Tench (3)	VI	> 18	Mills 1991, Copp & Mann 1993

South West Oxfordshire Reservoir Proposal (SWORP)

River Thames Juvenile Fish Survey 1993

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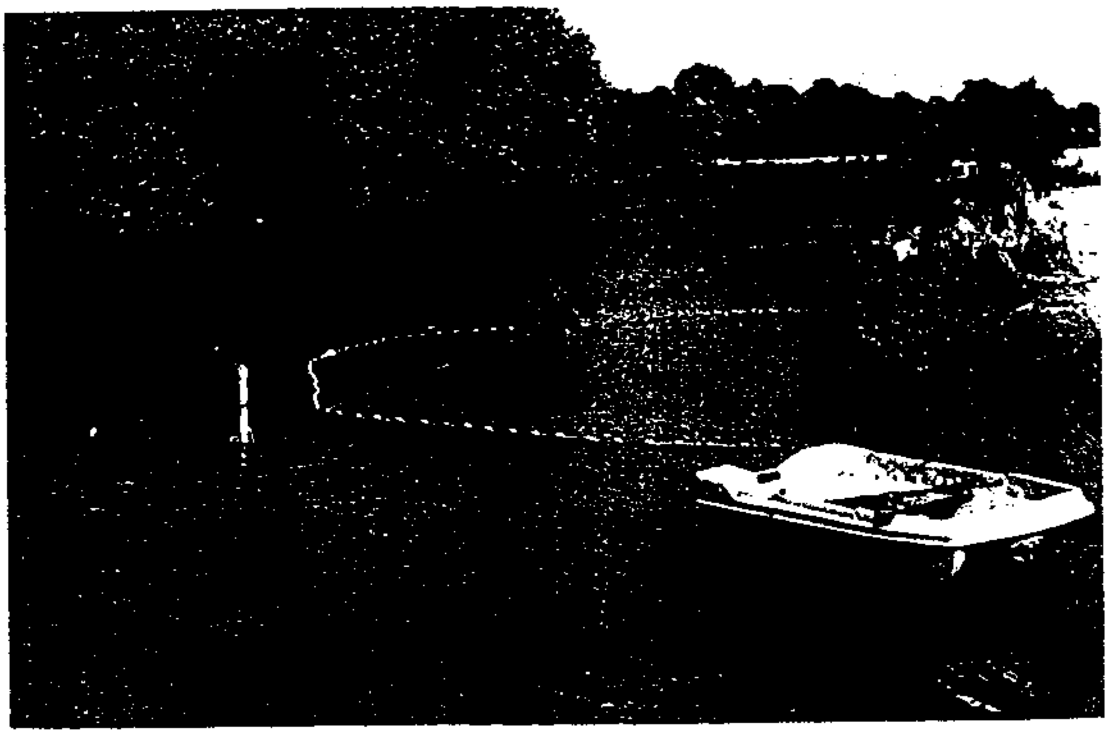

KES

April 1994

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Executive Summary

This report presents the results of a juvenile fish survey of the River Thames between Oxford and Days Weir, undertaken in July and August 1993 by King's Environmental Services. It is along this stretch of the Thames that the outlet of the South West Oxfordshire Reservoir proposed by Thames Water Utilities is likely to be sited. The 1993 juvenile fish survey follows on from previous surveys undertaken in 1991 by the Environmental Advisory Unit (EAU), and in 1992 by Royal Holloway and Bedford New College (RHBNC). Fourteen sites were sampled in 1993, thirteen of which corresponded approximately to the 13 sites sampled in 1992.

Each survey site was sampled with three seine net hauls using a 25m x 3m micromesh net with 3mm mesh size. With the exception of the additional site at Abingdon Marina, where three essentially identical net hauls were taken, three contrasting sub-sites were sampled at each site, representing three distinct habitat types, namely:

- i shallow with macrophytes,
- ii shallow without macrophytes,
- iii deep without macrophytes.

A comparison of the baseline juvenile fish stocks in the River Thames in 1993 with those recorded in 1992 and 1991 is as follows:

	1993 KES	1992 RHBNC	1991 EAU	1991 EAU
Number of sites	14	13	13*	36
Number of seinings	42	38	13	36
Juvenile density(nm^{-2})	3.84	5.81	4.07	3.07
Catch per unit effort	355	706	607	490

* *sites corresponding to 1992 & 1993 surveys*

Both juvenile density and catch per unit effort were found to be substantially lower in 1993 than for the two previous surveys. This difference in densities is almost entirely due to differences in the numbers of juvenile roach. Although the dominant species in each of the three years, the density of 0^+ roach in 1992 was more than twice that of 1993. If roach are subtracted from the overall mean density, the resulting densities for the remaining species are markedly similar: 1.96 nm^{-2} in 1993, 1.84 nm^{-2} in 1992.

Mean densities of 0^+ fry were compared for the three habitat types and found to be as follows:

Habitat type	With macrophytes	Shallow without macrophytes	Deep without macrophytes
Density 0^+ fry 1992(nm^{-2})	8.311	5.359	0.715
Density 0^+ fry 1993(nm^{-2})	2.468	3.091	2.317

Thus the very clear trends in overall fry distribution between the habitat types recorded in 1992 were not observed in 1993. In 1992 and 1993, roach densities were found to be highest in macrophyte sites and lowest in deep sites. Relationships between habitat type and density of other species was not the same between survey years.

3.4.9 *Instantaneous rates of mortality (Z) and survival (S)*

3.4.9.1 Instantaneous rates of mortality and survival for the 0^+ to 1^+ year classes in 1993 and 1992 are presented in Table 5.

3.4.9.2 The following observations can be made:

i) Instantaneous rates of mortality for bleak, chub, perch and roach were all higher in 1992 than in 1993. Only gudgeon had a higher instantaneous rate of mortality in 1993.

ii) Survival values for bleak, chub, perch, and roach were all higher in 1993 than in 1992. Only gudgeon had a higher survival rate in 1992.

iii) The highest 1993 Z value (and the lowest S value), was calculated for gudgeon, followed by perch, roach, chub, bleak then dace.

iv) The highest 1992 Z value (and the lowest S value), was calculated for roach, followed by chub, perch, gudgeon and bleak.

3.4.10 *Length weight conversions*

3.4.10.1 Scatter plots (including 95% confidence limits of the regression line), of log length (mm) vs. log preserved weight (g) are presented in Figure 13.

3.4.10.2 The equations for length weight conversion are presented below:

Bleak	$\log w = -4.8654 + 2.9296 (\log l)$
Chub	$\log w = -4.6662 + 2.8603 (\log l)$
Dace	$\log w = -4.4374 + 2.7062 (\log l)$
Gudgeon	$\log w = -4.8433 + 2.9882 (\log l)$
Perch	$\log w = -4.7558 + 2.9407 (\log l)$
Roach	$\log w = -4.5888 + 2.8590 (\log l)$

3.4.11 *Biomass (standing crop)*

3.4.11.1 Overall estimates of biomass (gm^{-2}) for the six major species (preserved weight); bleak, chub, dace, gudgeon, perch and roach are presented in decreasing order in the table below (these results are illustrated graphically in Figure 14):

Roach	2.32
Perch	1.12
Gudgeon	0.56
Chub	0.17
Dace	0.14
Bleak	0.07
Total	4.38

3.5.9 *Instantaneous rates of mortality (Z) and survival (S)*

3.5.9.1 Values of instantaneous rate of mortality and survival for 1993 and 1992 are presented in Table 5. Observations in both surveys are as follows:

i) Instantaneous rate of mortality of chub and perch was greatest in deep sub-sites.

ii) Instantaneous rate of mortality of gudgeon was greatest in shallow sub-sites.

iii) Instantaneous rate of mortality of perch was lowest in shallow sub-sites.

iv) Instantaneous rate of mortality of gudgeon was lowest in the macrophyte sub-sites.

3.5.9.2 Survival values reiterate these results showing a direct inverse relationship between survival and mortality.

3.5.10 *Biomass*

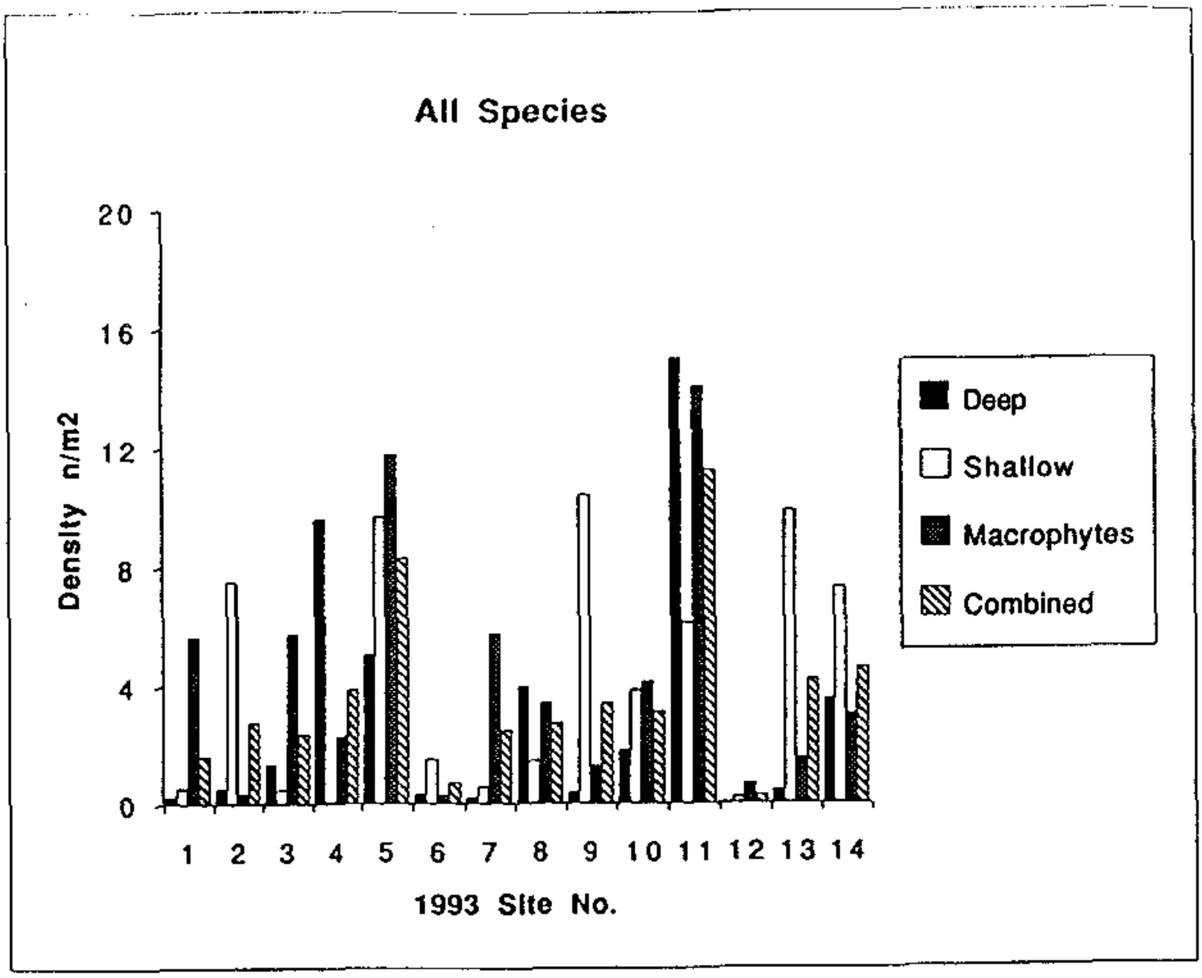
3.5.10.1 Values of biomass for the six major fish species in the three different habitat types are ranked in descending order in the following table:

Deep		Shallow		Macrophytes	
Roach	1.61	Gudgeon	1.03	Roach	3.60
Perch	0.82	Perch	0.52	Perch	1.06
Gudgeon	0.27	Roach	0.50	Gudgeon	0.39
Bleak	0.09	Dace	0.27	Chub	0.19
Chub	0.06	Chub	0.14	Bleak	0.09
Dace	0.04	Bleak	0.03	Dace	0.03
Total	2.89	Total	2.49	Total	5.36

These results are illustrated graphically in Figure 22

3.5.10.2 The above table indicates that although total densities were relatively similar in each of the habitat types, biomass in the macrophyte sub-sites appeared considerably higher. The biomass values of roach and perch were particularly high in the macrophytes relative to the other habitat types. Gudgeon biomass was relatively high in the shallow sites, where it ranked first. The biomass of dace was also higher in the shallow sites relative to the other two habitat types.

3.5.10.3 Statistical analysis was not carried out on the biomass data, as it was beyond the scope of this investigation. The point raised in 3.5.6.4 should be borne in mind when making inferences from these data.


All Species
Density n/m2
20
16
12
8
4
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14
1993 Site No.
Deep
Shallow
Macrophytes
Combined

1992 Fish densities for Sites 1-14 **Figure 12**

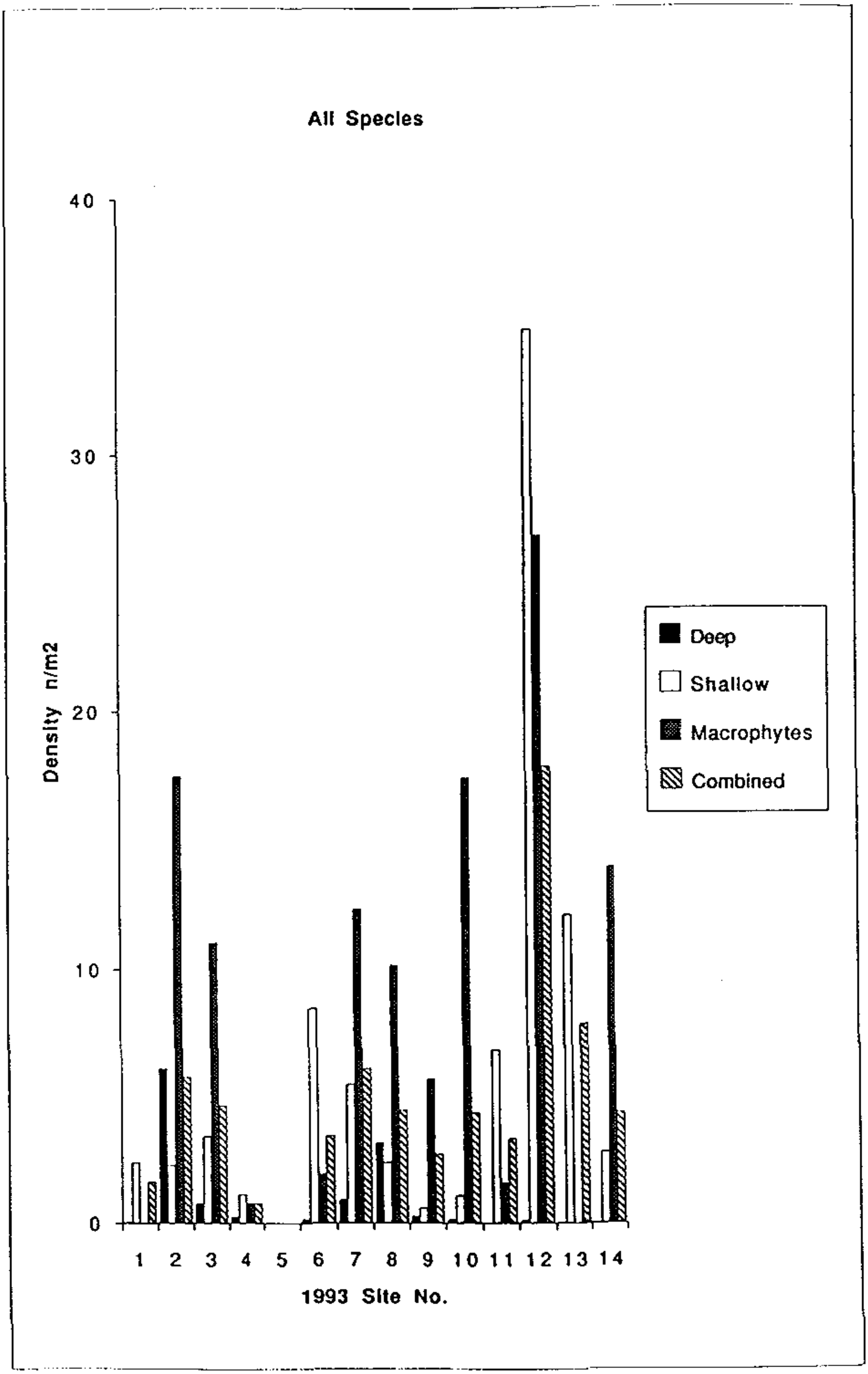
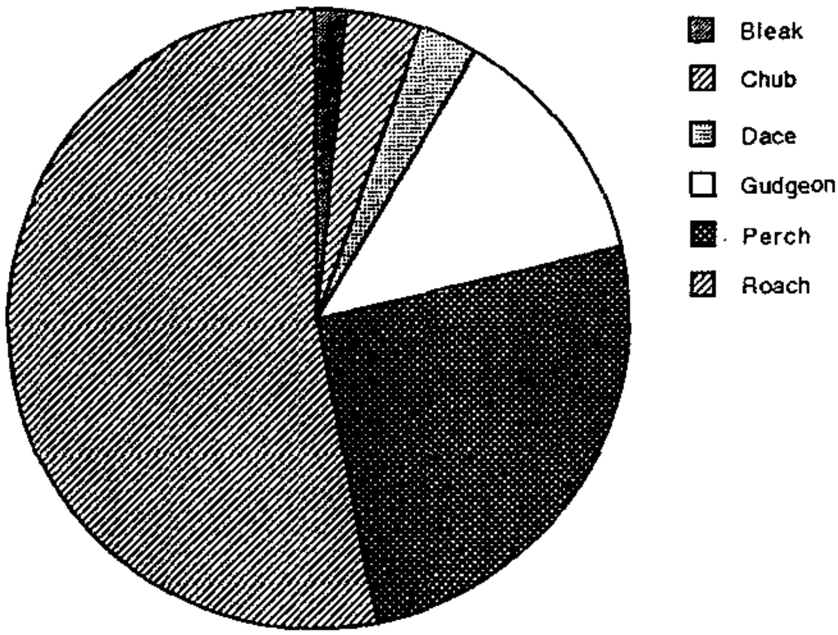


Figure 14

Combined total biomass



Combined total biomass = 4.3844 g/m^2

Strategic Water Resource Studies

River Thames Juvenile Fish Survey 1994

Volume 1 - Main Report

November 1994

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<u>Cover Photograph</u>

Measuring current velocity at Site 13 'shallow without macrophytes' with the Sensa RC2 electromagnetic flow meter. The net has been set and pulled but the net marker buoys and transect posts remain in situ. The buoys and posts define fixed points on the perimeter of the netted arc so that the total netted area can be calculated from the distances and angles of these markers to the centre point on the bank. The posts define the parallel and perpendicular transects along which depth, temperature, and water velocity are measured.

King's Environmental Services
November 1994

Executive Summary

This report presents the results of a juvenile fish survey of the River Thames between Oxford and Days Weir, undertaken in July and August 1994 by King's Environmental Services (KES). It is along this stretch of the Thames that the outlet of the South West Oxfordshire Reservoir proposed by Thames Water Utilities is likely to be sited. The 1994 juvenile fish survey follows on from previous surveys undertaken in 1991 by the Environmental Advisory Unit (EAU), in 1992 by Royal Holloway and Bedford New College (RHBNC) and in 1993 by KES. Fourteen sites were sampled in 1994, which corresponded very closely to the 14 sites sampled in 1993.

Each survey site was sampled with three seine net hauls using a 25m x 3m micromesh net with 3mm mesh size. With the exception of the Abingdon Marina site, where three essentially identical net hauls were taken, three contrasting sub-sites were sampled at each site, representing three distinct habitat types:

i) deep without macrophytes (mean depth 1.37m; 0-3% macrophyte cover),
ii) shallow without macrophytes (mean depth 0.52m; 0-5% macrophyte cover),
iii) shallow with macrophytes (mean depth 0.88m; 10-95% macrophyte cover).

A comparison of the baseline juvenile fish stocks in the River Thames in 1994 with those recorded in 1993, 1992 and 1991 is as follows:

	1994 KES	1993 KES	1992 RHBNC	1991 EAU	1991 EAU
Number of sites	14	14	13	13*	36
Number of seinings	42	42	38	13	36
Juvenile density(nm^{-2})	13.03	3.84	5.81	4.07	3.07
Catch per unit effort	1095	355	706	607	490

** sites corresponding to 1992 & 1993 surveys*

Both juvenile density and catch per unit effort in 1994 were substantially higher than for all previous surveys. This difference in densities is largely due to differences in the numbers of juvenile roach. The mean density of 0+ roach was 9.23 nm^{-2} in 1994, 1.29 nm^{-2} in 1993 and 2.52 nm^{-2} in 1992. The densities of other species are less variable between years with combined mean densities for all other species of 3.59 nm^{-2} in 1994, 1.96 nm^{-2} in 1993 and 1.84 nm^{-2} in 1992.

Mean densities of 0+ fry were compared for the three habitat types and found to be as follows:

Habitat type	Deep without macrophytes	Shallow without macrophytes	Shallow with macrophytes
Density 0+ fry 1992(nm^{-2})	0.72	5.36	8.31
Density 0+ fry 1993(nm^{-2})	2.32	3.09	2.47
Density 0+ fry 1994(nm-2)	4.17	5.12	32.48

In both 1992 and 1994 there were clear trends in juvenile distribution between habitat types although clear cut trends were fewer in 1993. The preference for macrophyte-rich sub-sites was most marked for roach and was apparent for this species in all three years.

The following relationships between habitat type and juvenile fish species were found in 1994:

i 0+ dace, chub, gudgeon and perch showed a clear preference for the shallow rather than the deep sites,

ii 0+ dace and chub showed a preference for the shallow macrophyte-poor sites rather than for the shallow macrophyte-rich sites,

iii 0+ perch and gudgeon showed a preference for the shallow macrophyte-rich sites rather than the shallow macrophyte-poor sites,

iv 0+ roach showed a very strong preference for the macrophyte-rich sites but in macrophyte-poor areas appeared to prefer the deep to the shallow sub-sites.

In addition, it was found that:

i perch, pike and roach density was positively correlated with the percentage macrophyte cover,

ii chub, dace and gudgeon densities were negatively correlated with depth,

iii chub and dace densities were positively correlated with the percentage of sand and gravel in the substrate.

There was no apparent correlation between juvenile fish density and water velocity.

This report also discusses the potential impacts to juvenile fish which may arise from construction and operation of the proposed South West Oxfordshire Reservoir and presents proposals for further studies on juvenile cyprinids in the Oxford region of the River Thames.

6 Summary and Conclusions

6.1 The current survey recorded the highest mean density of juvenile fish for the three survey years (1992-1994) in which densities could be calculated. Roach comprised 72.4% of the total 1994 catch of 46,030 fish. Of the remaining species, gudgeon comprised 18.09% of the 1994 catch with chub, bleak, dace and perch together accounting for 8.13%. Roach was also the most abundant species in 1991, 1992 and 1993, although the relative abundance of the other species varied from year to year.

6.2 The combined mean density of all species was 5.81 nm^{-2} in 1992, 3.84 nm^{-2} in 1993 and 13.03 nm^{-2} in 1994. The great majority of the density difference between years was due to the varying year class strength of 0+ roach, with densities of 2.52, 1.29, and 9.23 nm^{-2} recorded in 1992, 1993 and 1994 respectively. The mean density of 1+ roach showed much smaller variation between years with values of 0.15, 0.26 and 0.19 nm^{-2} for 1992-94 respectively.

6.3 Z and S values have been calculated for the major species by following cohorts from year to year. Calculated survival rates vary greatly between years and between species and are difficult to interpret because factors other than mortality affect the observed density of an individual species' year class. Calculated S values for 0+/1+ roach, dace, chub and perch are within the range of 0.02 to 0.3 and appear relatively realistic. Calculated first year survival rates for bleak and bream are particularly erratic, ranging over the survey years from 0.05 to >5. The most likely explanation for these results is that only a part of the 0+ cohort is being captured because of the relatively late spawning period of these two species.

6.4 Calculated survival values for roach, together with the relative constancy of the 1+ year class strength over the survey years, provides some indication that density-dependent mortality may operate for this species in the first year of life.

6.5 Although total juvenile density varied enormously in the different sites and sub-sites, there was a general overall trend of increasing densities from the top to the bottom of the survey stretch. This general trend was also apparent in 1992 and 1993, although the reasons for the trend are not clear.

6.6 Analysis of the measured habitat variables for the 1994 survey confirmed that, despite a small degree of overlap, the three habitat (sub-site) types sampled, namely 'deep without macrophytes', 'shallow without macrophytes' and 'shallow with macrophytes' formed statistically distinct sets with regard to macrophyte cover and depth. Although statistically less distinct, the habitat types also differed with respect to water velocity. Mean velocities were 0.023, 0.31 and 0.34 $msec^{-2}$ in the 'deep', 'shallow without' and 'shallow with macrophyte' sub-sites respectively. Although substrate composition varied greatly between sites and between sub-sites, there was no apparent relationship between substrate nature and sub-site type.

6.7 The 1994 survey indicated clear relationships between habitat type and fish density and in most cases these relationships were statistically significant. Mean total densities of 0+ fish were 32.48, 5.12 and 4.17 nm^{-2} for the 'shallow with macrophyte', 'shallow without macrophyte' and 'deep' sub-sites respectively. These total densities are heavily influenced by the dominant species, roach.

6.8 The 1994 0+ cohorts of perch, chub, dace and gudgeon, together with the 1+ gudgeon cohort, all showed a clear preference for the shallow (with or without macrophytes) rather than the deep sub-sites. Although not statistically significant, bleak appeared to show a similar preference. The 0+ cohorts of gudgeon and perch showed a statistically significant preference for the 'with macrophyte' sub-sites although this trend was not apparent for the 1+ gudgeon. Conversely, the 0+ chub and dace showed a preference for the shallow macrophyte-free sites.

6.9 Both 0+ and 1+ roach showed a highly significant association with the macrophyte-rich sites. Unlike the other species however, 0+ roach in the macrophyte free habitats displayed a preference for the deep rather than the shallow sub-sites.

6.10 When the habitat variables were considered independently rather than by sub-site groups, a number of significant correlations were obtained:

- i perch, pike and roach were positively correlated with percentage macrophyte cover,
- ii chub, dace and gudgeon were negatively correlated with depth,
- iii chub and dace were positively correlated with the percentage of sand and gravel in the substrate.

There was no apparent correlation between fish density and water velocity.

6.11 Stepwise multiple regression using nine potential habitat predictors suggested that 34.8% of observed variation in total fish density is attributed to % macrophyte cover (22.57%) and water velocity (34.79%). Biomass showed similar trends with 41% of the variation attributed to % cover, water velocity and % sand and gravel. Stepwise multiple regression was not attempted for individual species or year class cohorts.

6.12 The associations demonstrated between habitat variables and fish density in the 1994 survey generally confirm and extend observations made in the earlier surveys. The potential value of stepwise multiple regression has been demonstrated. However, the present system of sub-site selection, which seeks uniformity of habitat variables within one of three defined habitat types, may not be optimum for this type of analysis.

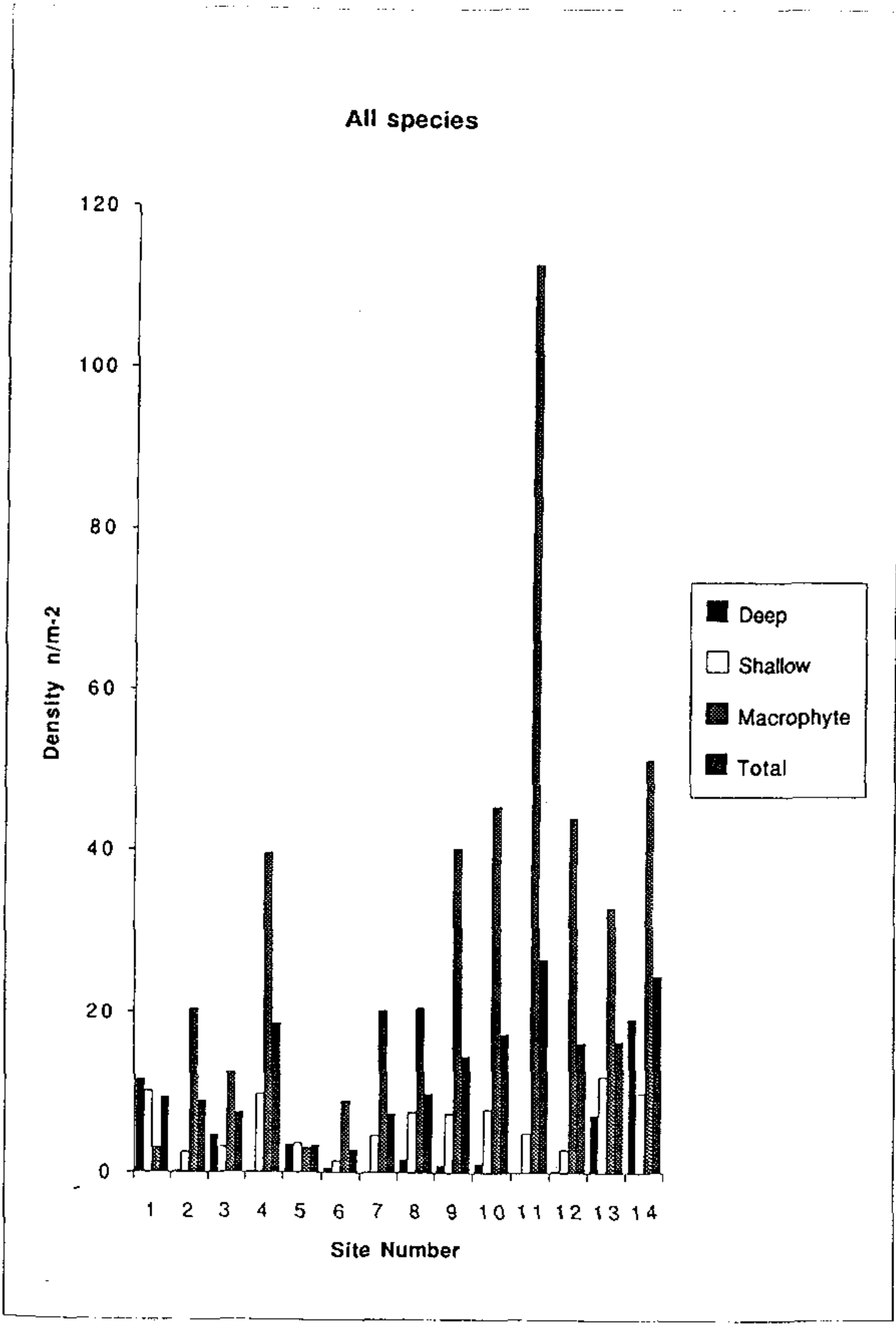
6.13 The possible underlying reasons for the variation in 0+ year class strength of the different fish species in the Thames have been discussed in this report. Although direct evidence from the Thames is tenuous, published information for other systems supports the hypothesis that spring and summer water velocities, and spring water temperatures, are likely to be the principal controlling factors. A longer term data set for juvenile fish abundance and more comprehensive seasonal temperature records will be required to adequately test this hypothesis.

6.14 Mean lengths and ranges of the various fish species show significant variation over the four survey years, although generally these variations are not great. Growth rates of 0+ to 2+ fish are generally similar to national standards and are thus within the range expected.

6.15 Experience gained from the 1991-1994 surveys of the Thames suggests that late July/early August is an appropriate sampling period for juveniles of most species of coarse fish inhabiting the river. However, at least in some years, this date appears to be rather early for the later spawning species such as bleak and bream, leading to under estimation of the 0+ year class strength for these two species

6.16 Considering the proposed South West Oxfordshire Reservoir, the most significant impacts to juvenile fish are likely to arise from changes to the flow and temperature regime and from changes in food availability. Changes to flow regime may affect juvenile fish directly, if their velocity tolerance is exceeded, or indirectly, by affecting the distribution and abundance of aquatic macrophyte stands. Water quality impacts would probably be of relatively minor significance if the proposed reservoir were fully mixed but would be potentially more severe if the reservoir were allowed to stratify thermally in summer.

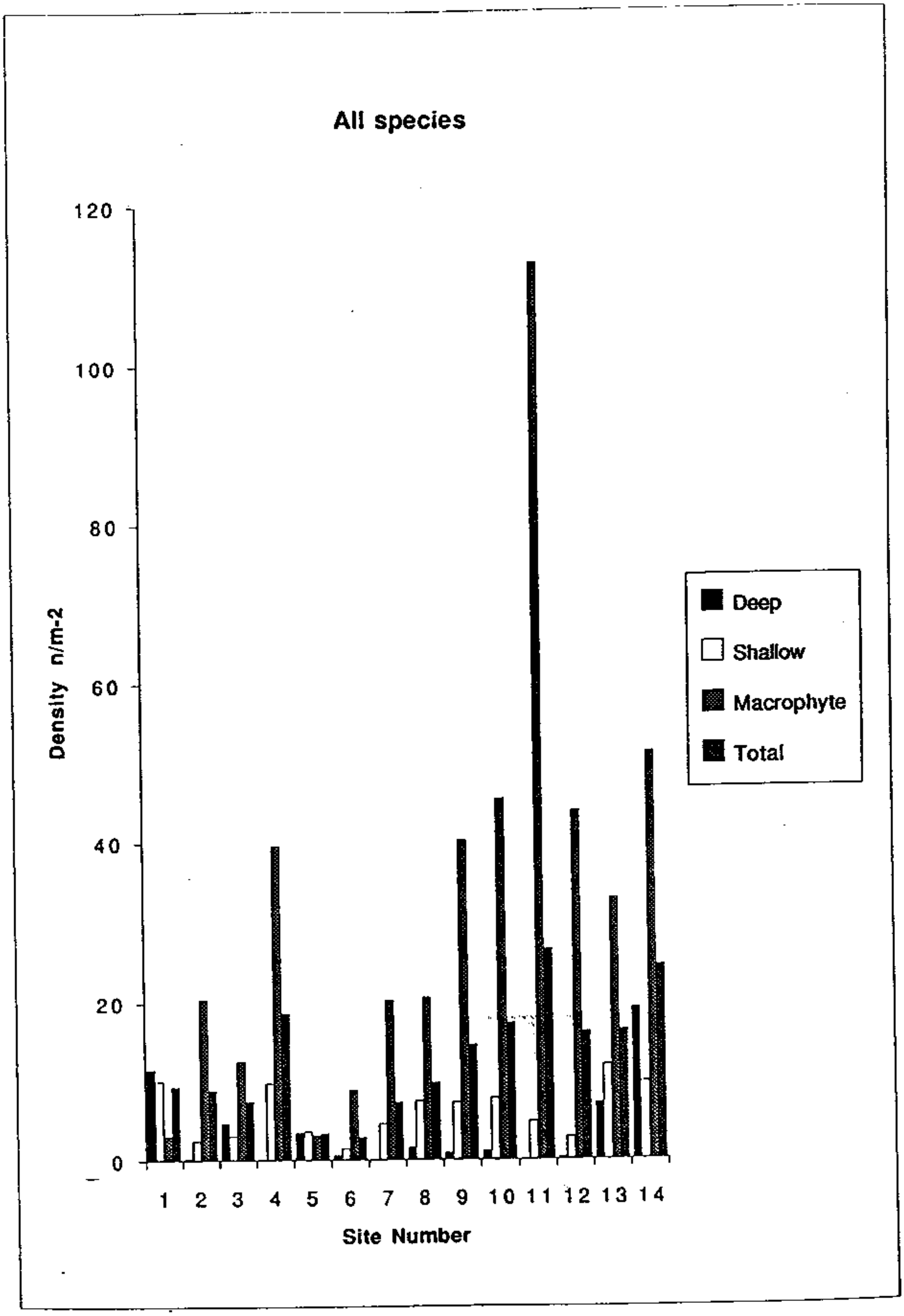
6.17 Although of necessity very tentative, the preliminary assessment of potential impacts presented in this report is nevertheless important. It provides a preliminary focus for the development of further studies on both the population dynamics of juvenile cyprinids in the Thames and the vulnerability of these species to the environmental perturbations that may arise from reservoir development.



Note: Change of vertical scale

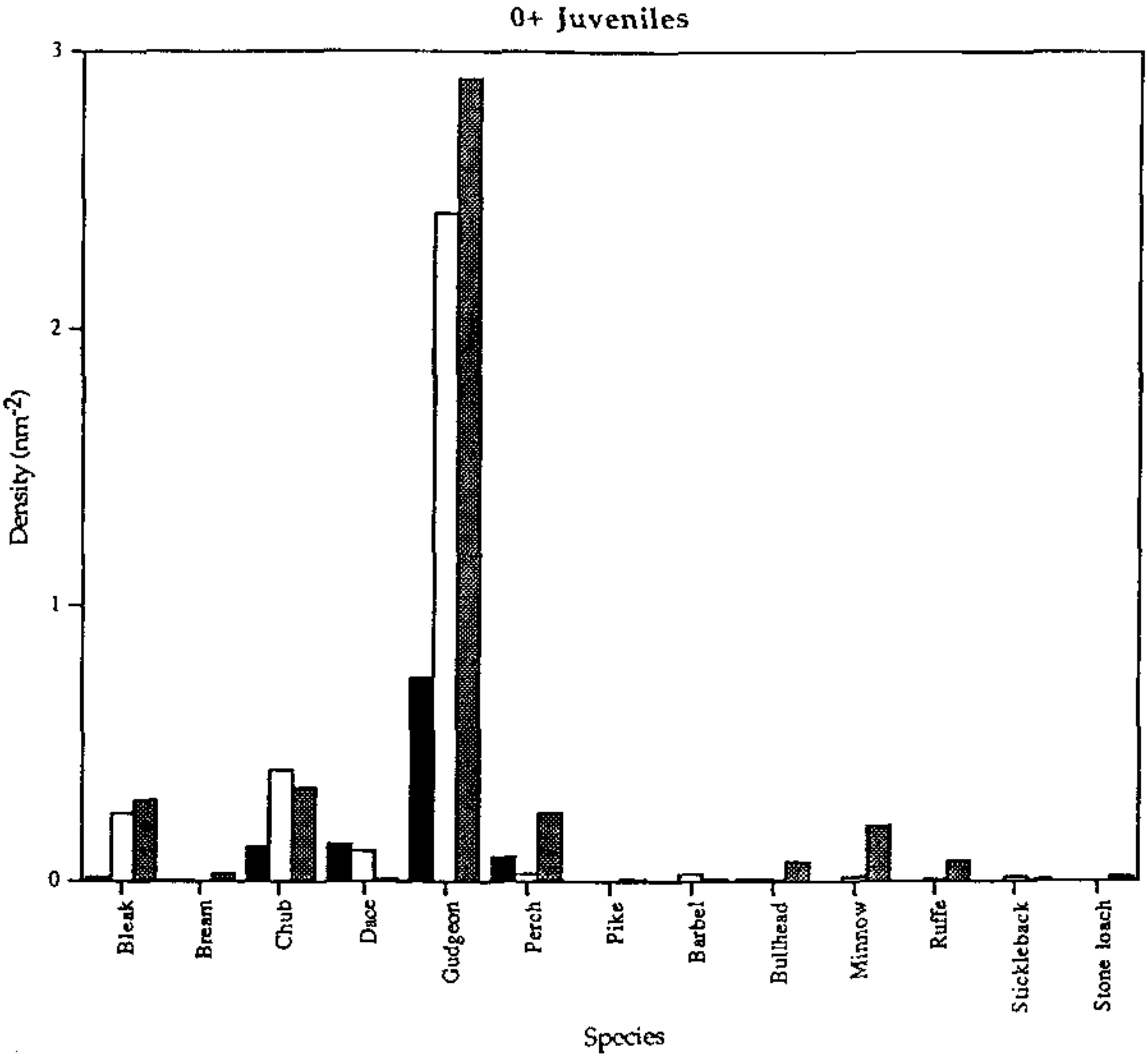
Fish densities at sites 1-14

Figure 6



Note: Change of vertical scale

Total density of 0+ and 1+ juveniles in each habitat type - 1994 survey Figure 7



	Deep				Shallow				Macrophytes			
	0+	1+	>1+	Total	0+	1+	>1+	Total	0+	1+	>1+	Total
Bleak	0.013	0.002	0.004	0.018	0.244	0.022	0.005	0.270	0.291	0.445	0.024	0.760
Bream	0.000	0.000	0.002	0.002	0.000	0.000	0.000	0.000	0.025	0.009	0.011	0.045
Chub	0.129	0.067	0.001	0.197	0.395	0.031	0.002	0.428	0.338	0.066	0.002	0.405
Dace	0.137	0.004	0.000	0.141	0.401	0.042	0.000	0.443	0.084	0.015	0.000	0.099
Gudgeon	0.732	0.088	0.010	0.830	2.404	0.514	0.341	3.260	2.903	0.382	0.062	3.346
Perch	0.092	0.011	0.008	0.111	0.023	0.005	0.001	0.029	0.247	0.043	0.012	0.302
Pike	0.002	0.000		0.002	0.000	0.001		0.001	0.006	0.004		0.011
Roach	3.047	0.056	0.016	3.119	1.877	0.045	0.008	1.929	28.364	0.507	0.034	28.905
Barbel	0.001			0.001	0.022			0.022	0.007			0.007
Bullhead	0.011			0.011	0.011			0.011	0.069			0.069
Minnow	0.003			0.003	0.014			0.014	0.199			0.199
Ruffe	0.002			0.002	0.009			0.009	0.071			0.071
Stickleback	0.002			0.002	0.012			0.012	0.011			0.011
Stone loach	0.001			0.001	0.002			0.002	0.014			0.014
Total				4.439				6.432				34.244

Calculated biomass at each site

Figure 9

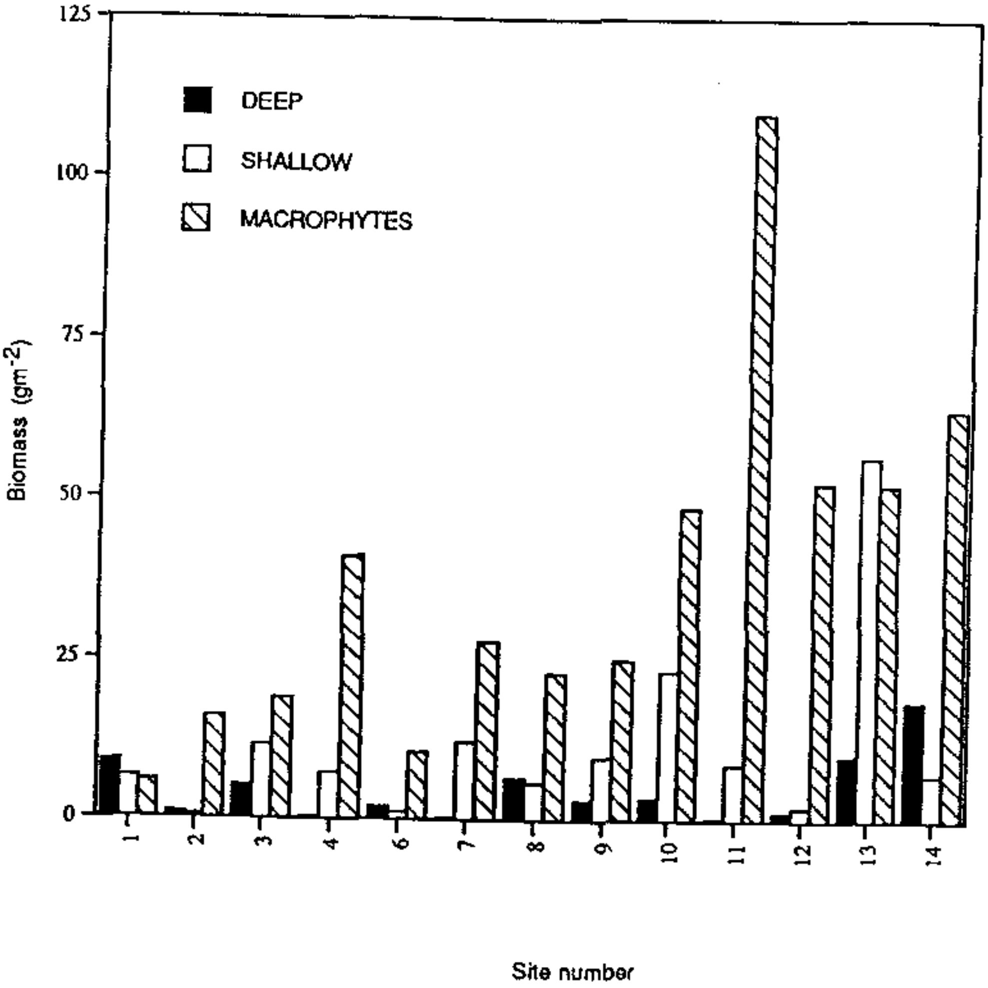
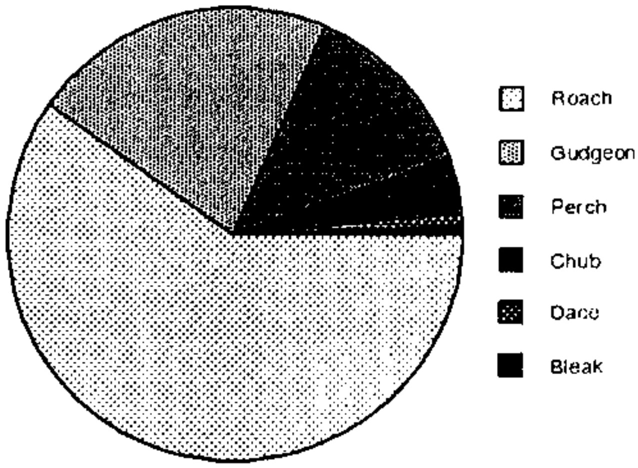


Figure 10

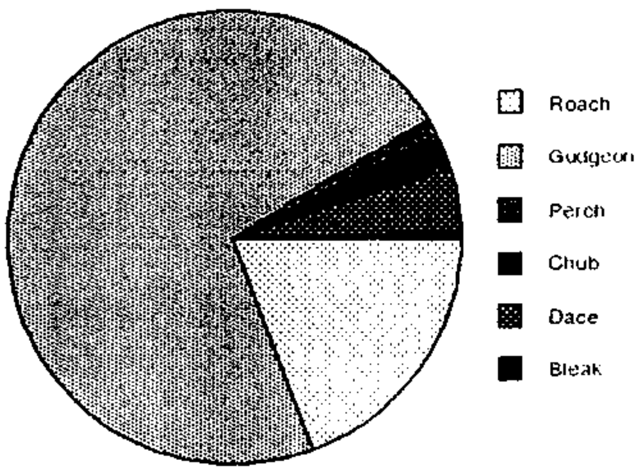
Relative biomass of major fish species in each habitat

Deep without macrophytes



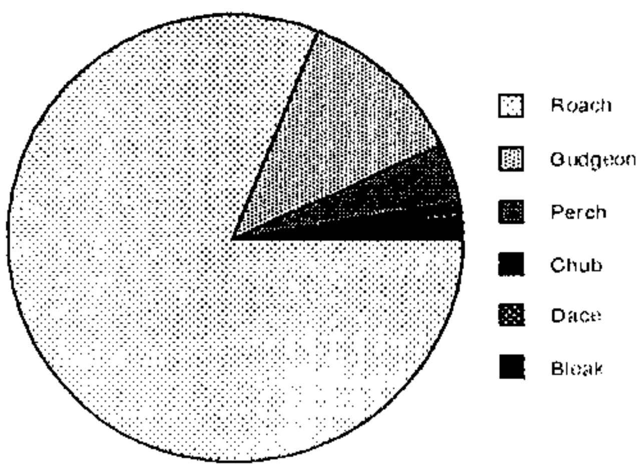
Biomass= 4.68 gm^{-2}

Shallow without macrophytes



Biomass= 11.72 gm^{-2}

Shallow with macrophytes



Biomass= 38.09 gm^{-2}

Total Biomass all sites= 18.16 gm^{-2}

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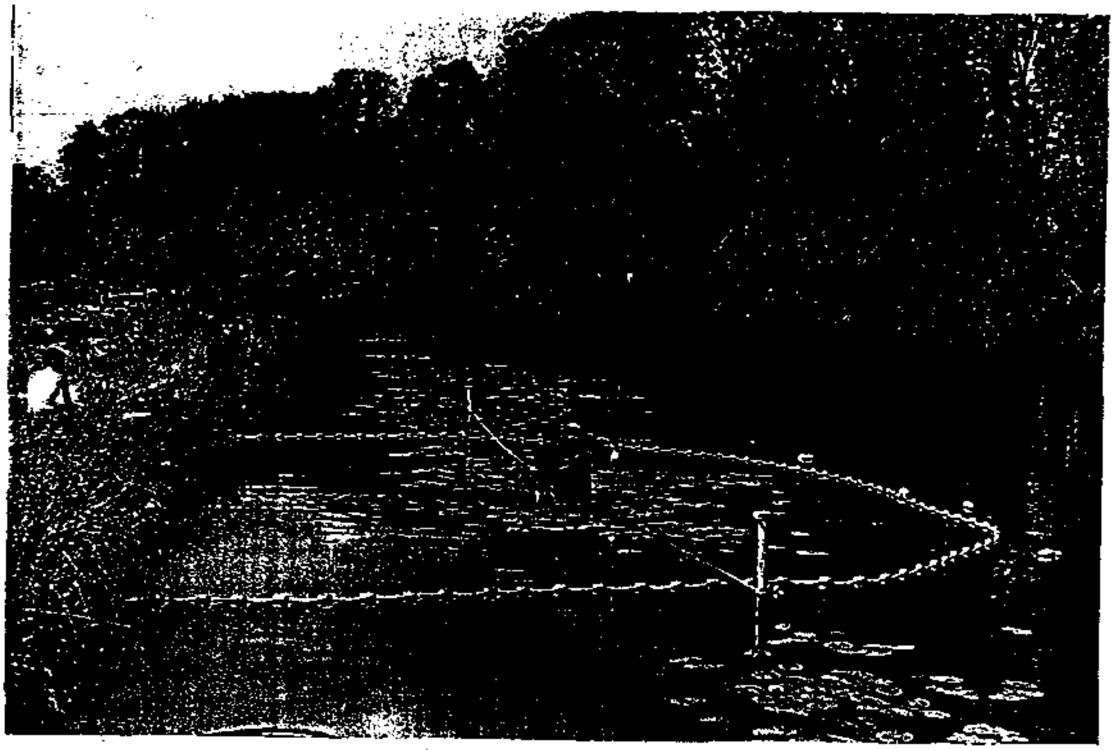

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Cover Photograph

Measuring current velocity at Site 10 'shallow with macrophytes' with the Sensa RC2 electromagnetic velocity meter. Following velocity measurement, the enclosed macrophytes are cut with a scythe and removed prior to hauling and landing the net. The buoys and posts define fixed points on the perimeter of the netted arc so that the total netted area can be calculated from the distances and angles of these markers to the centre point on the bank. Depth, temperature and water velocity are measured along two transects, one parallel to and the other perpendicular to the bank. The two posts define the parallel transect.

King's Environmental Services
November 1995

6 Summary and Conclusions

6.1 The 1995 survey recorded the highest mean density of juvenile fish for the four survey years (1992-1995) in which densities could be calculated. As in previous years, roach was the dominant species comprising 65.7% of the total 1995 catch of 59,926 fish. Previous total catches were 31,891 in 1992, 14,936 in 1993 and 46,030 in 1994. Of the remaining species, gudgeon comprised 17.19% of the 1995 catch, chub 7.76% and bleak 4.22%, with dace, perch and bream together accounting for 3.58%. Although roach dominated the catch in all survey years, the relative abundance of the other species varied significantly from year to year.

6.2 The combined mean density of all species was 4.38 nm^{-2} in 1992, 3.52 nm^{-2} in 1993, 13.03 nm^{-2} in 1994 and 16.05 nm^{-2} in 1995. The great majority of the density difference between years was due to the varying year class strength of 0+ roach, with densities of 2.52, 1.29, 9.23 and 10.55 nm^{-2} recorded in 1992 to 1995 respectively. The mean density of 1+ roach showed parallel inter-year variation with values of 0.15, 0.26 and 0.19 and 1.10 nm^{-2} for 1992 to 1995 respectively.

6.3 Z and S values were calculated for the major species by following cohorts from year to year over the period 1992-1995. Calculated survival rates vary greatly between years and between species and in many cases are difficult to interpret because factors other than mortality may affect the observed density of an individual species' year class. Calculated S values for 0+/1+ roach, dace, chub and perch are generally within the range of 0.02 to 0.35 and appear relatively realistic. Calculated first year survival rates for bleak and bream, and to a lesser extent for gudgeon, are particularly erratic, ranging over the survey years from 0.05 to > 5. The probable explanation for these results is that only a part of the 0+ cohort was captured. This is due to the relatively late spawning period of bleak and bream and probably because the bottom living habit of gudgeon makes it difficult to net the smallest individuals so that they are under-represented in the catch.

6.4 Calculated one year survival values for the 1992, 1993 and 1994 cohorts of roach and chub are markedly similar (mean S roach = 0.12, mean S chub = 0.3), despite substantial variation in initial cohort strength, suggesting that density-dependent mortality does not operate for these two species. In contrast, the calculated S values for perch suggest that density-dependent mortality may be occurring in this species.

6.5 Although total juvenile density varied enormously in the different sites and sub-sites in all survey years, a general overall trend of increasing densities from the top to the bottom of the survey stretch was clearly apparent in the 1992-1994 survey years. In contrast, fish densities were much more uniformly distributed along the survey stretch in 1995. The reasons for this trend, and its apparent absence in 1995, remain obscure.

6.6 Uniquely amongst the Thames fish species, the mean density of ruffe increased consistently from 1992 to 1995 (0.001, 0.01, 0.05 and 0.17 nm^{-2} 1992-1995 respectively) possibly indicating a long term trend.

6.7 As in 1993 and 1994, analysis of the measured habitat variables for the 1995 survey confirmed that, despite a small degree of overlap, the three habitat (sub-site) types sampled, namely 'deep without macrophytes', 'shallow without macrophytes' and 'shallow with macrophytes' formed statistically distinct sets with regard to macrophyte cover and depth.

6.8 Mean water velocity in 1995 for the 39 river sub-sites, at 0.012 ms^{-1}, was the lowest recorded for the three years in which velocity was measured (mean velocity 1993 = 0.0623 ms^{-1}; 1994 = 0.030 ms^{-1}). There were no significant differences in water velocity or temperature between the sub-site types in 1995. There was a clear longitudinal trend of increasing water temperature from the top to the bottom of the survey stretch but this was simply a reflection of prevailing weather conditions during the survey period. Although substrate composition varied greatly between sites and between sub-sites, the only clear pattern was the positive relationship between depth and the percentage of bare clay substrate.

6.9 As in previous surveys, the 1995 data indicated a clear relationship between habitat type and total fish density. Mean total densities of 0+ fish were 27.49, 10.52 and 3.02 nm^{-2} for the 'shallow with macrophyte', 'shallow without macrophyte' and 'deep' sub-sites respectively. These total 0+ densities were heavily influenced by, but not exclusively due to, the dominant species, roach.

6.10 Statistical analysis of the 1995 juvenile fish and environmental data established a number of associations and correlations which largely confirmed the findings of the 1993 and 1994 surveys. The more significant findings from the 1995 data set are as follows:

i 0+ chub and gudgeon showed a clear preference for the shallow rather than the deep sub-sites;

ii 0+ perch and roach showed a very strong preference for the macrophyte-rich sub-sites over either the deep or shallow macrophyte-poor sub-sites;

iii 1+ roach showed a preference for the macrophyte-rich sub-sites rather than for the deep macrophyte-poor sub-sites;

iv 0+ bleak, perch, roach and ruffe densities were positively correlated with the percentage macrophyte cover;

v 0+ bleak, chub and gudgeon densities were negatively correlated with depth and gradient;

vi 0+ chub were positively correlated with the percentage of sand and negatively correlated with the percentage of clay in the substrate;

vii 1+ bleak, chub and gudgeon and 2+ gudgeon were positively correlated with the percentage of gravel substrate.

6.11 When the 1993 to 1995 data sets were pooled to give a larger data set (117 sub-sites), relationships and correlations generally became more clear cut, especially for the 1+ and 2+ age classes. Several additional relationships became apparent that were not evident from the 1995 data set alone, namely:

i 0+ chub showed a preference for shallow macrophyte-poor sub-sites over both shallow macrophyte-rich and deep macrophyte-poor sub-sites;

ii 0+ dace showed similar preferences to 0+ chub;

iii 0+ perch showed a strong preference for macrophyte rich sub-sites but in the absence of macrophytes preferred deep to shallow sub-sites;

iv both 0+ and 1+ pike showed a preference for macrophyte-rich sites over the other two habitat types.

6.12 The associations demonstrated between habitat variables and fish density in the 1992 - 1994 data sets (RHBNC 1992; KES 1993, 1994) and in the 1995 and combined 1993-95 data sets means that it is now possible to define provisionally the habitat preferences of juveniles of the main fish species occurring in the Oxford region of the Thames. As a general rule, it would appear that for a given species, the habitat preferences of 0+ and 1+ fish are similar, but the usually weaker statistical relationships for 1+ fish suggest that they become more catholic in their habitat requirements with increasing age. Habitat preferences appear to be as follows:

i roach show a very strong preference for habitats with macrophyte cover, the preference for cover appearing to eclipse all other habitat requirements;

ii for perch, macrophyte cover is the single most important factor governing juvenile distribution. Perch juveniles display a marked aversion to macrophyte free shallows but can occur in significant numbers in deeper cover-free sites;

iii the preferred habitat for both chub and dace is gently shelving shallows with a sandy or gravelly bed;

iv juvenile pike lurk in weedy shallows, as do the adults;

v juvenile bleak appear to prefer shallow water with a gravelly substrate and good macrophyte cover;

vi bream show a fairly clear preference for sites containing macrophyte cover.

6.13 The possible underlying reasons for the variation in 0+ year class strength of the different fish species in the Thames are discussed in this report. Published information for other river systems supports the hypothesis that spring and summer water velocities and temperatures, are likely to be major controlling factors. Examination of flow records for the 1992-1995 survey years has suggested that there might be a negative relationship between early summer river flows and the 0+ year class strength for roach and bream. However, a much longer term data set will be required for these or other possible relationships to be confirmed. Evaluation of the potential effects of spring and summer temperature on year class strength has been precluded because of the fragmentary nature of the currently available temperature record.

6.14 Mean lengths and ranges of the various fish species showed some variation over the five survey years, although generally these variations were not great. Growth rates of 0+ to 2+ fish were generally similar to national standards and were within the range expected. The 1995 *b* constants for bleak, chub, dace, perch and roach were higher than those determined in 1994 but the gudgeon *b* constants were lower.

6.15 As shown by the 1992-1995 surveys of the Thames, late July/early August is an appropriate sampling period for juveniles of most species of coarse fish inhabiting the river. However, this date is rather early for the later spawning bleak and bream, leading to under estimation of the 0+ year class strength for these two species. A greater number of 0+ bleak and bream were captured in 1995 than in 1993 or 1994, probably indicating earlier spawning, but it is likely that even in 1995, 0+ individuals of both species were under-represented in the catch.

6.16 In the absence of any additional information concerning the design or operation of the proposed South West Oxfordshire Reservoir, no further assessment of potential impacts of the scheme to juvenile fish was undertaken.

Table 4: Comparison of mean densities (nm^{-2}) for all species 1992-1995

1995 Survey		1994 Survey		1993 Survey		1992 Survey	
Roach	10.55	Roach	9.44	Roach	1.88	Roach	3.97
Gudgeon	2.76	Gudgeon	2.36	Gudgeon	0.99	Bleak	0.68
Chub	1.25	Chub	0.33	Chub	0.27	Gudgeon	0.63
Bleak	0.68	Bleak	0.31	Perch	0.26	Chub	0.23
Perch	0.25	Dace	0.24	Dace	0.23	Perch	0.13
Bream	0.17	Perch	0.19	Bleak	0.07	Dace	0.08
Dace	0.15	Minnow	0.06	Minnow	0.05	Hybrids	0.03
Ruffe	0.14	Ruffe	0.05	Bullhead	0.02	Bream	0.02
Minnow	0.08	Bullhead	0.03	Bream	0.01	Minnow	0.01
Stickleback	0.013	Bream	0.01	Stickleback	0.01	Ruffe	0.001
Bullhead	0.009	Barbel	0.01	Ruffe	0.001	Pike	0.0009
Stone loach	0.004	Stickleback	0.01	Pike	0.004	Stickleback	0.0009
Barbel	0.0003	Stone loach	0.007	Stone loach	0.001	Bullhead	0.0004
Hybrids	0.0003	Pike	0.004	Tench	0.001	Tench	0.00
Pike	0.00	Tench	0.00	Hybrids	0.00	Stone loach	0.00
Tench	0.00	Hybrids	0.00	Barbel	0.00	Barbel	0.00

Table 5: Comparison of mean densities (nm^{-2}) for all species 1991-1995

Year	n	Mean Density	C.V.
1991*	36	3.07	-
1991*^	13	4.07	-
1992^^	37	4.38	137.18
1993	42	3.52	107.50
1994	42	13.03	148.29
1995	42	16.05	98.59

* Densities calculated in 1992 survey
^ Sites corresponding to those in 1992 and 1993 surveys
^^ Recalculated values
n = number of sites sampled

Table 7: Comparison of mean CPUE 1991-1995

Year	n	Mean CPUE	C.V.
1991*	36	470.40	114.40
1991*^	13	607.20	97.50
1992	37	861.92	107.52
1993	42	355.57	104.60
1994	42	1095.95	124.86
1995	42	1426.81	102.21

* Recalculated values (See KES 1993)
^ Sites corresponding to those in 1992 and 1993 surveys
n = number of sites sampled

Species ranked in descending order of % frequency and relative importance value 1991-1995

Table 6

%Frequency

1995	n=42	1994	n=42	1993	n=42	1992	n=37*	1991	n=13*
Roach	65.72	Roach	72.42	Roach	45.96	Roach	67.81	Roach	72.36
Gudgeon	17.19	Gudgeon	18.09	Gudgeon	27.31	Bleak	11.79	Gudgeon	10.83
Chub	7.76	Chub	2.53	Perch	7.75	Gudgeon	10.75	Bleak	6.70
Bleak	4.22	Bleak	2.36	Chub	7.39	Chub	4.06	Dace	3.93
Perch	1.56	Dace	1.82	Dace	6.38	Perch	2.58	Chub	3.51
Bream	1.06	Perch	1.43	Bleak	1.94	Dace	1.78	Perch	1.08
Dace	0.95	Minnow	0.45	Minnow	1.37	Hybrids	0.82	Bream	1.01
Ruffe	0.85	Ruffe	0.38	Bullhead	0.66	Bream	0.19	Stickleback	0.44
Minnow	0.48	Bullhead	0.20	Bream	0.54	Minnow	0.16	Bullhead	0.10
Stickleback	0.08	Bream	0.11	Ruffe	0.27	Stickleback	0.02	Ruffe	0.03
Bullhead	0.06	Barbel	0.08	Stickleback	0.25	Pike	0.02	Barbel	0.01
Stoneloach	0.03	Stickleback	0.06	Pike	0.12	Ruffe	0.01	Hybrids	0.00
Barbel	0.02	Stone loach	0.04	Tench	0.03	Bullhead	0.01	Minnow	0.00
Hybrids	0.02	Pike	0.03	Stone loach	0.03	Stone loach	0.00	Pike	0.00
Tench	0.00	Tench	0.00	Barbel	0.00	Barbel	0.00	Stone loach	0.00
Pike	0.00	Hybrids	0.00	Hybrids	0.00	Tench	0.00	Tench	0.00

Relative Importance Value

1995	n=42	1994	n=42	1993	n=42	1992	n=37*	1991	n=13*
Roach	165.73	Roach	162.90	Roach	143.58	Roach	157.00	Roach	172.36
Gudgeon	112.43	Gudgeon	106.19	Gudgeon	113.02	Bleak	95.57	Perch	101.08
Perch	101.56	Perch	82.38	Perch	100.61	Perch	94.47	Dace	88.54
Chub	91.10	Chub	76.34	Bleak	73.37	Gudgeon	83.72	Gudgeon	87.76
Bleak	87.56	Bleak	69.02	Chub	69.30	Chub	68.93	Bleak	68.24
Bream	51.07	Bullhead	59.73	Dace	46.86	Dace	39.62	Chub	65.05
Minnow	50.49	Dace	49.44	Bullhead	45.90	Hybrids	17.04	Stickleback	38.90
Dace	43.81	Minnow	36.17	Minnow	34.70	Bream	11.00	Bream	24.09
Ruffe	41.32	Ruffe	36.10	Pike	28.69	Pike	10.83	Bullhead	23.18
Bullhead	31.01	Pike	21.46	Stickleback	24.08	Minnow	8.27	Ruffe	7.72
Stickleback	19.13	Bream	19.16	Bream	17.21	Stickleback	8.13	Barbel	7.70
Stoneloach	16.69	Barbel	19.12	Ruffe	9.79	Bullhead	8.12	Hybrids	0.00
Barbel	2.38	Stickleback	16.73	Tench	4.79	Ruffe	5.42	Minnow	0.00
Hybrids	2.38	Stone loach	14.32	Stone loach	4.79	Barbel	0.00	Pike	0.00
Pike	0.00	Hybrids	0.00	Barbel	0.00	Stone loach	0.00	Stone loach	0.00
Tench	0.00	Tench	0.00	Hybrids	0.00	Tench	0.00	Tench	0.00

*Sites corresponding to 1993-1995 surveys
n=number of sub-sites sampled

b constants calculated for this and previous studies Table 9

Species	KES Survey (1995)	KES Survey (1994)	KES Survey (1993)	Williams (1965b)	Mathews (1971)
Bleak	2.99	2.76	2.93	3.60	3.25
Chub	3.11	2.85	2.86		
Dace	3.12	2.83	2.71	3.10	3.86
Gudgeon	2.97	3.15	2.99		3.05
Perch	3.07	2.97	2.94	3.14	
Roach	3.31	3.03	2.86	3.20	3.23

Biomass (gm^{-2}) calculated for all sites in 1995 with overall values for 1993, 1994 and 1995 Table 10

	Sub-sites 1995			Pooled-sites		
Species	Deep	Shallow	Macrophytes	1995	1994	1993
Roach	1.90	8.71	19.11	9.32	11.98	2.32
Gudgeon	8.53	9.05	4.09	7.02	4.68	0.56
Perch	0.40	0.32	1.07	0.55	0.78	1.12
Chub	1.12	0.48	0.38	0.72	0.25	0.17
Dace	0.11	0.52	0.14	0.25	0.24	0.14
Bleak	0.29	1.18	0.38	0.58	0.24	0.07
Bream	0.03	0.12	0.43	0.18	-	-
Total	12.37	20.38	25.61	18.63	18.14	4.38

- data not included in previous reports

Correlations of 1993-5 fish density and environmental variables

Table 17

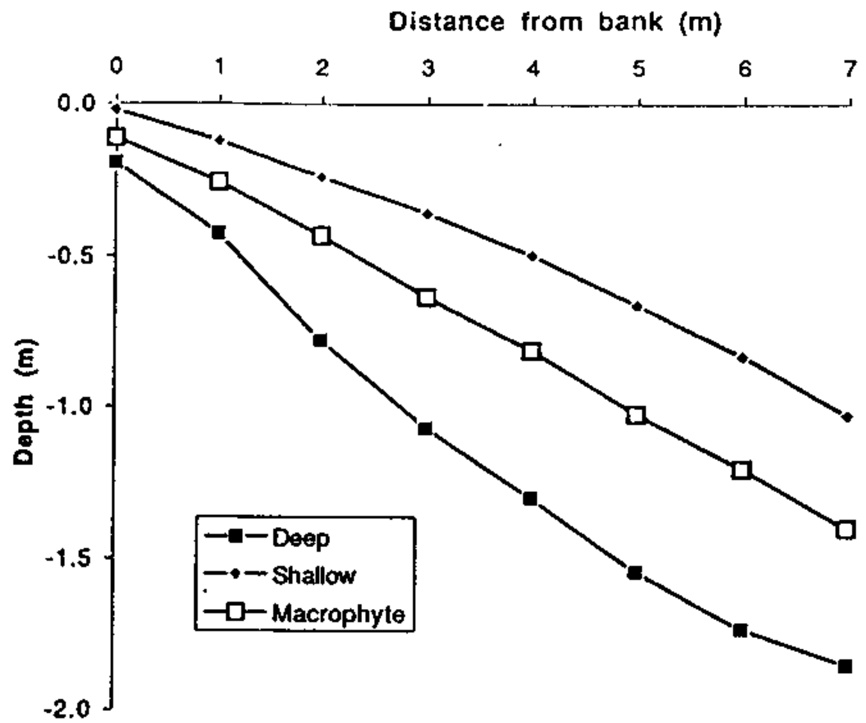
Species	r	p
Fish density v macrophyte cover		
Bream 0+	0.197	< 0.05
Gudgeon 2+	0.203	< 0.05
Perch 0+	0.344	< 0.001
Perch 1+	0.311	< 0.001
Pike 0+	0.373	< 0.001
Pike 1+	0.317	< 0.001
Roach 0+	0.449	< 0.001
Roach 1+	0.298	< 0.001
Roach 2+	0.372	< 0.001
Bullhead	0.457	< 0.001
Ruffe	0.273	< 0.01
Stone loach	0.316	< 0.001
Fish density v % clay		
Chub 0+	-0.246	< 0.01
Perch 1+	-0.203	< 0.05
Fish density v % silt		
Perch 0+	0.185	< 0.05
Stone loach	0.206	< 0.05
Fish density v % sand		
Chub 0+	0.273	< 0.01
Dace 0+	0.267	< 0.01
Barbel	0.232	< 0.05
Minnow	0.363	< 0.001
Stickleback	0.184	< 0.05
Fish density v % gravel		
Bleak 1+	0.237	< 0.001
Chub 1+	0.313	< 0.001
Fish density v depth		
Bleak 0+	-0.222	< 0.05
Chub 0+	-0.235	< 0.05
Gudgeon 1+	-0.229	< 0.05
Perch 0+	0.252	< 0.01
Perch 2+	0.194	< 0.05
Fish density v gradient		
Gudgeon 2+	0.194	< 0.05
Perch 0+	0.249	< 0.01

$p>0.05$	Not significant
$p<0.05$	Significant
$p<0.01$	Highly significant
$p<0.001$	Very highly significant

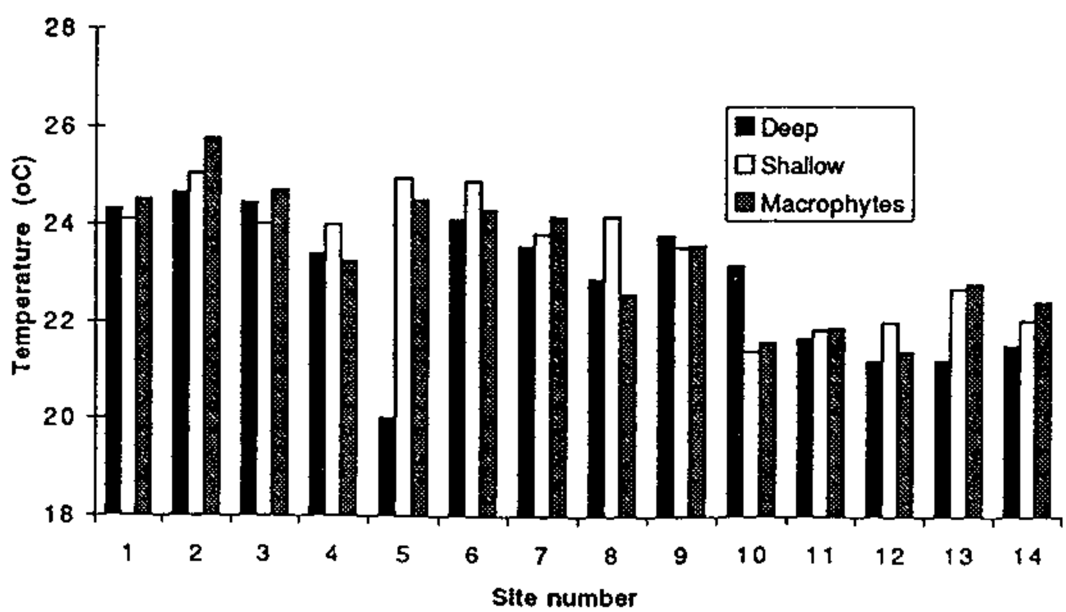
Estimated physical habitat preferences of 6 major fish species Table 19
(adapted from Bullock *et al.* 1991)

Modal value	Velocity (m/s)	Depth (m)
Species		
Bream		
Spawning	0.00-0.10	0.50-1.00
Fry	0.00-0.05	0.05-0.50
Juveniles	0.00-0.10	0.50-3.00
Adults	0.00-0.10	1.70-3.00
Chub		
Spawning	0.25-0.90	0.40-1.70
Fry	0.05-0.30	0.50-0.90
Juveniles	0.30-0.70	0.50-1.60
Adults	0.20-0.60	0.50-1.60
Dace		
Spawning	0.55-1.00	0.20-0.80
Fry	0.05-0.25	0.10-0.30
Juveniles	0.15-0.35	0.30-0.70
Adults	0.20-0.70	0.50-1.00
Perch		
Spawning	0.00-0.30	0.30-1.50
Fry	0.00-0.10	0.10-0.50
Juveniles	0.00-0.30	0.20-0.80
Adults	0.00-0.40	0.30-2.50
Pike		
Spawning	0.00-0.10	0.20-0.80
Fry	0.00-0.10	0.20-0.90
Juveniles	0.00-0.20	0.10-0.70
Adults	0.00-0.20	0.40-2.90
Roach		
Spawning	0.40-0.80	0.30-3.00
Fry	0.00-0.20	0.25
Juveniles	0.00-0.40	1.00-3.00
Adults	0.00-0.40	1.00-3.00

Average depth profiles for shallow and deep sites (1995) Figure 2



Average temperature for sites 1-14 (1995) **Figure 3**

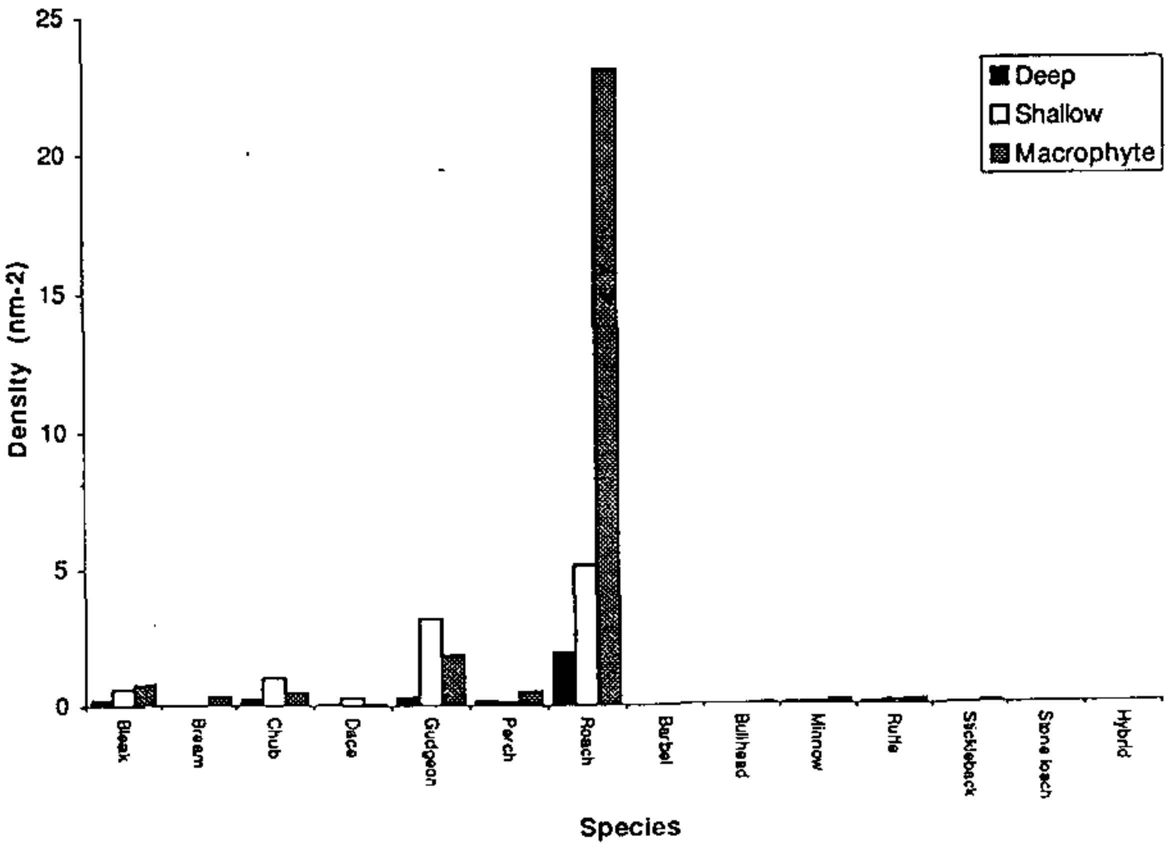


Mean density of 0+ and 1+ juveniles in each habitat type (1995) Figure 6

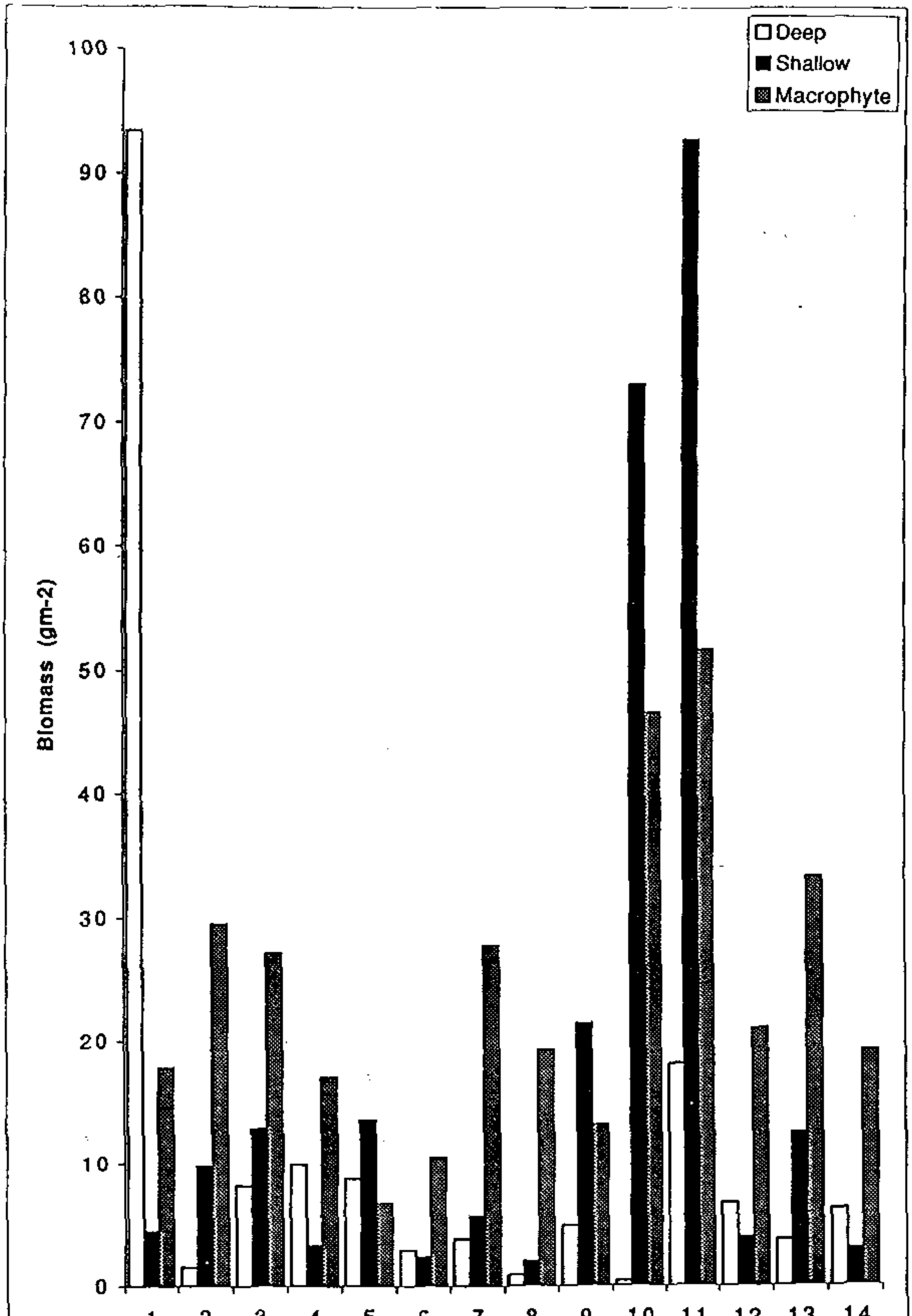
	Deep				Shallow				Macrophyte			
	0+	1+	>1+	Tot.	0+	1+	>1+	Tot.	0+	1+	>1+	Tot.
Bleak	0.220	0.067	0.005	0.292	0.614	0.320	0.072	1.006	0.765	0.136	0.000	0.902
Bream	0.003	0.008	0.000	0.011	0.003	0.027	0.003	0.033	0.341	0.133	0.004	0.477
Chub	0.234	0.204	0.000	0.438	1.027	0.040	0.000	1.067	0.468	0.051	0.000	0.519
Dace	0.046	0.008	0.000	0.054	0.279	0.045	0.000	0.325	0.059	0.014	0.000	0.073
Gudgeon	0.326	1.311	0.007	1.644	3.154	1.039	0.000	4.193	1.853	0.536	0.000	2.389
Perch	0.172	0.007	0.000	0.179	0.102	0.005	0.000	0.107	0.513	0.013	0.000	0.525
Roach	1.960	0.221	0.009	2.190	5.125	1.314	0.016	6.456	23.078	1.992	0.001	25.071
Barbel	0.000	0.003		0.000	0.001			0.001	0.000			0.000
Bullhead	0.003			0.003	0.005			0.005	0.022			0.022
Minnow	0.013			0.013	0.052			0.052	0.175			0.175
Ruffe	0.041			0.041	0.141			0.141	0.175			0.175
Stickleback	0.003			0.003	0.003			0.003	0.036			0.036
Stone loach	0.000			0.000	0.009			0.009	0.004			0.004
Hybrid	0.000			0.000	0.000			0.000	0.001			0.001
Total				4.868				13.399				30.368

1+ Juveniles

0+ Juveniles

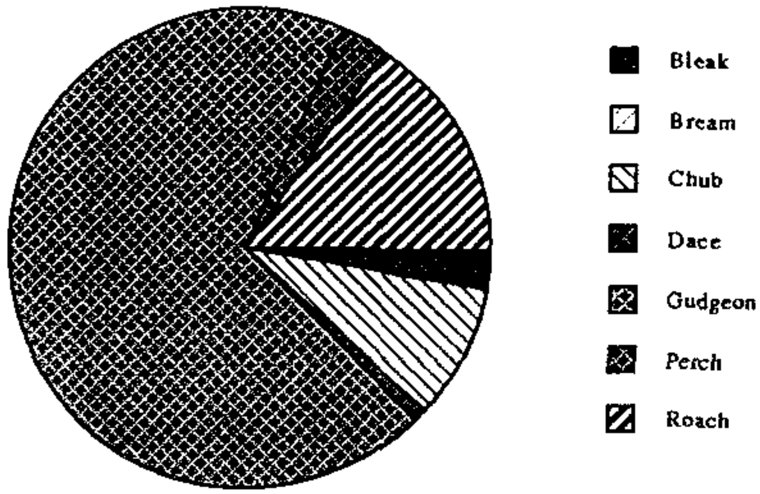


Calculated biomass at each site for major fish species (bleak, bream, chub, dace, gudgeon, perch, roach) Figure 8



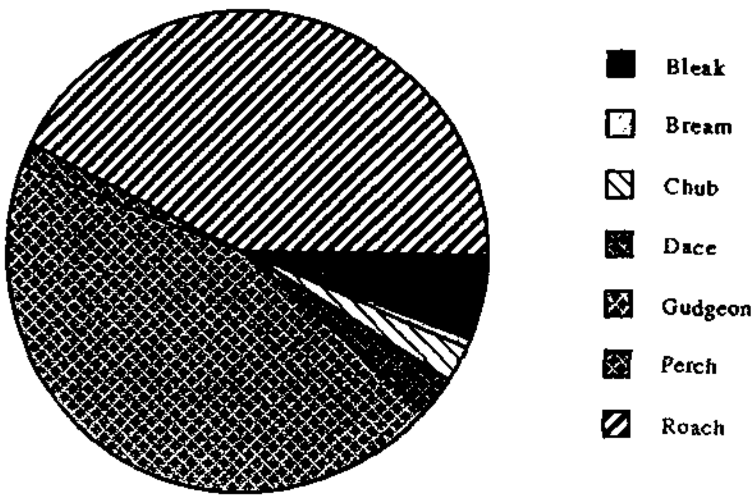
relative biomass of major fish species in each habitat (1995) Figure 9

Deep



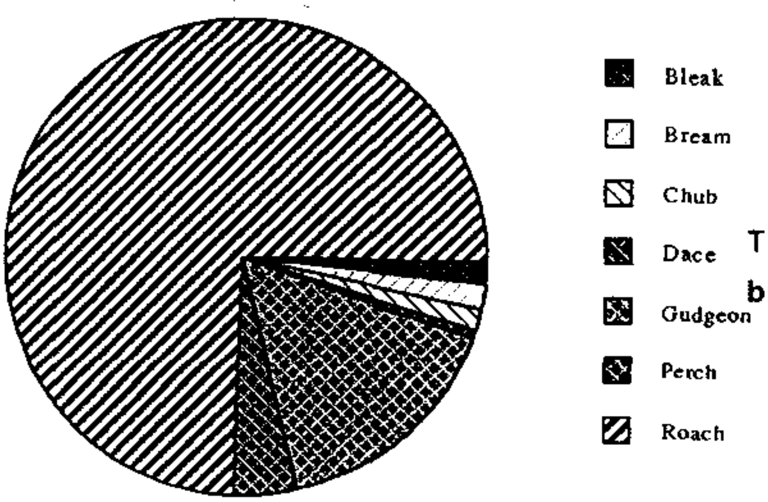
Total biomass = 12.37 gm^{-2}

Shallow



Total biomass = 20.38 gm^{-2}

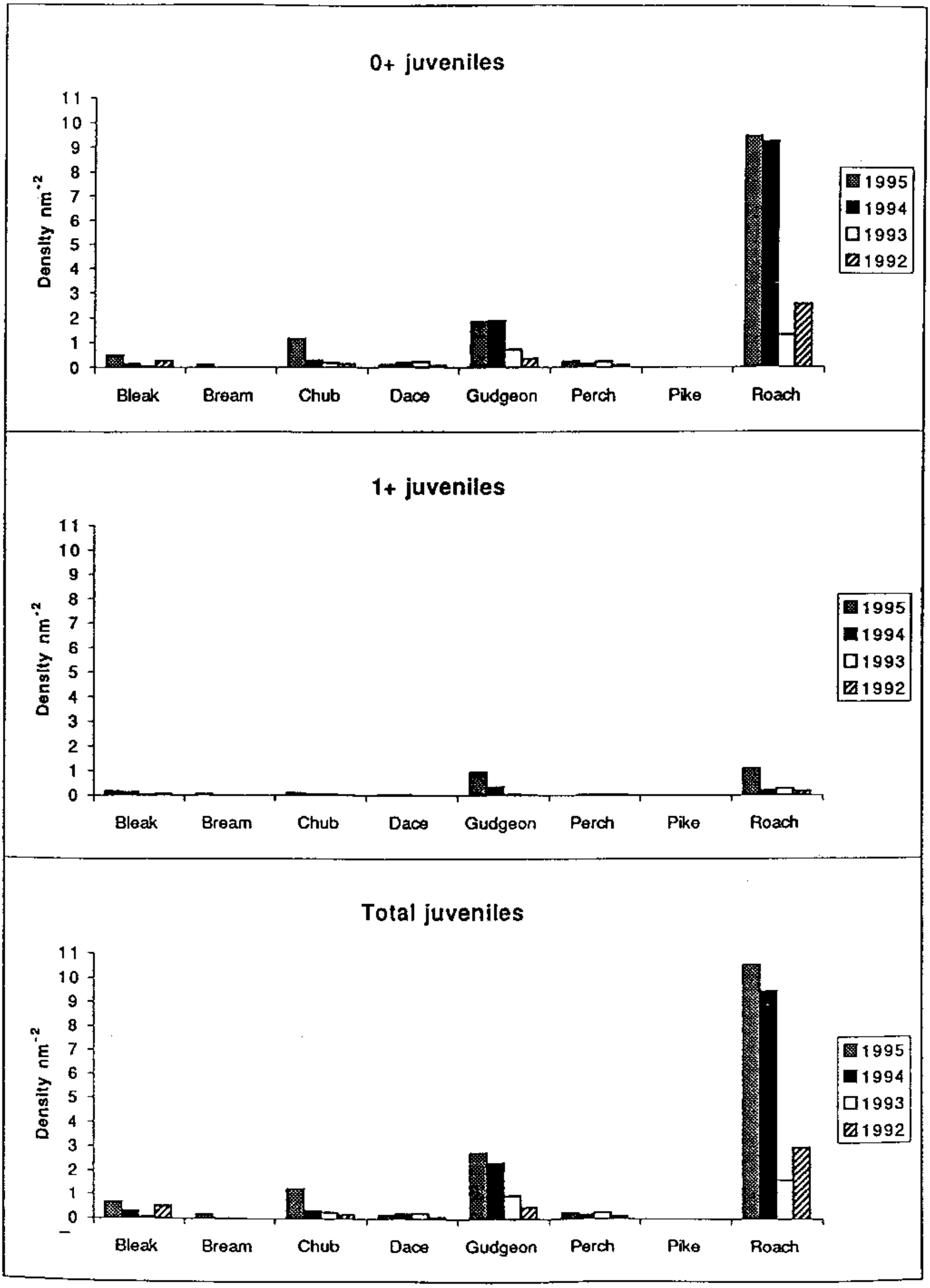
Macrophyte



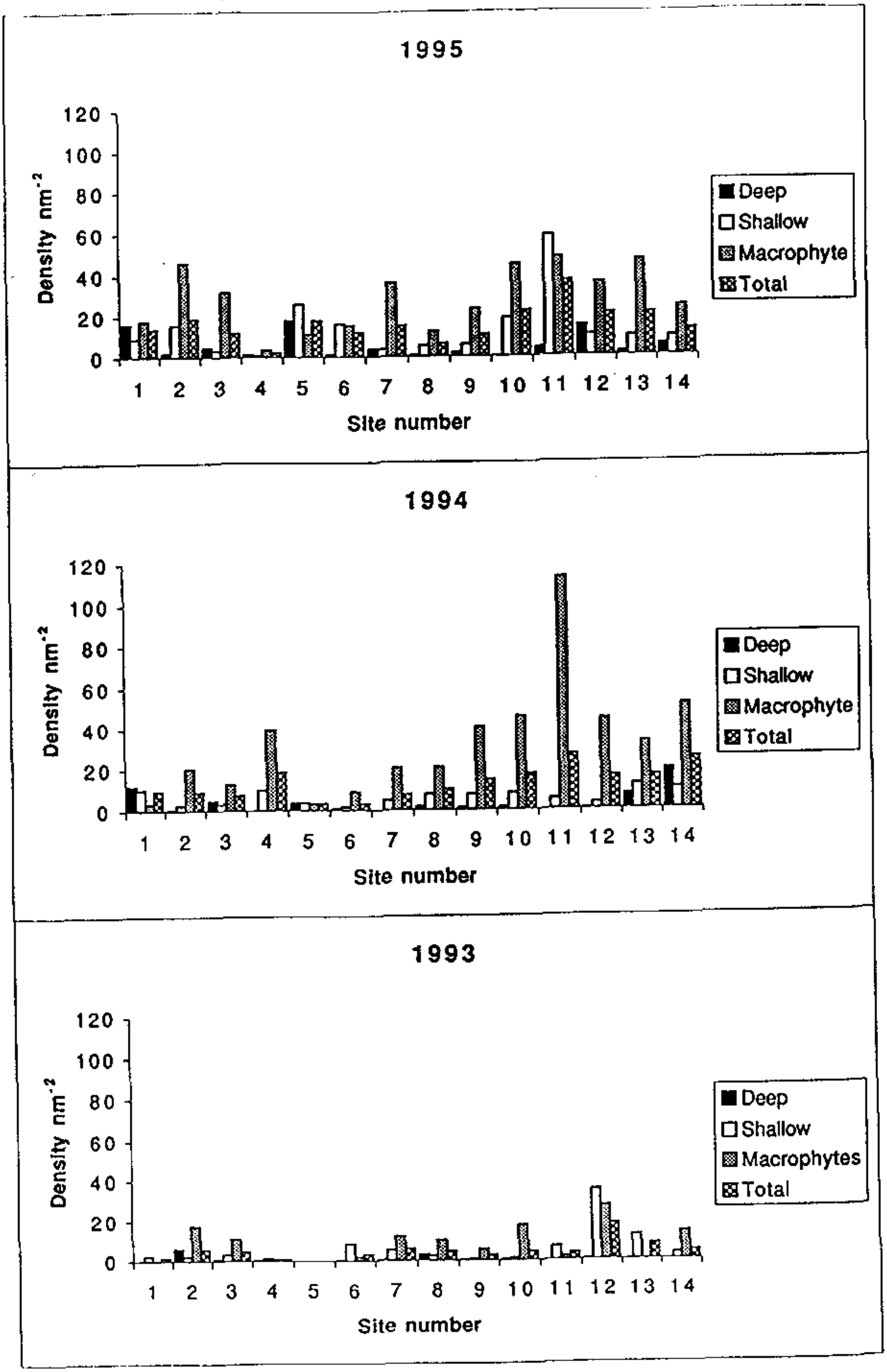
Total biomass = 25.61 gm^{-2}

Total mean biomass all sites = 18.63 gm^{-2}

Comparitive densities for major species from 1992-95 Figure 11



Comparitive densities for all species (1993-5) Figure 12



Institute of
Freshwater
Ecology

River Thames O Group Fish Gut Contents Study 1995

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RIVER THAMES 0 GROUP FISH GUT CONTENTS STUDY 1995

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November 1995

EXECUTIVE SUMMARY

This project on the diets of 0 group fish in the River Thames at Abingdon had four main objectives:

a) Assessment of the between-species, between-habitats and between-season changes in fish diets,
b) Comparison of the results from the River Thames with those of similar studies by IFE in the River Great Ouse,
c) Assessment of the likely effects of changes in the flow regime of the River Thames on the food sources of 0 group fish,
d) Recommendation for future studies that would increase the robustness of the results of the River Thames studies.

The diets were analyzed for five fish species: roach, gudgeon, chub, silver bream, perch. Although differences were observed between the diets of single species caught in different plant habitats, these were small compared with those observed between species. In general, the diet of each species changed from small prey (mostly rotifers) to larger items (mostly microcrustacea and insect larvae) as the fish grew in size. However, larger 0 group perch and gudgeon contained many copepods, whereas the other fish species contained more cladoceran taxa. The most striking difference between species was that, in July, the roach switched from an invertebrate diet to one dominated by detritus (aufwuchs) that accumulates on the underwater surfaces of plants.

The results from the River Thames show a close parallel with those of the same fish species in the River Great Ouse. This similarity adds weight to the reliability of the Thames results, even though they are based on small numbers of fish per sample. However, the Great Ouse data showed marked differences in the numbers and types of prey eaten in different years, which reflected changes in the abundance of these taxa in the river.

The Thames and Great Ouse studies highlight the importance of aquatic plants as feeding and refuge areas for young fish. Any major reduction in their areas, as could occur through large changes in the flow regime, would be detrimental to the growth of the young fish and to the numbers surviving to the adult stage.

Further studies to increase the reliability of the results from the River Thames are:

a) examination of more of the fish caught in the 1995 study,
b) collection of additional samples to determine the extent of year-to-year fluctuations.

For the greatest understanding of fish-prey dynamics, such studies should accompanied by assessments of prey availability (planktonic and non-planktonic invertebrates).

6. CONCLUSIONS

a) As they grew in size the 0 group fish progressed from a diet of small prey items to one that included larger prey taxa. In July, the roach switched from an invertebrate diet to one predominantly of detritus (aufwuchs). All the other species continued to feed on invertebrates.

b) Between-habitat differences in the diets of the same fish species could be explained by differences in the sizes of fish caught, or by the presence/absence of planktonic Cladocera (*Bosmina*). However, the results may have been affected by the ability of the larger 0 group fish to move between habitats.

c) Between-species differences in diets greatly exceeded those observed for the same species in different habitats. These partly reflected where the fish were feeding in the water column, e.g. gudgeon fed on the river bed, whereas roach fed much nearer the water surface. Moreover, as each species spawned and hatched at a different time, their 0 group fish were at different stages of development on any one sampling occasion.

d) The results closely parallel those obtained from IFE's studies in the Great Ouse. Both show the importance of aquatic plants as feeding and refuge areas for 0 group fish.

Table 7. 0 group roach: Chi-square analyses showing the statistical significance of differences in the contributions (numbers of animals) by each prey taxon. Ph = *Phragmites*, N = *Nuphar*, S = *Salix*, A = *Acorus*, Mix = Mixed reeds. Symbols refer to individual chi-square vales: = <3.0, + and o 3.0 - 15.0, ++ and oo >15.0; + values indicate higher than expected contribution, o values indicate lower than expected contribution; e/f = electrofishing.

	Ph	N seine	N e/f	S	A	Mix
6 June (chi-square = 18.01, 6 df)						
Rotifers	=	=	=			=
Chydoridae	=	=	=			+
Other taxa	o	=	=			=
20 June (chi-square = 555.1, 30 df)						
Rotifers	oo	++	=	=	o	=
Chydoridae	=	o	o	=	=	++
Bosmina	=	=	++	=	=	oo
Polyphemus	++	o	oo	=	+	oo
Other Cladocera	=	=	=	=	=	=
Chiron. l.	=	=	=	+	=	=
Other taxa	=	=	=	o	+	=
4 July (chi-square = 330.2, 15 df)						
Rotifers	o	=		+		=
Chydoridae	++	o		oo		++
Polyphemus	o	+		++		oo
Other Cladocera	o	=		o		++
Chiron. l.	=	=		o		++
Other taxa	=	=		=		++
25 July (chi-square = 374.0, 12 df)						
Chydoridae	=	oo	=		=	++
Other Cladocera	oo	++	=		oo	oo
Other taxa	+	o	=		=	++
Aufwuchs	++	oo	=		++	=
22 August (chi-square = 14.99, 3 df)						
All taxa	o	=			=	+
Aufwuchs	=	=			=	=
19 September (chi-square = 17.85, 4 df)						
All taxa	=	+	=	=		=
Aufwuchs	=	=	=	=		=

On 25 July comparisons between the same two sites revealed small but statistically significant differences (chi-square = 18.98, 6 df), with more chydorids and fewer copepods being found in fish from the *Salix* site, and the reverse at the *Nuphar* site. Nevertheless, the diets were very similar, with considerable overlap.

4.2.4 Chub

Table 9. 0 group chub: Chi-square analyses showing the statistical significance of differences in the contributions (number of animals) by each prey taxon. Key to symbols given in Table 7.

Habitat	*Salix*	Mixed	*Nuphar*
20 June (chi-square = 67.22, 6df)			
Rotifers	+	o	=
Chydoridae	oo	++	+
Other Cladocera	=	=	=
Other taxa	=	=	=

	Salix	Mixed	*Nuphar*	*Acorus*
4 July (chi-square = 1229.34, 15df)				
Rotifers	+	oo	oo	++
Chydoridae	=	++	o	oo
Polyphemus	oo	oo	++	oo
Other Cladocera	=	+	=	o
Chiron. l.	=	+	=	o
Other taxa	=	+	+	oo

	Mixed	d/s *Acorus*	*Nuphar*
25 July (chi-square = 85.02, 10df)			
Chydoridae	o	=	+
Other Cladocera	=	++	o
Copepoda	=	=	=
Chiron. l.	++	=	o
Terrestrial prey	=	=	=
Other taxa	=	=	=

In the 4 July sample, the number of *Polyphemus* eaten increased with the length of chub (Figure 2), the data giving the following linear relationship:

Number of *Polyphemus* = 5.113 (SLmm) - 52.57 $\quad r^2 = 0.68$

4.3 Comparisons between fish species

The following tables (11A-11Q)show the percentage number of prey items of various taxa that were eaten by different fish species caught at the same sites on the same sampling occasions.

Table 11. Comparison of prey taken by different fish species caught in the same habitat. Values are the percentage numbers of animals in each prey taxon, the highest contributions (>20%) being indicated in bold type. Aufwuchs values (index scale 0-3) are the means for each sample.

11(A) 6 June: *Nuphar* (combined seine and electro-fished samples)

	Roach	Gudgeon	Perch
No. of fish	29	10	20
No. of prey items	999	132	273
Rotifers	**93.50**		
Chydoridae	4.90	**90.91**	**31.50**
Polyphemus		6.06	10.62
Other Cladocera	1.17		3.66
Copepoda		2.27	**49.45**
Chiron. l.	0.43		4.03
Other taxa		0.76	0.73

11(B) 20 June: *Nuphar*

	Roach	Gudgeon	Chub
No. of fish	40	18	13
No. of prey items	892	214	235
Rotifers	**56.05**	3.27	**73.62**
Chydoridae	**21.52**	**76.17**	17.02
Polyphemus	5.38	0.47	1.70
Other Cladocera	14.01	0.47	5.11
Copepoda	1.23	13.55	0.43
Chiron. l.	0.67	2.34	1.70
Other taxa	1.12	3.74	0.43

11(C) 20 June: *Salix*

	Roach	Gudgeon
No. of fish	20	17
No. of prey items	382	124
Rotifers	**42.15**	
Chydoridae	**33.51**	**81.45**
Polyphemus	7.07	
Other Cladocera	13.61	
Copepoda	0.26	12.90
Chiron. l.	2.88	4.03
Other taxa	0.52	1.61

11(D) 20 June: Mixed reeds

	Roach	Chub
No. of fish	20	12
No. of prey items	404	121
Rotifers	**45.54**	**62.81**
Chydoridae	**47.52**	**31.41**
Polyphemus	0.50	
Other Cladocera	1.24	3.31
Copepoda	1.24	1.65
Chiron. l.	1.24	
Other taxa	2.72	0.83

11(E) 20 June: *Acorus*

	Roach	Silver Bream
No. of fish	20	19
No. of prey items	308	226
Rotifers	**36.69**	**98.23**
Chydoridae	**29.87**	1.33
Polyphemus	12.66	
Other Cladocera	14.94	
Copepoda.	2.60	0.44
Chiron. l.	0.32	
Other taxa	2.92	

11(F) 4 July: *Nuphar*

	Roach	Chub	Perch
No. of fish	20	20	20
No. of prey items	564	564	413
Rotifers	2.13	**31.38**	
Chydoridae	**22.52**	8.16	11.38
Polyphemus	**65.60**	**50.18**	10.41
Other Cladocera	6.91	1.77	**61.50**
Copepoda	0.18	6.56	12.59
Chiron. l.	2.48	1.60	2.91
Other taxa	0.18	0.35	1.21

11(G) 4 July: *Phragmites*

	Roach	Silver Bream
No. of fish	6	20
No. of prey items	131	361
Rotifers		**57.89**
Chydoridae	**57.25**	**29.09**
Polyphemus	**35.11**	10.80
Other Cladocera	3.05	2.21
Chiron. l.	4.58	

11(H) 4 July: Mixed reeds

	Roach	Chub	
No. of fish	20	15	
No. of prey items	235	180	
Rotifers	3.40	13.33	
Chydoridae	**45.53**	**65.00**	
Polyphemus	**20.85**	6.67	
Other Cladocera	15.74a	2.78	a = *Sida*
Copepoda	0.85	1.11	
Chiron. l.	10.21	3.33	
Other taxa	3.40	7.78	

11(I) 4 July: *Acorus*

	Chub	Silver Bream
No. of fish	15	15
No. of prey items	612	107
Rotifers	**96.73**	18.69
Chydoridae	3.10	**50.46**
Polyphemus		**30.84**
Chiron. l.	0.16	

11(J) 4 July: *Salix*

	Roach	Gudgeon	Chub	Silver Bream
No. of fish	16	7	20	11
No. of prey items	363	132	338	150
Rotifers	4.68		75.44	**82.67**
Chydoridae	9.09	**78.03**	10.36	5.33
Polyphemus	**80.99**	6.82	9.47	2.00
Other Cladocera	4.13	3.79	0.89	10.00
Copepoda		3.79	2.89	
Chiron. l.	0.55	4.55	0.89	
Other taxa	0.55	3.03		

11(K) 25 July: *Nuphar*

	Roach	Gudgeon	Chub	Perch
No. of fish	37	15	15	19
No. of prey items	322	186	170	681
Chydoridae	6.83	**33.33**	**44.12**	4.11
Sida	2.80		1.76	16.89
Daphnidae		5.91	0.59	**47.13**
Other Cladocera	**86.96a**		9.41	3.52
Copepoda		**34.41**	11.18	**20.70**
Chiron. l.	1.86	7.52	0.59	2.06
Large crustacea				2.64
Other taxa	1.55	18.82b	32.35c	2.94
Aufwuchs (index)	**2.54**			

a = *Bosmina* b = Ostracoda c = Terrestrial insects

11(L) 25 July: *Phragmites*

	Roach	Silver Bream	
No. of fish	20	20	
No. of prey items	24	303	
Rotifers	**33.00**		
Chydoridae	**20.83**	18.81	
Other Cladocera	**33.33a**	**24.09a**	a = mostly *Bosmina*
Copepoda	**20.83**	11.22	
Chiron. l.	12.50	11.55	
Other taxa	12.50	1.32	
Aufwuchs (index)	2.65	0.30	

11(M) 25 July: Mixed reeds

	Roach	Chub	
No. of fish	20	15	
No. of prey items	36	161	
Chydoridae	**55.56**	**22.36**	
Other Cladocera	11.11	16.15	a = mostly Ostracoda
Copepoda		19.25	
Chiron. l.	6.94	16.15	b = mostly terrestrial insects
Other taxa	**26.94a**	**26.09b**	
Aufwuchs (index)	**1.80**		

11(N) 25 July: *Salix*

	Gudgeon	Chub	
No. of fish	15	5	
No. of prey items	121	43	
Chydoridae	**52.89**	**34.88**	
Other Cladocera	4.13	18.60	a = mostly Ostracoda & Naidae
Copepoda	15.70	**20.93**	
Chiron. l.	5.79	6.98	b = mostly Naidae
Other taxa	21.49a	18.60b	

11(O) 22 August: Downstream of *Acorus* site

	Roach	Perch
No. of fish	20	15
No. of prey items	15	791
Chydoridae	13.33	8.85
Sida		7.46
Daphnidae		3.29
Other Cladocera	6.67	0.76
Copepoda		**54.11**
Chiron. l.	**46.67**	14.16
Ostracoda	**26.67**	3.54
Larger crustacea		4.42
Other taxa	6.67	3.41
Aufwuchs (index)	**2.65**	

11(P) 19 September: *Nuphar*

	Roach	Perch	Silver Bream
No. of fish	34	14	15
No. of prey items	16	557	35
Chydoridae	**37.50**	13.64	**68.57**
Sida	6.25	2.69	
Other Cladocera		0.18	8.57
Copepoda	6.25	66.43	
Chiron. l.	6.25	5.03	
Ostracoda	**31.25**	2.87	**22.86**
Larger crustacea	6.25	2.87	
Other taxa	6.25	6.28	
Aufwuchs (index)	**1.47**		**1.00**

11(Q) 19 September: Upstream of the *Salix* site

	Roach	Silver Bream
No. of fish	22	16
No. of prey items	33	417
Rotifers	1.44	
Chydoridae	**48.48**	3.12
Bosmina		**88.73**
Copepoda	3.03	3.36
Chiron. l.	6.06	0.24
Ostracoda	**36.36**	2.88
Other taxa	6.06	0.24
Aufwuchs (index)	**1.06**	0.19

4.4 Seasonal variations

Information on the seasonal variation in fish diets is presented as the mean number of each prey type per fish. This was found to be a useful measure in similar studies on the River Great Ouse, in which marked differences in prey intake were observed in different years (Mann *et al.*, 1996).

Table 12. Mean numbers of animals per gut; aufwuchs given as the mean index, scale 0 - 3.

12(A) Roach: *Phragmites*

	23/5	6/6	20/6	4/7	25/7	22/8	19/9
No. of fish	20	17	20	6	20	21	17
Mean SL (mm)	6.6	8.8	14.8	20.6	28.8	37.8	38.4
Rotifers	4.95	24.41	5.75				
Chydoridae		1.06	6.10	12.50	0.25	0.05	0.35
Bosmina			3.25				
Polyphemus			6.45	7.67			0.06
Other Cladocera			0.05	0.67	0.40		0.06
Chiron. l.			0.30	1.00			
Other taxa		0.06	0.40		0.50	0.19	0.35
Aufwuchs (index)					2.65	2.19	1.88

12(B) Roach: Mixed reeds

	23/5	6/6	20/6	4/7	25/7	22/8	19/9
No. of fish	10	20	20	20	20	20	20
Mean SL (mm)	6.7	9.8	12.9	21.5	30.6	36.6	39.9
Rotifers	6.65	20.10	9.20	0.40			
Chydoridae		1.90	9.60	5.35	2.00	0.35	
Bosmina			0.10	0.05	0.30		
Polyphemus			0.10	2.45			
Other Cladocera			0.15	1.80	0.10		
Chiron. l.		0.30	0.25	1.20		0.15	
Other taxa	0.10		0.80	0.40	1.20	0.45	0.20
Aufwuchs (index)					1.80	1.25	1.90

12(C) Roach: *Nuphar* (combined seine and electro-fished samples)

	23/5	6/6	20/6	4/7	25/7	22/8	19/9
No. of fish	20	29	40	20	37	27	34
Mean SL (mm)	6.9	10.6	15.3	21.8	30.1	38.4	40.1
Rotifers	15.75	30.28	12.50	0.60			
Chydoridae		1.59	4.80	6.35	0.62	0.37	0.18
Bosmina		0.31	3.10	0.25	1.84	0.04	
Polyphemus			1.20	18.50			
Other Cladocera		0.07	0.03	1.70	0.27		0.03
Chiron. l.		0.14	0.15	0.70	0.24	0.07	0.03
Other taxa			0.53	0.10	0.35	0.22	0.24
Aufwuchs (index)					2.68	2.78	1.47

12(D) Gudgeon: All sites combined

	23/5	6/6	20/6	4/7	25/7	22/8	19/9
No. of fish	0	29	39	9	30	0	0
Mean SL (mm)		11.4	12.5	19.9	16.8		
Rotifers			0.23				
Chydoridae		10.21	6.90	13.33	4.20		
Polyphemus		0.59	0.03	1.11			
Other Cladocera			0.03	0.44	0.53		
Copepoda		0.48	1.21	1.00	2.77		
Chiron. l.		0.03	0.33	0.67	0.70		
Ostracoda			0.21	0.33	1.07		
Other taxa		0.03	0.05	0.23	0.97		

12(E) Chub: All sites combined

	23/5	6/6	20/6	4/7	25/7	22/8	19/9
No. of fish	0	0	44	70	50	15	0
Mean SL (mm)			10.5	11.9	15.1	12.9	
Rotifers			15.48	14.97	0.02	0.47	
Chydoridae			2.48	3.10	3.44	2.80	
Polyphemus			0.43	4.67			
Other Cladocera			0.61	0.26	1.84a	7.93b	
Copepoda			0.07	0.70	1.62	1.87	
Chiron. l			0.14	0.27	0.70	0.87	
Other taxa			0.09	0.24	2.00c	1.40d	

a = mostly *Bosmina*, b = mostly *Scapholeberis*, c = terrestrial insects, d = terrestrial insects & Ostracoda.

12(F) Silver Bream: All sites combined

	23/5	6/6	20/6	4/7	25/7	22/8	19/9
No. of fish	0	0	19	46	20	0	31
Mean SL (mm)			7.2	9.3	13.1		29.2
Rotifers			11.68	7.67	5.00		0.19
Chydoridae			0.16	3.63	2.85		1.19
Polyphemus				1.63			
Other Cladocera				0.50	3.65a		12.03a
Copepoda			0.05		1.70		0.52
Chiron. l.					1.75		0.03
Other taxa					0.45		0.67
Aufwuchs (index)							0.58

a = mostly *Bosmina*

12(G) Perch: All sites combined

	23/5	6/6	20/6	4/7	25/7	22/8	19/9
No. of fish	0	20	4	20	19	15	29
Mean SL (mm)		13.4	17.3	28.5	44.2	54.9	60.2
Chydoridae		4.30	0.75	2.35	1.47	4.67	3.28
Polyphemus		1.45		2.15			
Daphnidae		0.15			16.89	1.73	0.03
Sida				12.70	6.05	4.21	0.55
Other Cladocera		0.35	2.50		1.26	0.40	
Copepoda		6.75	26.75	2.60	7.42	28.53	36.41
Chiron. l.		0.55	0.25	0.60	0.74	7.47	4.17
Ostracoda		0.10			0.05	1.87	0.86
Larger crustacea					0.95	2.33	1.41
Other taxa		0.15		0.25	1.00	1.80	1.21

APPENDIX 3.1 A full list of the samples held in the macro-invertebrate data-base together with their identifiers and principal environmental descriptors.

Reach ID	Reach name	Site ID	Site name	Subsidiary ID	Subsidiary code	Season ID	Sample ID	Sample date	Easting	Northing	Altitude	Slope	Disch cat	Dist from source	Water width	Average depth	%B/c	%P/g	%Sa	%S/c
TH10	St. Johns	38	A417 Buscot	WA/NRA/E	PUTR.0088	3	300	22/10/80	422500	198300	71	0.5	6	35						
TH10	St. Johns	38	A417 Buscot	WA/NRA/E	PUTR.0088	2	3500	10/07/87	422500	198300	71	0.5	6	35	20	160	0	70	0	30
TH10	St. Johns	127	Buscot	LR	BUS86	8	2					0.5	6							
TH10	St. Johns	127	Buscot	LR	BUS78	8	3					0.5	6							
TH10	St. Johns	127	Buscot	LR	BUS77	8	1					0.5	6							
TH10	St. Johns	127	Buscot	LR	40792	2	2	24/08/92				0.5	6							
TH10	St. Johns	127	Buscot	LR	28492	2	1	24/06/92				0.5	6							
TH10	St. Johns	127	Buscot	LR	15192	1	1	08/05/92				0.5	6							
TH10	St. Johns	143	Malthouse	FBA	69110102	2	7002	26/07/84	422500	198400	71	0.5	6	35	27	161	20	52	12	17
TH10	St. Johns	143	Malthouse	FBA	69110203	3	7006	17/10/84	422500	198400	71	0.5	6	35	27	161	20	52	12	17
TH10	St. Johns	143	Malthouse	FBA	69110101	1	7000	09/05/84	422500	198400	71	0.5	6	35	27	161	20	52	12	17
TH10	St. Johns	143	Malthouse	FBA	69110202	2	7004	26/07/84	422500	198400	71	0.5	6	35	27	161	20	52	12	17
TH10	St. Johns	143	Malthouse	FBA	69110201	1	7001	09/05/84	422500	198400	71	0.5	6	35	27	161	20	52	12	17
TH10	St. Johns	143	Malthouse	FBA	69110103	3	7005	17/10/84	422500	198400	71	0.5	6	35	27	161	20	52	12	17
TH10	St. Johns	31	St. Johns	FBA	FBA77_18	2	1	15/08/77				0.5	6							
TH10	St. Johns	31	St. Johns	FBA	FBA77_18	2	18	03/08/77				0.5	6							
TH10	St. Johns	39	Water Intake Buscot	WA/NRA/E	PUTR.0107	2	7800	05/09/90	422900	198100	72	0.5	6	36	15	75	1	54	10	35
TH10	St. Johns	39	Water Intake Buscot	WA/NRA/E	PUTR.0107	2	10400	13/07/92	422900	198100	72	0.5	6	36	15	150	0	50	15	35
TH10	St. Johns	39	Water Intake Buscot	WA/NRA/E	PUTR.0107	1	8700	08/04/91	422900	198100	72	0.5	6	36	15	75	1	54	10	35
TH10	St. Johns	39	Water Intake Buscot	WA/NRA/E	PUTR.0107	2	9400	05/08/91	422900	198100	72	0.5	6	36	15	75	1	54	10	35
TH10	St. Johns	39	Water Intake Buscot	WA/NRA/E	PUTR.0107	2	7200	13/07/90	422900	198100	72	0.5	6	36	15	75	1	54	10	35
TH10	St. Johns	39	Water Intake Buscot	WA/NRA/E	PUTR.0107	3	9800	14/11/91	422900	198100	72	0.5	6	36	15	150	0	50	15	35
TH10	St. Johns	39	Water Intake Buscot	WA/NRA/E	PUTR.0107	2	12100	09/08/94	422900	198100	72	0.5	6	36	15	150	0	50	15	35
TH10	St. Johns	39	Water Intake Buscot	WA/NRA/E	PUTR.0107	1	2100	03/02/87	422900	198100	72	0.5	6	36	10					
TH10	St. Johns	39	Water Intake Buscot	WA/NRA/E	PUTR.0107	1	11300	29/04/93	422900	198100	72	0.5	6	36	15	75	0	50	15	35
TH10	St. Johns	39	Water Intake Buscot	WA/NRA/E	PUTR.0107	1	13800	04/05/95	422900	198100	72	0.5	6	36	15	150	0	50	15	35
TH10	St. Johns	39	Water Intake Buscot	WA/NRA/E	PUTR.0107	3	16500	14/11/95	422900	198100	72	0.5	6	36	15	150	0	50	15	35
TH10	St. Johns	39	Water Intake Buscot	WA/NRA/E	PUTR.0107	3	6400	24/04/90	422900	198100	72	0.5	6	36	15	75	1	54	10	35
TH10	St. Johns	39	Water Intake Buscot	WA/NRA/E	PUTR.0107	1	5400	01/06/89	422900	198100	72	0.5	6	36	15	75	1	54	10	35
TH10	St. Johns	39	Water Intake Buscot	WA/NRA/E	PUTR.0107	2	4900	01/08/88	422900	198100	72	0.5	6	36	15	75	1	54	10	35
TH10	St. Johns	39	Water Intake Buscot	WA/NRA/E	PUTR.0107	3	10800	07/10/92	422900	198100	72	0.5	6	36	15	150	0	50	15	35
TH11	Buscot	37	Buscot	FBA	FBA77_19M7	2	2197	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19B7	2	3197	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19B2	2	3192	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19M8	2	2198	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19M6	2	2196	15/08/77				0.33	6							

TH11	Buscot	37	Buscot	FBA	FBA77_19M9	2	2199	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19B10	2	3190	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19B1	2	3191	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19B3	2	3193	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19B4	2	3194	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19B9	2	3199	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19B6	2	3196	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19B8	2	3198	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19M5	2	2195	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19M1	2	2191	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19B5	2	3195	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19V4	2	1194	15/08/77				0.33	6							
TH11	Buscot	30	Buscot	FBA	FBA77_17	2	17	03/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19V10	2	1190	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19V1	2	1191	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19M4	2	2194	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19V3	2	1193	15/08/77				0.33	6							
TH11	Buscot	30	Buscot	FBA	FBA77_17	2	2	16/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19V5	2	1195	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19V6	2	1196	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19V7	2	1197	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19V8	2	1198	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19V9	2	1199	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19M10	2	2190	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19M2	2	2192	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19M3	2	2193	15/08/77				0.33	6							
TH11	Buscot	37	Buscot	FBA	FBA77_19V2	2	1192	15/08/77				0.33	6							
TH12	Grafton	29	Grafton	FBA	FBA77_16	2	3	16/08/77				0.33	6							
TH12	Grafton	29	Grafton	FBA	FBA77_16	2	16	03/08/77				0.33	6							
TH13	Radcot	28	Radcot	FBA	FBA77_15	2	4	16/08/77				0.33	6							
TH13	Radcot	28	Radcot	FBA	FBA77_15	2	15	02/08/77				0.33	6							
TH14	Rushey	40	0.5km below Tadpole Bridg	WA/NRA/E	PUTR9993	2	14900	10/08/95	434000	200300	66	0.33	6	52	22	160	0	0	0	100
TH14	Rushey	27	Rushey	FBA	FBA77_14	2	5	16/08/77				0.33	6							
TH14	Rushey	27	Rushey	FBA	FBA77_14	2	14	02/08/77				0.33	6							
TH15	Shifford	41	Newbridge	WA/NRA/E	PUTR.0099	3	15400	02/10/95	440300	201400	63	0.33	6	60	22	160	0	0	0	100
TH15	Shifford	41	Newbridge	WA/NRA/E	PUTR.0099	1	14400	17/05/95	440300	201400	63	0.33	6	60	22	160	0	0	0	100
TH15	Shifford	41	Newbridge	WA/NRA/E	PUTR.0099	2	3600	10/07/87	440300	201400	63	0.33	6	60	22	160	0	0	0	100
TH15	Shifford	36	Shifford	FBA	FBA77_20B9	2	3209	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20M8	2	2208	22/08/77				0.33	6							

TH15	Shifford	36	Shifford	FBA	FBA77_20M9	2	2209	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20B10	2	3200	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20B1	2	3201	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20B3	2	3203	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20B5	2	3205	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20B6	2	3206	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20B8	2	3208	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20XV	2	4201	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20XV	2	4202	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20XV	2	4203	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20XV	2	4204	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20M7	2	2207	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20B2	2	3202	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20B7	2	3207	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20V5	2	1205	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20M6	2	2206	22/08/77				0.33	6							
TH15	Shifford	26	Shifford	FBA	FBA77_13	2	13	02/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20V10	2	1200	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20V1	2	1201	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20V2	2	1202	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20V4	2	1204	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20V6	2	1206	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20V7	2	1207	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20V8	2	1208	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20M3	2	2203	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20M5	2	2205	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20V3	2	1203	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20M4	2	2204	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20V9	2	1209	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20M2	2	2202	22/08/77				0.33	6							
TH15	Shifford	26	Shifford	FBA	FBA77_13	2	6	16/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20M1	2	2201	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20B4	2	3204	22/08/77				0.33	6							
TH15	Shifford	36	Shifford	FBA	FBA77_20M10	2	2200	22/08/77				0.33	6							
TH15	Shifford	42	US Newbridge	WA/NRA/E	PUTR.9992	2	15000	10/08/95	438300	201610	64	0.33	6	58	22	160	0	0	0	100
TH16	Northmoor	144	Bablock Hythe	FBA	69130101	1	7007	09/05/84	443500	204200	62	0.33	7	66	33	183	2	58	7	33
TH16	Northmoor	144	Bablock Hythe	FBA	69130201	1	7008	09/05/84	443500	204200	62	0.33	7	66	33	183	2	58	7	33
TH16	Northmoor	144	Bablock Hythe	FBA	69130203	3	7012	17/10/84	443500	204200	62	0.33	7	66	33	183	2	58	7	33
TH16	Northmoor	144	Bablock Hythe	FBA	69130103	3	7011	17/10/84	443500	204200	62	0.33	7	66	33	183	2	58	7	33

TH16	Northmoor	144	Bablock Hythe	FBA	69130102	2	7009	26/07/84	443500	204200	62	0.33	7	66	33	183	2	58	7	33
TH16	Northmoor	144	Bablock Hythe	FBA	69130202	2	7010	26/07/84	443500	204200	62	0.33	7	66	33	183	2	58	7	33
TH16	Northmoor	131	Newbridge	LR	28592	2	2	24/06/92				0.33	7							
TH16	Northmoor	131	Newbridge	LR	15292	1	1	08/05/92				0.33	7							
TH16	Northmoor	131	Newbridge	LR	13694	1	2	12/05/94				0.33	7							
TH16	Northmoor	131	Newbridge	LR	40892	2	1	24/08/92				0.33	7							
TH16	Northmoor	131	Newbridge	LR	NB78	8	3					0.33	7							
TH16	Northmoor	131	Newbridge	LR	NB77	8	2					0.33	7							
TH16	Northmoor	131	Newbridge	LR	NB86	8	1					0.33	7							
TH16	Northmoor	131	Newbridge	LR	30294	3	1	12/09/94				0.33	7							
TH16	Northmoor	131	Newbridge	LR	14094	2	3	13/06/94				0.33	7							
TH16	Northmoor	25	Northmoor	FBA	FBA77_12	2	7	23/08/77				0.33	7							
TH16	Northmoor	25	Northmoor	FBA	FBA77_12	2	12	01/08/77				0.33	7							
TH17	Pinkhill	24	Pinkhill	FBA	FBA77_11	2	8	23/08/77				0.33	7							
TH17	Pinkhill	24	Pinkhill	FBA	FBA77_11	2	11	01/08/77				0.33	7							
TH17	Pinkhill	130	Swinford	LR	SW77	8	1					0.33	7							
TH17	Pinkhill	130	Swinford	LR	14194	2	3	13/06/94				0.33	7							
TH17	Pinkhill	130	Swinford	LR	SW86	8	2					0.33	7							
TH17	Pinkhill	130	Swinford	LR	30394	3	1	12/09/94				0.33	7							
TH17	Pinkhill	130	Swinford	LR	28692	2	1	24/06/92				0.33	7							
TH17	Pinkhill	130	Swinford	LR	15392	1	3	08/05/92				0.33	7							
TH17	Pinkhill	130	Swinford	LR	13794	1	1	12/05/94				0.33	7							
TH17	Pinkhill	130	Swinford	LR	40992	2	2	24/08/92				0.33	7							
TH17	Pinkhill	130	Swinford	LR	SW78	8	3					0.33	7							
TH18	Eynsham	118	DS Swinford WTW	RPS	OSP.01	2	5000	30/06/92	444900	208800	62	0.33	7	71	15	200	0	0	0	100
TH18	Eynsham	35	Eynsham	FBA	FBA77_21B5	2	3215	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21M6	2	2216	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21M7	2	2217	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21M8	2	2218	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21M9	2	2219	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21B10	2	3210	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21B1	2	3211	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21B2	2	3212	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21B4	2	3214	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21B6	2	3216	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21B7	2	3217	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21B8	2	3218	24/08/77				0.33	7							
TH18	Eynsham	23	Eynsham	FBA	FBA77_10	2	10	01/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21B9	2	3219	24/08/77				0.33	7							

TH18	Eynsham	35	Eynsham	FBA	FBA77_21M5	2	2215	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21B3	2	3213	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21V5	2	1215	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21M4	2	2214	24/08/77				0.33	7							
TH18	Eynsham	23	Eynsham	FBA	FBA77_10	2	9	23/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21V10	2	1210	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21V2	2	1212	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21V1	2	1211	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21V4	2	1214	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21V6	2	1216	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21V7	2	1217	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21V8	2	1218	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21V9	2	1219	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21M10	2	2210	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21M1	2	2211	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21M2	2	2212	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21M3	2	2213	24/08/77				0.33	7							
TH18	Eynsham	35	Eynsham	FBA	FBA77_21V3	2	1213	24/08/77				0.33	7							
TH18	Eynsham	43	Water Intake, Swinford	WA/NRA/E	PTHR.0114	2	3900	24/07/87	444500	208800	62	0.33	7	70	26	200	0	20	50	30
TH18	Eynsham	43	Water Intake, Swinford	WA/NRA/E	PTHR.0114	3	15500	09/10/95	444500	208800	62	0.33	7	70	26	200	1	4	30	65
TH18	Eynsham	43	Water Intake, Swinford	WA/NRA/E	PTHR.0114	1	13200	10/04/95	444500	208800	62	0.33	7	70	26	200	5	65	20	10
TH18	Eynsham	43	Water Intake, Swinford	WA/NRA/E	PTHR.0114	2	4800	15/06/88	444500	208800	62	0.33	7	70	26	200	5	65	20	10
TH18	Eynsham	43	Water Intake, Swinford	WA/NRA/E	PTHR.0114	1	2200	17/02/87	444500	208800	62	0.33	7	70	30	200				
TH18	Eynsham	43	Water Intake, Swinford	WA/NRA/E	PTHR.0114	3	400	06/11/80	444500	208800	62	0.33	7	70						
TH18	Eynsham	43	Water Intake, Swinford	WA/NRA/E	PTHR.0114	3	6100	10/10/89	444500	208800	62	0.33	7	70	26	200	5	65	20	10
TH19	King's	22	King's	FBA	FBA77_9	2	9	25/08/77				0.45	7							
TH19	King's	22	King's	FBA	FBA77_9	2	10	25/08/77				0.45	7							
TH19	King's	44	Trout Inn, Godstow	WA/NRA/E	PTHR.0110	2	10500	28/07/92	448300	209200	59	0.45	7	74	25	220	10	60	10	20
TH19	King's	44	Trout Inn, Godstow	WA/NRA/E	PTHR.0110	3	800	01/12/80	448300	209200	59	0.45	7	74						
TH19	King's	44	Trout Inn, Godstow	WA/NRA/E	PTHR.0110	1	6500	30/04/90	448300	209200	59	0.45	7	74	25	220	10	60	10	20
TH19	King's	44	Trout Inn, Godstow	WA/NRA/E	PTHR.0110	2	7600	09/08/90	448300	209200	59	0.45	7	74	25	220	0	65	25	10
TH19	King's	44	Trout Inn, Godstow	WA/NRA/E	PTHR.0110	3	8000	08/10/90	448300	209200	59	0.45	7	74	25	220	10	60	10	20
TH19	King's	44	Trout Inn, Godstow	WA/NRA/E	PTHR.0110	1	8600	08/04/91	448300	209200	59	0.45	7	74	25	220	10	60	10	20
TH19	King's	44	Trout Inn, Godstow	WA/NRA/E	PTHR.0110	2	9100	03/07/91	448300	209200	59	0.45	7	74	25	220	10	60	10	20
TH19	King's	44	Trout Inn, Godstow	WA/NRA/E	PTHR.0110	2	9500	19/09/91	448300	209200	59	0.45	7	74	25	220	10	60	10	20
TH19	King's	44	Trout Inn, Godstow	WA/NRA/E	PTHR.0110	1	11200	24/02/93	448300	209200	59	0.45	7	74	25	220	10	60	10	20
TH19	King's	44	Trout Inn, Godstow	WA/NRA/E	PTHR.0110	1	10100	26/05/92	448300	209200	59	0.45	7	74	25	220	10	60	10	20
TH19	King's	44	Trout Inn, Godstow	WA/NRA/E	PTHR.0110	2	12000	28/07/94	448300	209200	59	0.45	7	74	25	220	10	60	10	20
TH19	King's	44	Trout Inn, Godstow	WA/NRA/E	PTHR.0110	1	13700	01/05/95	448300	209200	59	0.45	7	74	25	230	15	40	20	25

TH19	King's	44	Trout Inn, Godstow	WA/NRA/E	PTHR.0110	3	16100	30/10/95	448300	209200	59	0.45	7	74	25	230	15	40	20	25
TH19	King's	44	Trout Inn, Godstow	RPS	OSP.04	2	5002	30/06/92	448300	209200	59	0.45	7	74	40	220	1	33	33	33
TH19	King's	119	West Mead	RPS	OSP.02	2	5001	30/06/92	447100	210200	60	0.45	7	72	25	250	0	0	20	80
TH20	Godstow	121	Binsey	RPS	OSP.07	2	5003	30/06/92	449400	207800	58	0.45	7	77	40	250	10	20	40	30
TH20	Godstow	21	Godstow	FBA	FBA77_8	2	8	28/07/77				0.45	7							
TH20	Godstow	21	Godstow	FBA	FBA77_8	2	11	25/08/77				0.45	7							
TH21	Osney	46	Donnington Bridge, Oxford	WA/NRA/E	PTHR.0186	3	16800	02/11/95	452400	204500	55	0.45	8	82	28	200	5	30	35	30
TH21	Osney	46	Donnington Bridge, Oxford	WA/NRA/E	PTHR.0186	1	13100	10/04/95	452400	204500	55	0.45	8	82	38	210	5	45	35	15
TH21	Osney	122	DS Cherwell	RPS	OSP.13	2	5004	07/06/92	452100	204800	57	0.45	8	81	30	200	2	18	45	35
TH21	Osney	47	Folley Bridge, Oxford	WA/NRA/E	PTHR.0085	1	14500	23/05/95	451400	205500	57	0.45	8	80	51	230	2	60	13	25
TH21	Osney	47	Folley Bridge, Oxford	WA/NRA/E	PTHR.0085	3	16000	30/10/95	451400	205500	57	0.45	8	80	51	230	5	55	15	25
TH21	Osney	20	Osney	FBA	FBA77_7	2	12	30/08/77				0.45	8							
TH21	Osney	20	Osney	FBA	FBA77_7	2	7	28/07/77				0.45	8							
TH21	Osney	45	Osney Weir	WA/NRA/E	PTHR.0097	2	5800	28/06/89	450600	205600	58	0.45	7	79	22	190	50	40	10	0
TH21	Osney	45	Osney Weir	WA/NRA/E	PTHR.0097	1	2600	22/03/87	450600	205600	58	0.45	7	79	22	190	0	40	10	50
TH21	Osney	45	Osney Weir	WA/NRA/E	PTHR.0097	1	4500	13/06/88	450600	205600	58	0.45	7	79	8	25	15	80	5	0
TH22	Iffley	34	Iffley	FBA	FBA77_22B5	2	3225	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22M5	2	2225	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22M6	2	2226	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22M7	2	2227	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22M8	2	2228	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22M9	2	2229	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22B10	2	3220	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22B1	2	3221	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22B2	2	3222	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22B4	2	3224	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22B6	2	3226	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22B7	2	3227	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22B9	2	3229	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22M4	2	2224	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22B8	2	3228	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22B3	2	3223	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22V1	2	1221	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22M3	2	2223	30/08/77				0.45	8							
TH22	Iffley	19	Iffley	FBA	FBA77_6	2	6	28/07/77				0.45	8							
TH22	Iffley	19	Iffley	FBA	FBA77_6	2	13	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22V10	2	1220	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22V2	2	1222	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22V3	2	1223	30/08/77				0.45	8							

TH22	Iffley	34	Iffley	FBA	FBA77_22V4	2	1224	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22M1	2	2221	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22M2	2	2222	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22V5	2	1225	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22M10	2	2220	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22V9	2	1229	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22V8	2	1228	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22V7	2	1227	30/08/77				0.45	8							
TH22	Iffley	34	Iffley	FBA	FBA77_22V6	2	1226	30/08/77				0.45	8							
TH22	Iffley	48	Top of Sandford Lock Cut	WA/NRA/E	PTHR.0109	3	12700	08/11/94	452800	202100	54	0.45	8	85	55	280	5	55	30	10
TH22	Iffley	48	Top of Sandford Lock Cut	WA/NRA/E	PTHR.0109	1	8500	08/04/91	452800	202100	54	0.45	8	85	55	280	0	70	20	10
TH22	Iffley	48	Top of Sandford Lock Cut	PA	T14	2	1	09/07/92	452800	202100	54	0.45	8	85	60	150	0	40	50	10
TH22	Iffley	48	Top of Sandford Lock Cut	WA/NRA/E	PTHR.0109	1	11100	24/02/93	452800	202100	54	0.45	8	85	55	280	0	70	20	10
TH22	Iffley	48	Top of Sandford Lock Cut	WA/NRA/E	PTHR.0109	2	10700	11/08/92	452800	202100	54	0.45	8	85	55	280	0	70	20	10
TH22	Iffley	48	Top of Sandford Lock Cut	WA/NRA/E	PTHR.0109	1	10200	26/05/92	452800	202100	54	0.45	8	85	55	280	0	70	20	10
TH22	Iffley	48	Top of Sandford Lock Cut	WA/NRA/E	PTHR.0109	3	9700	30/10/91	452800	202100	54	0.45	8	85	55	280	0	70	20	10
TH22	Iffley	48	Top of Sandford Lock Cut	WA/NRA/E	PTHR.0109	2	9200	03/07/91	452800	202100	54	0.45	8	85	55	280	0	70	20	10
TH22	Iffley	48	Top of Sandford Lock Cut	RPS	OSP.15	2	5005	30/06/92	452800	202100	54	0.45	8	85	25	150	97	2	1	0
TH22	Iffley	48	Top of Sandford Lock Cut	WA/NRA/E	PTHR.0109	2	7700	20/08/90	452800	202100	54	0.45	8	85	55	280	0	70	20	10
TH22	Iffley	48	Top of Sandford Lock Cut	WA/NRA/E	PTHR.0109	1	6300	17/04/90	452800	202100	54	0.45	8	85	55	280	0	70	20	10
TH22	Iffley	48	Top of Sandford Lock Cut	WA/NRA/E	PTHR.0109	1	5700	08/05/89	452800	202100	54	0.45	8	85	55	280	0	70	20	10
TH22	Iffley	48	Top of Sandford Lock Cut	WA/NRA/E	PTHR.0109	1	4600	13/06/88	452800	202100	54	0.45	8	85	55	280	5	55	20	20
TH22	Iffley	48	Top of Sandford Lock Cut	WA/NRA/E	PTHR.0109	1	2500	22/03/87	452800	202100	54	0.45	8	85	55	280	0	30	10	60
TH22	Iffley	48	Top of Sandford Lock Cut	WA/NRA/E	PTHR.0109	1	1400	09/03/84	452800	202100	54	0.45	8	85						
TH22	Iffley	48	Top of Sandford Lock Cut	WA/NRA/E	PTHR.0109	1	1000	18/02/82	452800	202100	54	0.45	8	85						
TH22	Iffley	48	Top of Sandford Lock Cut	WA/NRA/E	PTHR.0109	3	7900	08/10/90	452800	202100	54	0.45	8	85	55	280	0	70	20	10
TH23	Sandford	49	Abingdon Weir	WA/NRA/E	PTHR.0077	3	11000	23/11/92	450400	197200	50	0.45	8	93	40	300	1	79	15	5
TH23	Sandford	49	Abingdon Weir	WA/NRA/E	PTHR.0077	3	16200	01/11/95	450400	197200	50	0.45	8	93	40	300	1	79	15	5
TH23	Sandford	49	Abingdon Weir	WA/NRA/E	PTHR.0077	1	14000	09/05/95	450400	197200	50	0.45	8	93	40	300	1	79	15	5
TH23	Sandford	49	Abingdon Weir	WA/NRA/E	PTHR.0077	1	11400	24/05/93	450400	197200	50	0.45	8	93	40	300	5	75	15	5
TH23	Sandford	49	Abingdon Weir	WA/NRA/E	PTHR.0077	1	6700	05/06/90	450400	197200	50	0.45	8	93	40	300	5	75	15	5
TH23	Sandford	49	Abingdon Weir	WA/NRA/E	PTHR.0077	1	5600	08/05/89	450400	197200	50	0.45	8	93	40	300	5	75	15	5
TH23	Sandford	49	Abingdon Weir	WA/NRA/E	PTHR.0077	1	4700	15/06/88	450400	197200	50	0.45	8	93	40	300	1	50	39	10
TH23	Sandford	49	Abingdon Weir	WA/NRA/E	PTHR.0077	1	1300	09/03/84	450400	197200	50	0.45	8	93						
TH23	Sandford	49	Abingdon Weir	WA/NRA/E	PTHR.0077	1	1200	26/01/83	450400	197200	50	0.45	8	93	30	80				
TH23	Sandford	49	Abingdon Weir	WA/NRA/E	PTHR.0077	1	1100	18/02/82	450400	197200	50	0.45	8	93						
TH23	Sandford	49	Abingdon Weir	WA/NRA/E	PTHR.0077	3	600	20/11/80	450400	197200	50	0.45	8	93						
TH23	Sandford	49	Abingdon Weir	PA	T10	2	1	28/07/92	450400	197200	50	0.45	8	93	75	150	0	5	85	10
TH23	Sandford	49	Abingdon Weir	WA/NRA/E	PTHR.0077	3	12400	19/10/94	450400	197200	50	0.45	8	93	40	300	1	79	15	5

TH23	Sandford	49	Abingdon Weir	WA/NRA/E	PTHR.0077	1	2400	12/03/87	450400	197200	50	0.45	8	93	40	300	1	50	39	10
TH23	Sandford	139	Near Lock Wood	PA	T11	2	1	28/07/92	452600	197000	50	0.45	8	91	50	150	10	60	24	1
TH23	Sandford	140	Radley	PA	T12	2	1	20/07/92	453800	199000	53	0.45	8	88	40	150	0	45	45	10
TH23	Sandford	124	Radley College Boathouse	RPS	OSP.16	2	5006	30/06/92	453800	198800	53	0.45	8	88	20	200	30	30	35	5
TH23	Sandford	50	Sandford	WA/NRA/E	PTHR.0099	1	1900	12/06/86	453000	201200	54	0.45	8	86	40	100				
TH23	Sandford	18	Sandford	FBA	FBA77_5	2	14	01/09/77				0.45	8							
TH23	Sandford	18	Sandford	FBA	FBA77_5	2	5	27/07/77				0.45	8							
TH23	Sandford	141	Sandford Reach	PA	T13	2	1	28/07/92	453300	200300	54	0.45	8	87	40	150	5	63	30	2
TH24	Abingdon	17	Abingdon	FBA	FBA77_4	2	4	27/07/77				0.26	8							
TH24	Abingdon	17	Abingdon	FBA	FBA77_4	2	15	01/09/77				0.26	8							
TH24	Abingdon	137	Culham Reach	PA	T7	2	1	20/07/92	450000	195500	50	0.26	8	96	55	150	10	60	25	5
TH24	Abingdon	136	Sutton Pools	PA	T6	2	1	03/08/92	450300	194500	50	0.26	8	99	40	150	0	50	25	25
TH25	Culham	135	Clifton Reach	PA	T5	2	1	28/07/92	452600	194200	49	0.26	8	102	45	150	5	50	40	5
TH25	Culham	16	Culham	FBA	FBA77_3	2	3	26/07/77				0.26	8							
TH25	Culham	16	Culham	FBA	FBA77_3	2	16	01/09/77				0.26	8							
TH25	Culham	134	Long Wittenham	PA	T4	2	1	03/08/92	454000	193700	49	0.26	8	103	35	150	0	5	75	20
TH25	Culham	52	Sutton Bridge, Culham	WA/NRA/E	PTHR.0105	2	3200	07/07/87	450900	194900	49	0.26	8	100	5	8	0	0	0	100
TH25	Culham	52	Sutton Bridge, Culham	WA/NRA/E	PTHR.0105	1	13300	10/04/95	450900	194900	49	0.26	8	100	38	190	5	40	40	15
TH25	Culham	52	Sutton Bridge, Culham	WA/NRA/E	PTHR.0105	3	16400	02/11/95	450900	194900	49	0.26	8	100	38	190	2	20	45	33
TH26	Clifton	33	Clifton	FBA	FBA77_23B4	2	3234	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23M5	2	2235	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23M6	2	2236	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23M8	2	2238	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23B10	2	3230	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23B1	2	3231	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23M4	2	2234	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23B3	2	3233	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23M7	2	2237	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23B5	2	3235	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23B6	2	3236	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23B7	2	3237	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23B8	2	3238	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23B9	2	3239	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23B2	2	3232	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23V3	2	1233	05/09/77				0.26	8							
TH26	Clifton	15	Clifton	FBA	FBA77_2	2	2	26/07/77				0.26	8							
TH26	Clifton	15	Clifton	FBA	FBA77_2	2	17	01/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23V10	2	1230	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23M9	2	2239	05/09/77				0.26	8							

TH26	Clifton	33	Clifton	FBA	FBA77_23V2	2	1232	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23M3	2	2233	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23V4	2	1234	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23V5	2	1235	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23M2	2	2232	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23V7	2	1237	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23V8	2	1238	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23V9	2	1239	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23M10	2	2230	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23M1	2	2231	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23V6	2	1236	05/09/77				0.26	8							
TH26	Clifton	33	Clifton	FBA	FBA77_23V1	2	1231	05/09/77				0.26	8							
TH26	Clifton	133	Clifton Bridge	PA	T3	2	1	03/08/92	454700	195400	49	0.26	8	106	45	150	4	25	70	1
TH26	Clifton	128	Clifton Hampden	LR	28792	2	1	24/06/92				0.26	8							
TH26	Clifton	128	Clifton Hampden	LR	41092	2	2	24/08/92				0.26	8							
TH26	Clifton	128	Clifton Hampden	LR	14294	2	3	13/06/94				0.26	8							
TH26	Clifton	128	Clifton Hampden	LR	CH78	8	3					0.26	8							
TH26	Clifton	128	Clifton Hampden	LR	30494	3	1	12/09/94				0.26	8							
TH26	Clifton	128	Clifton Hampden	LR	13894	1	2	12/05/94				0.26	8							
TH26	Clifton	128	Clifton Hampden	LR	CH86	8	1					0.26	8							
TH26	Clifton	128	Clifton Hampden	LR	CH77	8	2					0.26	8							
TH26	Clifton	128	Clifton Hampden	LR	15492	1	1	08/05/92				0.26	8							
TH26	Clifton	51	Clifton Hampden Bridge	WA/NRA/E	PTHR.0081	2	3800	24/07/87	454700	195400	49	0.26	8	106	40	130	0	40	20	40
TH26	Clifton	51	Clifton Hampden Bridge	WA/NRA/E	PTHR.0081	3	500	06/11/80	454700	195400	49	0.26	8	106						
TH26	Clifton	53	Day's Lock	PA	T1	2	1	03/08/92	456900	193600	48	0.26	8	108						
TH26	Clifton	53	Day's Lock	WA/NRA/E	PTHR.0083	3	16300	01/11/95	456900	193600	48	0.26	8	108	45	310	1	79	20	0
TH26	Clifton	53	Day's Lock	WA/NRA/E	PTHR.0083	1	14100	09/05/95	456900	193600	48	0.26	8	108	45	310	1	79	20	0
TH26	Clifton	53	Day's Lock	WA/NRA/E	PTHR.0083	3	8200	14/11/90	456900	193600	48	0.26	8	108	45	310	1	79	20	0
TH26	Clifton	53	Day's Lock	WA/NRA/E	PTHR.0083	1	5500	05/05/89	456900	193600	48	0.26	8	108	35	310	1	79	20	0
TH26	Clifton	132	Days Reach	PA	T2	2	1	28/07/92	456600	195500	49	0.26	8	108	40	150	10	53	35	2
TH27	Day's	14	Day's	FBA	FBA77_1	2	1	26/07/77				0.26	8							
TH27	Day's	14	Day's	FBA	FBA77_1	2	18	01/09/77				0.26	8							
TH27	Day's	145	Shillingford	FBA	69150103	3	7018	17/10/84	459000	193200	47	0.26	8	110	50	183	0	2	35	63
TH27	Day's	145	Shillingford	FBA	69150203	3	7019	17/10/84	459000	193200	47	0.26	8	110	50	183	0	2	35	63
TH27	Day's	145	Shillingford	FBA	69150202	2	7017	26/07/84	459000	193200	47	0.26	8	110	50	183	0	2	35	63
TH27	Day's	145	Shillingford	FBA	69150101	1	7013	09/05/84	459000	193200	47	0.26	8	110	50	183	0	2	35	63
TH27	Day's	145	Shillingford	FBA	69150201	1	7015	09/05/84	459000	193200	47	0.26	8	110	50	183	0	2	35	63
TH27	Day's	145	Shillingford	FBA	69150102	2	7016	26/07/84	459000	193200	47	0.26	8	110	50	183	0	2	35	63
TH29	Cleeve	54	South Stoke	WA/NRA/E	PTHR.0103	2	15300	13/09/95	459300	183700	47	0.26	8	126	55	300	1	29	50	20

TH29	Cleeve	54	South Stoke	WA/NRA/E	PTHR.0103	1	13600	27/04/95	459300	183700	47	0.26	8	126	55	300	1	29	50	20
TH29	Cleeve	56	US Goring Weir	WA/NRA/E	PTHR.0120	1	13500	27/04/95	460000	181600	46	0.26	8	127	52	320	0	40	40	20
TH29	Cleeve	56	US Goring Weir	WA/NRA/E	PTHR.0120	2	15200	13/09/95	460000	181600	46	0.26	8	127	52	320	0	40	40	20
TH30	Goring	129	Whitchurch	LR	15592	1	1	08/05/92				0.26	8							
TH30	Goring	129	Whitchurch	LR	13994	1	2	12/05/94				0.26	8							
TH30	Goring	129	Whitchurch	LR	28892	2	1	24/06/92				0.26	8							
TH30	Goring	129	Whitchurch	LR	41192	2	2	24/08/92				0.26	8							
TH30	Goring	129	Whitchurch	LR	WH86	8	3					0.26	8							
TH30	Goring	129	Whitchurch	LR	30594	3	1	12/09/94				0.26	8							
TH30	Goring	129	Whitchurch	LR	WH77	8	1					0.26	8							
TH30	Goring	129	Whitchurch	LR	WH78	8	2					0.26	8							
TH30	Goring	129	Whitchurch	LR	14394	2	3	13/06/94				0.26	8							
TH30	Goring	55	Whitchurch Weir	WA/NRA/E	PTHR.0115	3	15700	16/10/95	463300	176800	42	0.26	8	135	50	230	10	50	30	10
TH30	Goring	55	Whitchurch Weir	WA/NRA/E	PTHR.0115	3	8300	29/11/90	463300	176800	42	0.26	8	135	50	230	5	60	20	15
TH30	Goring	55	Whitchurch Weir	WA/NRA/E	PTHR.0115	1	6600	23/05/90	463300	176800	42	0.26	8	135	50	230	5	15	70	10
TH30	Goring	55	Whitchurch Weir	WA/NRA/E	PTHR.0115	2	9000	03/07/91	463300	176800	42	0.26	8	135	50	230	0	50	25	25
TH30	Goring	55	Whitchurch Weir	WA/NRA/E	PTHR.0115	2	3700	24/07/87	463300	176800	42	0.26	8	135	50	230	0	5	90	5
TH30	Goring	55	Whitchurch Weir	WA/NRA/E	PTHR.0115	1	13400	12/04/95	463300	176800	42	0.26	8	135	50	230	0	50	25	25
TH30	Goring	55	Whitchurch Weir	WA/NRA/E	PTHR.0115	2	7500	23/07/90	463300	176800	42	0.26	8	135	50	230	0	5	90	5
TH30	Goring	55	Whitchurch Weir	WA/NRA/E	PTHR.0115	1	8900	15/05/91	463300	176800	42	0.26	8	135	50	230	0	50	25	25
TH30	Goring	55	Whitchurch Weir	WA/NRA/E	PTHR.0115	3	9900	14/11/91	463300	176800	42	0.26	8	135	50	230	0	50	25	25
TH30	Goring	55	Whitchurch Weir	WA/NRA/E	PTHR.0115	1	10300	28/05/92	463300	176800	42	0.26	8	135	50	230	0	50	25	25
TH30	Goring	55	Whitchurch Weir	WA/NRA/E	PTHR.0115	2	10600	11/08/92	463300	176800	42	0.26	8	135	50	230	0	50	25	25
TH30	Goring	55	Whitchurch Weir	WA/NRA/E	PTHR.0115	3	11600	04/10/93	463300	176800	42	0.26	8	135	50	230	0	50	25	25
TH30	Goring	55	Whitchurch Weir	WA/NRA/E	PTHR.0115	2	11900	28/07/94	463300	176800	42	0.26	8	135	50	230	0	50	25	25
TH32	Mapledurha	57	Caversham Weir	WA/NRA/E	PTHR.0080	3	900	31/12/80	471700	174100	41	0.26	8	145						
TH32	Mapledurha	57	Caversham Weir	WA/NRA/E	PTHR.0080	1	2300	18/02/87	471700	174100	41	0.26	8	145	75	280				
TH32	Mapledurha	57	Caversham Weir	WA/NRA/E	PTHR.0080	2	4000	12/08/87	471700	174100	41	0.26	8	145	75	280	5	60	25	10
TH32	Mapledurha	57	Caversham Weir	WA/NRA/E	PTHR.0080	1	4400	09/05/88	471700	174100	41	0.26	8	145	75	280	5	60	25	10
TH32	Mapledurha	57	Caversham Weir	WA/NRA/E	PTHR.0080	2	5900	19/07/89	471700	174100	41	0.26	8	145	75	280	5	60	25	10
TH32	Mapledurha	57	Caversham Weir	WA/NRA/E	PTHR.0080	3	6000	02/10/89	471700	174100	41	0.26	8	145	75	280	5	60	25	10

APPENDIX 3.2 A full list of the taxa recorded in one or more samples held in the macro-invertebrate data-base.

Species found in entire database

Invertebrates only

27-Mar-97

02110000	Spongillidae
03110000	Hydridae
03110100	Hydra sp.
05110000	Planariidae
05110101	Planaria torva (Muller)
05110203	Polycelis tenuis (Ijima)
0511020Z	Polycelis nigra group
05120103	Dugesia tigrina (Girard)
0512010Z	Dugesia polychroa group
05130201	Dendrocoelum lacteum (Muller)
051Z0000	Planariidae (incl. Dugesiidae)
08110100	Prostoma sp.
10000000	Nematoda
14000000	Ectoprocta
16110000	Neritidae
16110101	Theodoxus fluviatilis (L.)
16120101	Viviparus contectus (Millet)
16120102	Viviparus viviparus (L.)
16130000	Valvatidae
16130100	Valvata sp.
16130101	Valvata cristata Muller
16130103	Valvata piscinalis (Muller)
16140000	Hydrobiidae
16140301	Potamopyrgus jenkinsi (Smith)
16160101	Bithynia leachii (Sheppard)
16160102	Bithynia tentaculata (L.)
161Z0000	Hydrobiidae (incl. Bithyniidae)
16210000	Physidae
16210200	Physa sp.
16210202	Physa fontinalis (L.)
1621020Z	Physa acuta group
16220000	Lymnaeidae
16220101	Lymnaea auricularia (L.)
16220103	Lymnaea palustris (Muller)
16220104	Lymnaea peregra (Muller)
16220105	Lymnaea stagnalis (L.)
16220106	Lymnaea truncatula (Muller)
16230000	Planorbidae
16230101	Planorbis carinatus Muller
16230102	Planorbis planorbis (L.)
16230201	Anisus leucostoma (Millet)
16230202	Anisus vortex (L.)
16230301	Bathyomphalus contortus (L.)
16230401	Gyraulus acronicus (Ferussac)
16230402	Gyraulus albus (Muller)
16230501	Armiger crista (L.)
16230601	Hippeutis complanatus (L.)
16230801	Planorbarius corneus (L.)
16240000	Ancylidae
16240101	Ancylus fluviatilis Muller
16250101	Acroloxus lacustris (L.)
162Z0000	Ancylidae (incl. Acroloxidae)
16320200	Succinea sp.
17120000	Unionidae
17120100	Unio sp.
17120101	Unio pictorum (L.)
17120102	Unio tumidus Philipsson
17120200	Anodonta sp.
17120201	Anodonta anatina (L.)
17120202	Anodonta cygnea (L.)
17130000	Sphaeriidae
17130100	Sphaerium sp.
17130101	Sphaerium corneum (L.)
17130102	Sphaerium lacustre (Muller)
17130103	Sphaerium rivicola (Lamarck)
17130105	Sphaerium transversum (Say)
17130200	Pisidium sp.
17130201	Pisidium amnicum (Muller)
17130202	Pisidium casertanum (Poli)
17130204	Pisidium henslowanum (Sheppard)
17130208	Pisidium moitessierianum Paladilhe
17130209	Pisidium nitidum Jenyns
17130215	Pisidium subtruncatum Malm
17130216	Pisidium supinum Schmidt
20000000	Oligochaeta
20110000	Lumbriculidae
20110300	Stylodrilus sp.
20110302	Stylodrilus heringianus Claparede
20110Z00	Lumbriculus group
20310000	Enchytraeidae
20330000	Naididae
20330100	Chaetogaster sp.
20330501	Uncinais uncinata (Orsted)
20330601	Ophidonais serpentina (Muller)
20330702	Nais barbata Muller
20330703	Nais bretscheri Michaelsen
20330706	Nais pardalis Piguet
20330708	Nais simplex Piguet
2033070Y	Nais communis group
20331201	Stylaria lacustris (L.)
20340000	Tubificidae
20340102	Tubifex ignotus (Stolc)
20340104	Tubifex newaensis (Michaelsen)
20340106	Tubifex tubifex (Muller)
20340201	Limnodrilus cervix Brinkhurst
20340202	Limnodrilus claparedeianus Ratzel
20340203	Limnodrilus hoffmeisteri Claparede
20340204	Limnodrilus profundicola (Verrill)
20340205	Limnodrilus udekemianus Claparede
20340302	Psammoryctides barbatus (Grube)
20340402	Potamothrix hammoniensis (Michaelsen)
20340404	Potamothrix moldaviensis (Vejdovsky & Mrazek)
20340903	Aulodrilus pluriseta (Piguet)
20341101	Rhyacodrilus coccineus (Vejdovsky)
20341301	Branchiura sowerbyi Beddard
20420000	Lumbricidae

Species found in entire database

Invertebrates only

27-Mar-97

22110000	Piscicolidae
22110101	Piscicola geometra (L.)
22120000	Glossiphoniidae
22120201	Theromyzon tessulatum (Muller)
22120301	Hemiclepsis marginata (Muller)
22120401	Glossiphonia complanata (L.)
22120402	Glossiphonia heteroclita (L.)
22120601	Boreobdella verrucata (Muller)
22120701	Helobdella stagnalis (L.)
22310000	Erpobdellidae
22310100	Erpobdella sp.
22310101	Erpobdella octoculata (L.)
22310201	Dina lineata (Muller)
22310302	Trocheta subviridis Dutrochet
24000000	Hydracarina
24320107	Eylais extendens (Muller)
24320111	Eylais infundibulifera Koenike
24420101	Hydrodroma despiciens (Muller)
24540144	Lebertia (Pilolebertia) inaequalis (Koch)
24540145	Lebertia (Pilolebertia) insignis Neuman
24540149	Lebertia (Pilolebertia) porosa Thor
24560111	Torrenticola (Torrenticola) amplexa (Koenike)
24610113	Limnesia (Limnesia) koenikei Piersig
24610114	Limnesia (Limnesia) maculata (Muller)
24610115	Limnesia (Limnesia) undulata (Muller)
24620112	Hygrobates (Hygrobates) fluviatilis (Strom)
24620114	Hygrobates (Hygrobates) longipalpis (Hermann)
24630121	Unionicola (Pentatax) aculeata (Koenike)
24630211	Neumania (Neumania) callosa (Koenike)
24650200	Piona sp.
24650207	Piona coccinea (Koch)
24650208	Piona conglobata (Koch)
24650218	Piona pusilla (Neuman)
24650913	Forelia (Forelia) variegator (Koch)
24730112	Mideopsis (Mideopsis) orbicularis (Muller)
24770100	Arrenurus sp.
24770113	Arrenurus (Arrenurus) albator (Muller)
30000000	Ostracoda
32010100	Argulus sp.
36110000	Asellidae
36110101	Asellus aquaticus (L.)
36110104	Asellus meridianus Racovitza
37110000	Corophiidae
37110101	Corophium curvispinum Sars
37130101	Crangonyx pseudogracilis Bousfield
37140000	Gammaridae
37140200	Gammarus sp.
37140206	Gammarus pulex (L.)
371Z0000	Gammaridae (incl. Crangonyctidae & Niphargidae)
40120000	Baetidae
40120100	Baetis sp.
40120107	Baetis rhodani (Pictet)
40120111	Baetis vernus Curtis
4012011Z	Baetis scambus group
40120201	Centroptilum luteolum (Muller)
40120300	Cloeon sp.
40120301	Cloeon dipterum (L.)
40120302	Cloeon simile Eaton
40120401	Procloeon bifidum Bengtsson
40130000	Heptageniidae
40130201	Heptagenia fuscogrisea (Retzius)
40210000	Leptophlebiidae
40210301	Habrophlebia fusca (Curtis)
40320000	Ephemeridae
40320100	Ephemera sp.
40320101	Ephemera danica Muller
40320103	Ephemera vulgata L.
40410000	Ephemerellidae
40410101	Ephemerella ignita (Poda)
40510000	Caenidae
40510200	Caenis sp.
40510201	Caenis horaria (L.)
40510203	Caenis macrura Stephens
40510205	Caenis rivulorum Eaton
40510206	Caenis robusta Eaton
4051020Z	Caenis luctuosa group
41110000	Taeniopterygidae
41120000	Nemouridae
41120400	Nemoura sp.
41130000	Leuctridae
41130102	Leuctra geniculata (Stephens)
41210000	Perlodidae
42110000	Platycnemididae
42110101	Platycnemis pennipes (Pallas)
42120000	Coenagriidae
42120201	Ischnura elegans (Van der Linden)
42120301	Enallagma cyathigerum (Charpentier)
4212040Z	Coenagrion puella group
42120601	Erythromma najas (Hansemann)
42140000	Calopterygidae
42140100	Calopteryx sp.
42140101	Calopteryx splendens (Harris)
42140102	Calopteryx virgo (L.)
42210000	Gomphidae
42210101	Gomphus vulgatissimus (L.)
42230000	Aeshnidae
42230200	Aeshna sp.
42230202	Aeshna cyanea (Muller)
42230203	Aeshna grandis (L.)
42230301	Anax imperator Leach
42250000	Libellulidae
42250306	Sympetrum striolatum (Charpentier)
43110000	Mesoveliidae
43210000	Hydrometridae
43210102	Hydrometra stagnorum (L.)
43220000	Veliidae

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43230000	Gerridae
43230100	Gerris sp.
43230114	Gerris (Gerris) lacustris (L.)
43310000	Nepidae
43310101	Nepa cinerea L.
43310201	Ranatra linearis (L.)
43410000	Naucoridae
43420000	Aphelocheiridae
43420101	Aphelocheirus aestivalis (Fabricius)
43510000	Notonectidae
43510100	Notonecta sp.
43510101	Notonecta glauca L.
43510102	Notonecta maculata Fabricius
43510104	Notonecta viridis Delcourt
43610000	Corixidae
43610100	Micronecta sp.
43610111	Micronecta (Dichaetonecta) scholtzi (Scholtz)
43610122	Micronecta (Micronecta) poweri (Douglas & Scott)
43610900	Sigara sp.
43610910	Sigara (Sigara) sp.
43610921	Sigara (Subsigara) distincta (Fieber)
43610922	Sigara (Subsigara) falleni (Fieber)
43610924	Sigara (Subsigara) fossarum (Leach)
45110000	Haliplidae
45110101	Brychius elevatus (Panzer)
45110300	Haliplus sp.
45110303	Haliplus flavicollis Sturm
45110304	Haliplus fluviatilis Aube
45110308	Haliplus immaculatus Gerhardt
45110309	Haliplus laminatus Schaller
45110311	Haliplus lineatocollis (Marsham)
45110314	Haliplus obliquus (Fabricius)
45110315	Haliplus ruficollis (Degeer)
45130101	Noterus clavicornis (Degeer)
45140000	Dytiscidae
45140100	Laccophilus sp.
45140101	Laccophilus hyalinus (Degeer)
45140301	Hyphydrus ovatus (L.)
45140604	Hygrotus versicolor (Schaller)
45140800	Hydroporus sp.
45140812	Hydroporus incognitus Sharp
45140824	Hydroporus palustris (L.)
45141303	Potamonectes depressus (Fabricius)
45141401	Stictotarsus duodecimpustulatus (Fabricius)
45141901	Platambus maculatus (L.)
45142009	Agabus didymus (Olivier)
45142018	Agabus sturmii (Gyllenhal)
45142102	Ilybius ater (Degeer)
45142104	Ilybius fuliginosus (Fabricius)
45142700	Dytiscus sp.
45150000	Gyrinidae
45150200	Gyrinus sp.
45150204	Gyrinus distinctus Aube
45150212	Gyrinus urinator Illiger
45150401	Orectochilus villosus (Muller)
451Z0000	Dytiscidae (incl. Noteridae)
45310000	Hydrophilidae
45310300	Helophorus sp.
45310352	Helophorus (Atracthelophorus) brevipalpis Bedel
45311101	Hydrobius fuscipes (L.)
45311301	Anacaena bipustulata (Marsham)
45311302	Anacaena globulus (Paykull)
45311303	Anacaena limbata (Fabricius)
45311400	Laccobius sp.
45311412	Laccobius (Laccobius) minutus (L.)
45311423	Laccobius (Macrolaccobius) bipunctatus (Fabricius)
45311426	Laccobius (Macrolaccobius) sinuatus Motschulsky
45311427	Laccobius (Macrolaccobius) striatulus (Fabricius)
453Z0000	Hydrophilidae (incl. Hydraenidae)
45620200	Dryops sp.
45630000	Elmidae
45630101	Elmis aenea (Muller)
45630301	Limnius volckmari (Panzer)
45630600	Oulimnius sp.
45630601	Oulimnius major (Rey)
45630604	Oulimnius tuberculatus (Muller)
45710200	Donacia sp.
46110000	Sialidae
46110101	Sialis fuliginosa Pictet
46110102	Sialis lutaria (L.)
46110103	Sialis nigripes Pictet
47120100	Sisyra sp.
48130000	Hydroptilidae
48130101	Agraylea multipunctata Curtis
48130300	Hydroptila sp.
48130400	Oxyethira sp.
48130600	Ithytrichia sp.
481Z0000	Rhyacophilidae (incl. Glossosomatidae)
48220100	Lype sp.
48220101	Lype phaeopa (Stephens)
48220102	Lype reducta (Hagen)
48220400	Tinodes sp.
48220408	Tinodes waeneri (L.)
48230101	Ecnomus tenellus (Rambur)
48240000	Polycentropodidae
48240101	Cyrnus flavidus Mclachlan
48240103	Cyrnus trimaculatus (Curtis)
48240301	Neureclipsis bimaculata (L.)
48240400	Plectrocnemia sp.
48240402	Plectrocnemia conspersa (Curtis)
48240403	Plectrocnemia geniculata Mclachlan
48240500	Polycentropus sp.
48240501	Polycentropus flavomaculatus (Pictet)
48240502	Polycentropus irroratus (Curtis)
48250000	Hydropsychidae
48250200	Hydropsyche sp.

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48250201	Hydropsyche angustipennis (Curtis)
48250207	Hydropsyche pellucidula (Curtis)
482Z0000	Psychomyiidae (incl. Ecnomidae)
48310000	Phryganeidae
48310500	Phryganea sp.
48310501	Phryganea bipunctata Retzius
48320000	Brachycentridae
48320101	Brachycentrus subnubilus Curtis
48330301	Lepidostoma hirtum (Fabricius)
48340000	Limnephilidae
48340501	Allogamus auricollis (Pictet)
48340600	Halesus sp.
48340602	Halesus radiatus (Curtis)
48341102	Potamophylax latipennis (Curtis)
48341401	Anabolia nervosa (Curtis)
48341700	Limnephilus sp.
48341719	Limnephilus lunatus Curtis
48341X00	Potamophylax group
48350000	Goeridae
48350101	Goera pilosa (Fabricius)
48350200	Silo sp.
48370000	Sericostomatidae
48390000	Molannidae
48390101	Molanna angustata Curtis
48410000	Leptoceridae
48410102	Athripsodes aterrimus (Stephens)
48410104	Athripsodes cinereus (Curtis)
48410200	Ceraclea sp.
48410202	Ceraclea annulicornis (Stephens)
48410203	Ceraclea dissimilis (Stephens)
48410206	Ceraclea senilis (Burmeister)
48410302	Leptocerus lusitanicus (Mclachlan)
48410400	Mystacides sp.
48410401	Mystacides azurea (L.)
48410402	Mystacides longicornis (L.)
48410403	Mystacides nigra (L.)
48410701	Triaenodes bicolor (Curtis)
48410900	Oecetis sp.
48410902	Oecetis lacustris (Pictet)
48410904	Oecetis ochracea (Curtis)
50000000	Diptera
50100000	Tipulidae
50110300	Tipula sp.
5011041Z	Tipula (Yamatotipula) montium group
50130900	Helius sp.
50350000	Ceratopogonidae
50360000	Simuliidae
50360361	Simulium (Boophthora) erythrocephalum (de Geer)
50400000	Chironomidae
50420101	Clinotanypus nervosus (Meigen)
50420201	Apsectrotanypus trifascipennis (Zetterstedt)
50420400	Macropelopia sp.
50420402	Macropelopia nebulosa (Meigen)
50420500	Procladius sp.
50420601	Psectrotanypus varius (Fabricius)
50420800	Ablabesmyia sp.
50420802	Ablabesmyia monilis (L.)
50420900	Arctopelopia sp.
50420Y00	Thienemannimyia group
50421000	Conchapelopia sp.
50421001	Conchapelopia melanops (Meigen)
50421400	Larsia sp.
50421600	Natarsia sp.
50421701	Nilotanypus dubius (Meigen)
50421800	Paramerina sp.
50421900	Rheopelopia sp.
50422100	Thienemannimyia sp.
50422501	Tanypus punctipennis Meigen
50440200	Diamesa sp.
50440300	Potthastia sp.
5044030Y	Potthastia gaedii group
5044030Z	Potthastia longimana group
50450201	Odontomesa fulva (Kieffer)
50450301	Prodiamesa olivacea (Meigen)
50460000	Orthocladiinae
50460300	Brillia sp.
50460301	Brillia flavifrons Johannsen
50460402	Cardiocladius fuscus Kieffer
50460500	Cricotopus sp.
50460510	Cricotopus (Cricotopus) sp.
50460513	Cricotopus (Cricotopus) bicinctus (Meigen)
50460520	Cricotopus (Cricotopus) sp.
50460540	Cricotopus (Isocladius) sp.
50460549	Cricotopus (Isocladius) sylvestris (Fabricius)
50460561	Cricotopus (Nostrocladius) lygropis Edwards
50460800	Eukiefferiella sp.
50460802	Eukiefferiella claripennis (Lundbeck)
50460Z00	Cricotopus group
50461300	Heterotrissocladius sp.
50461800	Nanocladius sp.
50461801	Nanocladius balticus Palmen
50462000	Orthocladius sp.
50462010	Orthocladius (Eudactylocladius) sp.
50462021	Orthocladius (Pogonocladius) consobrinus (Holmgren)
50462030	Orthocladius (Euorthocladius) sp.
50462040	Orthocladius (Orthocladius) sp.
50462050	Orthocladius (Symposiocladius) sp.
50462100	Paracladius sp.
50462101	Paracladius conversus (Walker)
50462301	Paratrichocladius rufiventris (Meigen)
50462700	Psectrocladius sp.
50462721	Psectrocladius (Allopsectrocladius) obvius (Walker)
50462740	Psectrocladius (Psectrocladius) sp.
50462800	Rheocricotopus sp.
50462901	Synorthocladius semivirens (Kieffer)
50463200	Tvetenia sp.

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50463512	Bryophaenocladius subvernalis (Edwards)
50463700	Chaetocladius sp.
50463800	Corynoneura sp.
50463901	Epoicocladius flavens (Malloch)
50464300	Limnophyes sp.
50464500	Metriocnemus sp.
50464700	Parakiefferiella sp.
50464701	Parakiefferiella bathophila (Kieffer)
50464900	Parametriocnemus sp.
50465201	Paratrissocladius excerptus (Walker)
50465300	Pseudorthocladius sp.
50465400	Pseudosmittia sp.
50465900	Thienemanniella sp.
50466300	Paracricotopus sp.
50470300	Chironomus sp.
50470400	Cladopelma sp.
50470500	Cryptochironomus sp.
50470600	Cryptotendipes sp.
50470701	Demeijerea rufipes (L.)
50470801	Demicryptochironomus vulneratus (Zetterstedt)
50470900	Dicrotendipes sp.
50470920	Dicrotendipes (Limnochironomus) sp.
50470922	Dicrotendipes (Limnochironomus) nervosus (Staeger)
50470923	Dicrotendipes (Limnochironomus) notatus (Meigen)
50471100	Endochironomus sp.
50471200	Glyptotendipes sp.
50471400	Harnischia sp.
50471501	Kiefferulus tendipediformis (Goetghebuer)
50471800	Microchironomus sp.
50471900	Microtendipes sp.
50472300	Parachironomus sp.
50472400	Paracladopelma sp.
50472401	Paracladopelma camptolabis (Kieffer)
5047240Z	Paracladopelma camptolabis group
50472500	Paralauterborniella sp.
50472501	Paralauterborniella nigrohalteralis (Malloch)
50472600	Paratendipes sp.
50472800	Phaenopsectra sp.
50472900	Polypedilum sp.
50472910	Polypedilum (Pentapedilum) sp.
50472920	Polypedilum (Polypedilum) sp.
50473100	Stenochironomus sp.
50473200	Stictochironomus sp.
50473301	Xenochironomus xenolabis (Kieffer)
50490100	Cladotanytarsus sp.
50490200	Micropsectra sp.
50490203	Micropsectra atrofasciata Kieffer
50490300	Neozavrelia sp.
50490500	Paratanytarsus sp.
50490600	Rheotanytarsus sp.
50490701	Stempellina bausei (Kieffer)
50490702	Stempellina almi Brundin
50490800	Stempellinella sp.
50490900	Tanytarsus sp.
50490902	Tanytarsus brundini Lindeberg
50490W00	Micropsectra group
50491000	Virgatanytarsus sp.
50491101	Zavrelia pentatoma Kieffer
50630000	Tabanidae
50630100	Chrysops sp.
50710000	Empididae
50830000	Ephydridae
50850000	Muscidae

APPENDIX 3.3 A full list of the families recorded in one or more samples held in the macro-invertebrate data-base.

	TH10 - St Johns	TH11 - Buscot	TH12 - Grafton	TH13 - Radcot	TH14 - Rushey	TH15 - Shifford	TH16 - Northmoor	TH17 - Pinkhill	TH18 - Eynsham	TH19 - King's	TH20 - Godstow	TH21 - Osney	TH22 - Iffley	TH23 - Sandford	TH24 - Abingdon	TH25 - Culham	TH26 - Clifton	TH27 - Day's	TH29 - Cleeve	TH30 - Goring	TH32 - Mapledurham
Spongillidae				+	+	+	+		+			+	+								
Hydridae													+				+	+			
Planariidae							+	+	+	+		+	+	+			+				
Dugesiidae						+			+	+	+		+	+			+			+	
Dendrocoelidae												+	+	+							
Planariidae (incl. Dugesiidae)															+						
Tetrastemmatidae						+															
Nematoda	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
Ectoprocta		+				+	+		+			+	+				+				
Neritidae	+		+		+	+	+		+	+	+	+	+	+	+	+	+	+			+
Viviparidae					+	+	+		+	+	+	+	+	+	+	+	+	+		+	
Valvatidae	+	+			+	+	+		+	+		+	+	+	+	+	+	+	+	+	+
Hydrobiidae	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	
Bithyniidae	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	
Hydrobiidae (incl. Bithyniidae)	+				+	+			+	+		+	+	+		+	+		+	+	+
Physidae	+	+			+	+	+		+	+		+	+	+	+	+	+	+	+	+	+
Lymnaeidae	+	+			+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+
Planorbidae	+	+				+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Ancylidae	+	+	+		+	+	+		+	+	+		+	+	+	+	+	+			
Acroloxidae	+					+	+		+				+	+	+	+	+	+			
Ancylidae (incl. Acroloxidae)	+				+	+			+	+		+	+	+			+		+	+	+
Succineidae																		+			
Unionidae	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Sphaeriidae	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Oligochaeta	+				+	+			+	+		+	+	+	+	+	+		+	+	+
Lumbriculidae	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+
Enchytraeidae							+							+			+	+			
Naididae	+	+	+		+	+	+	+		+			+				+	+			+
Tubificidae	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
Lumbricidae		+					+	+	+			+	+	+	+	+					
Piscicolidae	+						+		+	+	+	+	+	+	+	+		+	+	+	+
Glossiphoniidae	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Erpobdellidae	+	+	+			+	+		+	+	+	+	+	+	+	+	+	+	+	+	+
Hydracarina	+	+				+	+		+	+			+				+	+			
Eylaidae													+		+						
Hydrodromidae						+	+	+		+		+									
Lebertiidae	+	+	+		+	+	+	+	+	+	+	+	+			+		+			
Torrenticolidae						+				+			+								
Limnesiidae	+				+	+		+	+	+		+	+	+	+	+	+	+			
Hygrobatidae	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+		+			
Unionicolidae									+	+	+	+	+	+	+	+	+				
Pionidae					+	+		+	+		+	+	+	+	+						
Mideopsidae	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+			
Arrenuridae												+	+		+		+				
Ostracoda	+					+			+			+	+	+		+	+				+
Argulidae	+					+						+	+	+	+						
Asellidae	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Corophiidae	+					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Crangonyctidae	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	
Gammaridae	+	+	+		+	+	+		+	+		+	+	+	+	+	+			+	
Gammaridae (incl. Crangonyctidae & Niphargidae)	+				+	+			+	+		+	+	+		+	+		+	+	+
Baetidae	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Heptageniidae													+					+			+
Leptophlebiidae	+																				
Ephemeridae	+	+				+	+		+	+	+	+	+	+	+	+	+	+	+	+	+
Ephemerellidae	+	+				+	+		+	+	+	+	+	+	+		+			+	+
Caenidae	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Taeniopterygidae										+				+							
Nemouridae						+								+							
Leuctridae	+								+	+		+	+							+	
Perlodidae												+									
Platycnemididae				+		+	+		+	+			+	+	+	+	+			+	
Coenagriidae	+		+			+	+		+	+		+	+	+	+	+	+	+	+	+	
Calopterygidae	+					+	+	+	+	+		+	+	+	+	+	+	+	+	+	+
Gomphidae							+						+	+			+	+		+	+
Aeshnidae	+						+			+			+	+		+	+				

	TH10 - St Johns	TH11 - Buscot	TH12 - Grafton	TH13 - Radcot	TH14 - Rushey	TH15 - Shifford	TH16 - Northmoor	TH17 - Pinkhill	TH18 - Eynsham	TH19 - King's	TH20 - Godstow	TH21 - Osney	TH22 - Iffley	TH23 - Sandford	TH24 - Abingdon	TH25 - Culham	TH26 - Clifton	TH27 - Day's	TH29 - Cleeve	TH30 - Goring	TH32 - Mapledurham
Libellulidae														+							
Mesovelidae																+					
Hydrometridae	+								+	+			+	+	+	+	+			+	
Veliidae	+																			+	
Gerridae	+					+			+	+			+	+	+	+	+			+	
Nepidae	+									+			+	+	+	+	+				
Naucoridae																					+
Aphelocheiridae		+					+			+		+			+					+	
Notonectidae	+						+		+				+	+	+	+		+			+
Corixidae	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+
Haliplidae	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+
Noteridae													+	+	+	+					
Dytiscidae	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	
Gyrinidae	+									+		+	+	+	+		+	+		+	
Dytiscidae (incl. Noteridae)	+				+	+			+	+		+	+	+		+	+		+	+	+
Hydrophilidae	+	+	+	+	+	+		+	+	+			+	+	+	+	+	+			
Hydrophilidae (incl. Hydraenidae)	+					+				+						+					+
Dryopidae									+												
Elmidae	+	+	+			+	+		+	+		+	+	+	+	+	+	+		+	+
Chrysomelidae															+						
Sialidae	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Sisyridae							+		+	+											
Hydroptilidae	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Rhyacophilidae (incl. Glossosomatidae)												+									
Psychomyiidae	+					+	+'	+	+		+		+	+	+	+	+	+			
Ecnomidae								+					+				+	+			
Polycentropodidae	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+
Hydropsychidae	+					+				+		+		+		+	+				
Psychomyiidae (incl. Ecnomidae)	+								+	+		+	+	+			+		+	+	
Phryganeidae	+	+		+		+	+	+	+	+		+	+	+	+	+	+	+	+	+	
Brachycentridae										+		+						+		+	
Lepidostomatidae	+																				
Limnephilidae	+	+			+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+
Goeridae	+	+				+			+	+				+	+		+				
Sericostomatidae																				+	
Molannidae	+	+	+		+	+	+		+	+		+	+	+	+	+	+	+	+	+	+
Leptoceridae	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+
Diptera	+	+	+	+		+	+	+	+	+			+		+		+				
Tipulidae	+				+		+		+	+			+	+	+	+	+			+	
Tipulinae							+						+					+			
Ceratopogonidae	+						+		+	+		+	+	+		+	+	+		+	+
Simuliidae	+		+			+			+	+		+	+	+		+	+			+	
Chironomidae	+				+	+			+	+	+	+	+	+	+	+	+		+	+	+
Tanypodinae	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	
Diamesinae	+		+			+	+	+				+	+				+	+		+	
Prodiamesinae	+	+	+	+	+	+	+	+	+	+		+	+	+		+	+	+		+	
Orthocladiinae	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	
Chironomini	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	
Tanytarsini	+	+	+			+	+	+	+	+	+	+	+			+	+	+		+	
Tabanidae							+									+					
Empididae													+	+							
Ephydridae	+																				
Muscidae														+				+			+

APPENDIX 3.4 The Biological Monitoring Working Party (BMWP) index values of all samples held in the macro-invertebrate data-base.

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH10	St. Johns	FBA-1977 survey	1977	31	St. Johns	03/08/77	2	18	162	5.400	30
		FBA-RIVPACS 1984 survey	1984	143	Malthouse	09/05/84	1	7000	158	5.852	27
		FBA-RIVPACS 1984 survey	1984	143	Malthouse	09/05/84	1	7001	119	5.174	23
		FBA-RIVPACS 1984 survey	1984	143	Malthouse	26/07/84	2	7002	118	4.917	24
		FBA-RIVPACS 1984 survey	1984	143	Malthouse	26/07/84	2	7004	128	5.565	23
		FBA-RIVPACS 1984 survey	1984	143	Malthouse	17/10/84	3	7005	116	5.273	22
		FBA-RIVPACS 1984 survey	1984	143	Malthouse	17/10/84	3	7006	126	5.727	22
		Les Ruse's Chironomid exuviae	1977	127	Buscot		8	1	2	2.000	1
		Les Ruse's Chironomid exuviae	1978	127	Buscot		8	3	2	2.000	1
		Les Ruse's Chironomid exuviae	1986	127	Buscot		8	2	2	2.000	1
		Les Ruse's Chironomid exuviae	1992	127	Buscot	08/05/92	1	1	2	2.000	1
		Les Ruse's Chironomid exuviae	1992	127	Buscot	24/06/92	2	1	2	2.000	1
		Les Ruse's Chironomid exuviae	1992	127	Buscot	24/08/92	2	2	2	2.000	1
		Thames WA/NRA/EA routine monitoring	1980	38	A417 Buscot	22/10/80	3	300	126	5.040	25
		Thames WA/NRA/EA routine monitoring	1987	38	A417 Buscot	10/07/87	2	3500	121	4.840	25
		Thames WA/NRA/EA routine monitoring	1987	39	Water Intake Buscot	03/02/87	1	2100	112	5.091	22
		Thames WA/NRA/EA routine monitoring	1988	39	Water Intake Buscot	01/08/88	2	4900	146	4.867	30
		Thames WA/NRA/EA routine monitoring	1989	39	Water Intake Buscot	01/06/89	1	5400	103	5.150	20
		Thames WA/NRA/EA routine monitoring	1990	39	Water Intake Buscot	24/04/90	3	6400	114	4.957	23
		Thames WA/NRA/EA routine monitoring	1990	39	Water Intake Buscot	13/07/90	2	7200	114	4.560	25
		Thames WA/NRA/EA routine monitoring	1990	39	Water Intake Buscot	05/09/90	2	7800	153	5.100	30
		Thames WA/NRA/EA routine monitoring	1991	39	Water Intake Buscot	08/04/91	1	8700	102	5.100	20
		Thames WA/NRA/EA routine monitoring	1991	39	Water Intake Buscot	05/08/91	2	9400	103	4.682	22
		Thames WA/NRA/EA routine monitoring	1991	39	Water Intake Buscot	14/11/91	3	9800	98	4.667	21
		Thames WA/NRA/EA routine monitoring	1992	39	Water Intake Buscot	13/07/92	2	10400	112	4.667	24
		Thames WA/NRA/EA routine monitoring	1992	39	Water Intake Buscot	07/10/92	3	10800	132	5.077	26
		Thames WA/NRA/EA routine monitoring	1993	39	Water Intake Buscot	29/04/93	1	11300	122	4.880	25
		Thames WA/NRA/EA routine monitoring	1994	39	Water Intake Buscot	09/08/94	2	12100	120	5.714	21
		Thames WA/NRA/EA routine monitoring	1995	39	Water Intake Buscot	04/05/95	1	13800	113	5.136	22
		Thames WA/NRA/EA routine monitoring	1995	39	Water Intake Buscot	14/11/95	3	16500	129	4.778	27

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH11	Buscot	FBA-1977 survey	1977	30	Buscot	03/08/77	2	17	96	4.174	23
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	1190	43	4.300	10
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	1191	60	4.615	13
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	1192	37	3.364	11
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	1193	66	5.077	13
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	1194	34	3.400	10
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	1195	40	3.636	11
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	1196	17	3.400	5
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	1197	58	4.833	12
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	1198	28	3.500	8
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	1199	39	4.333	9
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	2190	30	4.286	7
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	2191	29	4.143	7
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	2192	11	2.750	4
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	2193	29	5.800	5
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	2194	43	4.778	9
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	2195	17	4.250	4
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	2196	46	4.182	11
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	2197	27	4.500	6
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	2198	35	5.000	7
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	2199	13	3.250	4
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	3190	18	3.000	6
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	3191	45	4.500	10
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	3192	56	5.091	11
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	3193	16	3.200	5
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	3194	21	3.000	7
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	3195	47	3.917	12
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	3196	83	5.188	16
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	3197	50	4.167	12
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	3198	28	3.500	8
		FBA-1977 survey	1977	37	Buscot	15/08/77	2	3199	13	4.333	3

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH12	**Grafton**	FBA-1977 survey	1977	29	Grafton	03/08/77	2	16	123	5.125	24

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH13	**Radcot**	FBA-1977 survey	1977	28	Radcot	02/08/77	2	15	101	5.050	20

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH14	**Rushey**	FBA-1977 survey	1977	27	Rushey	02/08/77	2	14	100	4.762	21
		Thames WA/NRA/EA routine monitoring	1995	40	0.5km below Tadpole Brid	10/08/95	2	14900	109	4.739	23

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH15	Shifford	FBA-1977 survey	1977	26	Shifford	02/08/77	2	13	136	4.857	28
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	1200	46	4.182	11
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	1201	56	5.091	11
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	1202	77	4.529	17
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	1203	85	4.474	19
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	1204	48	3.692	13
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	1205	37	4.111	9
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	1206	78	4.105	19
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	1207	30	3.750	8
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	1208	26	3.714	7
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	1209	32	3.556	9
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	2200	55	5.000	11
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	2201	18	3.600	5
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	2202	29	4.833	6
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	2203	36	4.500	8
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	2204	20	4.000	5
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	2205	37	4.625	8
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	2206	88	5.867	15
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	2207	29	4.833	6
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	2208	9	3.000	3
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	2209	20	5.000	4
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	3200	18	2.571	7
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	3201	25	3.571	7
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	3202	12	3.000	4
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	3203	93	4.650	20
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	3204	20	3.333	6
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	3205	28	4.000	7
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	3206	26	4.333	6
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	3207	31	3.875	8
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	3208	52	4.727	11
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	3209	22	3.667	6
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	4201	12	3.000	4

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH15	Shifford	FBA-1977 survey	1977	36	Shifford	22/08/77	2	4202	29	3.625	8
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	4203	29	4.833	6
		FBA-1977 survey	1977	36	Shifford	22/08/77	2	4204	23	3.286	7
		Thames WA/NRA/EA routine monitoring	1987	41	Newbridge	10/07/87	2	3600	103	5.150	20
		Thames WA/NRA/EA routine monitoring	1995	41	Newbridge	17/05/95	1	14400	91	4.789	19
		Thames WA/NRA/EA routine monitoring	1995	41	Newbridge	02/10/95	3	15400	122	4.880	25
		Thames WA/NRA/EA routine monitoring	1995	42	US Newbridge	10/08/95	2	15000	122	4.880	25

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH16	Northmoor	FBA-1977 survey	1977	25	Northmoor	01/08/77	2	12	151	5.207	29
		FBA-RIVPACS 1984 survey	1984	144	Bablock Hythe	09/05/84	1	7007	75	4.412	17
		FBA-RIVPACS 1984 survey	1984	144	Bablock Hythe	09/05/84	1	7008	114	5.429	21
		FBA-RIVPACS 1984 survey	1984	144	Bablock Hythe	26/07/84	2	7009	79	4.158	19
		FBA-RIVPACS 1984 survey	1984	144	Bablock Hythe	26/07/84	2	7010	131	5.240	25
		FBA-RIVPACS 1984 survey	1984	144	Bablock Hythe	17/10/84	3	7011	121	5.261	23
		FBA-RIVPACS 1984 survey	1984	144	Bablock Hythe	17/10/84	3	7012	136	5.440	25
		Les Ruse's Chironomid exuviae	1977	131	Newbridge		8	2	2	2.000	1
		Les Ruse's Chironomid exuviae	1978	131	Newbridge		8	3	2	2.000	1
		Les Ruse's Chironomid exuviae	1986	131	Newbridge		8	1	2	2.000	1
		Les Ruse's Chironomid exuviae	1992	131	Newbridge	08/05/92	1	1	2	2.000	1
		Les Ruse's Chironomid exuviae	1992	131	Newbridge	24/06/92	2	2	2	2.000	1
		Les Ruse's Chironomid exuviae	1992	131	Newbridge	24/08/92	2	1	2	2.000	1
		Les Ruse's Chironomid exuviae	1994	131	Newbridge	12/05/94	1	2	2	2.000	1
		Les Ruse's Chironomid exuviae	1994	131	Newbridge	13/06/94	2	3	2	2.000	1
		Les Ruse's Chironomid exuviae	1994	131	Newbridge	12/09/94	3	1	2	2.000	1

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH17	**Pinkhill**	FBA-1977 survey	1977	24	Pinkhill	01/08/77	2	11	120	5.217	23
		Les Ruse's Chironomid exuviae	1977	130	Swinford		8	1	2	2.000	1
		Les Ruse's Chironomid exuviae	1978	130	Swinford		8	3	2	2.000	1
		Les Ruse's Chironomid exuviae	1986	130	Swinford		8	2	2	2.000	1
		Les Ruse's Chironomid exuviae	1992	130	Swinford	08/05/92	1	3	2	2.000	1
		Les Ruse's Chironomid exuviae	1992	130	Swinford	24/06/92	2	1	2	2.000	1
		Les Ruse's Chironomid exuviae	1992	130	Swinford	24/08/92	2	2	2	2.000	1
		Les Ruse's Chironomid exuviae	1994	130	Swinford	12/05/94	1	1	2	2.000	1
		Les Ruse's Chironomid exuviae	1994	130	Swinford	13/06/94	2	3	2	2.000	1
		Les Ruse's Chironomid exuviae	1994	130	Swinford	12/09/94	3	1	2	2.000	1

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH18	Eynsham	FBA-1977 survey	1977	23	Eynsham	01/08/77	2	10	132	5.077	26
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	1210	31	3.875	8
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	1211	55	3.667	15
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	1212	39	4.333	9
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	1213	43	4.300	10
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	1214	45	5.000	9
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	1215	28	3.500	8
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	1216	41	4.100	10
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	1217	42	4.200	10
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	1218	75	4.412	17
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	1219	52	4.333	12
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	2210	28	4.000	7
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	2211	78	5.200	15
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	2212	16	4.000	4
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	2213	24	3.429	7
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	2214	30	4.286	7
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	2215	34	4.250	8
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	2216	37	4.625	8
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	2217	26	4.333	6
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	2218	36	4.000	9
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	2219	31	3.444	9
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	3210	44	4.889	9
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	3211	32	4.000	8
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	3212	24	4.000	6
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	3213	25	3.571	7
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	3214	32	4.000	8
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	3215	6	2.000	3
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	3216	54	4.154	13
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	3217	3	1.500	2

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH18	Eynsham	FBA-1977 survey	1977	35	Eynsham	24/08/77	2	3218	20	3.333	6
		FBA-1977 survey	1977	35	Eynsham	24/08/77	2	3219	39	4.333	9
		Oxford Structures Environmental Survey	1992	118	DS Swinford WTW	30/06/92	2	5000	132	5.077	26
		Thames WA/NRA/EA routine monitoring	1980	43	Water Intake, Swinford	06/11/80	3	400	121	5.261	23
		Thames WA/NRA/EA routine monitoring	1987	43	Water Intake, Swinford	17/02/87	1	2200	115	4.600	25
		Thames WA/NRA/EA routine monitoring	1987	43	Water Intake, Swinford	24/07/87	2	3900	124	4.593	27
		Thames WA/NRA/EA routine monitoring	1988	43	Water Intake, Swinford	15/06/88	2	4800	174	5.800	30
		Thames WA/NRA/EA routine monitoring	1989	43	Water Intake, Swinford	10/10/89	3	6100	111	4.826	23
		Thames WA/NRA/EA routine monitoring	1995	43	Water Intake, Swinford	10/04/95	1	13200	117	4.875	24
		Thames WA/NRA/EA routine monitoring	1995	43	Water Intake, Swinford	09/10/95	3	15500	83	4.611	18

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH19	King's	FBA-1977 survey	1977	22	King's	25/08/77	2	9	124	4.960	25
		Oxford Structures Environmental Survey	1992	44	Trout Inn, Godstow	30/06/92	2	5002	168	5.250	32
		Oxford Structures Environmental Survey	1992	119	West Mead	30/06/92	2	5001	99	4.714	21
		Thames WA/NRA/EA routine monitoring	1980	44	Trout Inn, Godstow	01/12/80	3	800	128	5.120	25
		Thames WA/NRA/EA routine monitoring	1990	44	Trout Inn, Godstow	30/04/90	1	6500	107	5.350	20
		Thames WA/NRA/EA routine monitoring	1990	44	Trout Inn, Godstow	09/08/90	2	7600	181	5.171	35
		Thames WA/NRA/EA routine monitoring	1990	44	Trout Inn, Godstow	08/10/90	3	8000	139	5.148	27
		Thames WA/NRA/EA routine monitoring	1991	44	Trout Inn, Godstow	08/04/91	1	8600	100	4.545	22
		Thames WA/NRA/EA routine monitoring	1991	44	Trout Inn, Godstow	03/07/91	2	9100	93	4.429	21
		Thames WA/NRA/EA routine monitoring	1991	44	Trout Inn, Godstow	19/09/91	2	9500	153	6.120	25
		Thames WA/NRA/EA routine monitoring	1992	44	Trout Inn, Godstow	26/05/92	1	10100	135	5.000	27
		Thames WA/NRA/EA routine monitoring	1992	44	Trout Inn, Godstow	28/07/92	2	10500	115	6.765	17
		Thames WA/NRA/EA routine monitoring	1993	44	Trout Inn, Godstow	24/02/93	1	11200	136	5.667	24
		Thames WA/NRA/EA routine monitoring	1994	44	Trout Inn, Godstow	28/07/94	2	12000	168	6.462	26
		Thames WA/NRA/EA routine monitoring	1995	44	Trout Inn, Godstow	01/05/95	1	13700	148	5.481	27
		Thames WA/NRA/EA routine monitoring	1995	44	Trout Inn, Godstow	30/10/95	3	16100	122	5.545	22

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH20	**Godstow**	FBA-1977 survey	1977	21	Godstow	28/07/77	2	8	113	4.913	23
		Oxford Structures Environmental Survey	1992	121	Binsey	30/06/92	2	5003	111	4.625	24

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH21	**Osney**	FBA-1977 survey	1977	20	Osney	28/07/77	2	7	148	4.933	30
		Oxford Structures Environmental Survey	1992	122	DS Cherwell	07/06/92	2	5004	108	5.143	21
		Thames WA/NRA/EA routine monitoring	1987	45	Osney Weir	22/03/87	1	2600	87	4.833	18
		Thames WA/NRA/EA routine monitoring	1988	45	Osney Weir	13/06/88	1	4500	148	5.692	26
		Thames WA/NRA/EA routine monitoring	1989	45	Osney Weir	28/06/89	2	5800	152	5.429	28
		Thames WA/NRA/EA routine monitoring	1995	46	Donnington Bridge, Oxfor	10/04/95	1	13100	138	5.750	24
		Thames WA/NRA/EA routine monitoring	1995	46	Donnington Bridge, Oxfor	02/11/95	3	16800	45	4.091	11
		Thames WA/NRA/EA routine monitoring	1995	47	Folley Bridge, Oxford	23/05/95	1	14500	122	5.304	23
		Thames WA/NRA/EA routine monitoring	1995	47	Folley Bridge, Oxford	30/10/95	3	16000	68	4.857	14

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH22	**Iffley**	FBA-1977 survey	1977	19	Iffley	28/07/77	2	6	176	5.176	34
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	1220	9	3.000	3
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	1221	91	4.789	19
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	1222	19	3.167	6
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	1223	26	4.333	6
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	1224	39	3.900	10
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	1225	48	4.000	12
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	1226	45	3.750	12
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	1227	30	3.750	8
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	1228	70	4.375	16
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	1229	53	4.077	13
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	2220	35	3.889	9
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	2221	60	5.000	12
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	2222	19	3.800	5
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	2223	25	3.571	7
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	2224	57	5.182	11
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	2225	40	3.636	11
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	2226	19	3.167	6
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	2227	24	3.429	7
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	2228	39	3.900	10
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	2229	58	4.462	13
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	3220	35	4.375	8
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	3221	48	4.364	11
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	3222	58	4.833	12
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	3223	35	3.500	10
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	3224	51	4.636	11
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	3225	55	4.583	12
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	3226	65	4.643	14
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	3227	29	4.143	7
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	3228	41	4.556	9
		FBA-1977 survey	1977	34	Iffley	30/08/77	2	3229	92	4.600	20
		Oxford Structures Environmental Survey	1992	48	Top of Sandford Lock Cut	30/06/92	2	5005	108	4.696	23

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH22	Iffley	Pond Action SWORDS Survey	1992	48	Top of Sandford Lock Cut	09/07/92	2	1	203	5.342	38
		Thames WA/NRA/EA routine monitoring	1982	48	Top of Sandford Lock Cut	18/02/82	1	1000	120	5.000	24
		Thames WA/NRA/EA routine monitoring	1984	48	Top of Sandford Lock Cut	09/03/84	1	1400	116	5.273	22
		Thames WA/NRA/EA routine monitoring	1987	48	Top of Sandford Lock Cut	22/03/87	1	2500	133	5.320	25
		Thames WA/NRA/EA routine monitoring	1988	48	Top of Sandford Lock Cut	13/06/88	1	4600	156	5.200	30
		Thames WA/NRA/EA routine monitoring	1989	48	Top of Sandford Lock Cut	08/05/89	1	5700	165	5.690	29
		Thames WA/NRA/EA routine monitoring	1990	48	Top of Sandford Lock Cut	17/04/90	1	6300	143	5.107	28
		Thames WA/NRA/EA routine monitoring	1990	48	Top of Sandford Lock Cut	20/08/90	2	7700	128	4.923	26
		Thames WA/NRA/EA routine monitoring	1990	48	Top of Sandford Lock Cut	08/10/90	3	7900	189	5.400	35
		Thames WA/NRA/EA routine monitoring	1991	48	Top of Sandford Lock Cut	08/04/91	1	8500	107	4.652	23
		Thames WA/NRA/EA routine monitoring	1991	48	Top of Sandford Lock Cut	03/07/91	2	9200	115	4.792	24
		Thames WA/NRA/EA routine monitoring	1991	48	Top of Sandford Lock Cut	30/10/91	3	9700	119	5.409	22
		Thames WA/NRA/EA routine monitoring	1992	48	Top of Sandford Lock Cut	26/05/92	1	10200	146	5.407	27
		Thames WA/NRA/EA routine monitoring	1992	48	Top of Sandford Lock Cut	11/08/92	2	10700	136	5.231	26
		Thames WA/NRA/EA routine monitoring	1993	48	Top of Sandford Lock Cut	24/02/93	1	11100	89	4.450	20
		Thames WA/NRA/EA routine monitoring	1994	48	Top of Sandford Lock Cut	08/11/94	3	12700	115	5.000	23

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH23	**Sandford**	FBA-1977 survey	1977	18	Sandford	27/07/77	2	5	93	4.429	21
		Oxford Structures Environmental Survey	1992	124	Radley College Boathouse	30/06/92	2	5006	80	5.000	16
		Pond Action SWORDS Survey	1992	49	Abingdon Weir	28/07/92	2	1	230	5.349	43
		Pond Action SWORDS Survey	1992	139	Near Lock Wood	28/07/92	2	1	171	5.344	32
		Pond Action SWORDS Survey	1992	140	Radley	20/07/92	2	1	193	5.361	36
		Pond Action SWORDS Survey	1992	141	Sandford Reach	28/07/92	2	1	193	5.514	35
		Thames WA/NRA/EA routine monitoring	1980	49	Abingdon Weir	20/11/80	3	600	122	4.692	26
		Thames WA/NRA/EA routine monitoring	1982	49	Abingdon Weir	18/02/82	1	1100	129	5.160	25
		Thames WA/NRA/EA routine monitoring	1983	49	Abingdon Weir	26/01/83	1	1200	118	4.720	25
		Thames WA/NRA/EA routine monitoring	1984	49	Abingdon Weir	09/03/84	1	1300	113	4.708	24
		Thames WA/NRA/EA routine monitoring	1986	50	Sandford	12/06/86	1	1900	50	4.545	11
		Thames WA/NRA/EA routine monitoring	1987	49	Abingdon Weir	12/03/87	1	2400	103	4.682	22
		Thames WA/NRA/EA routine monitoring	1988	49	Abingdon Weir	15/06/88	1	4700	136	5.037	27
		Thames WA/NRA/EA routine monitoring	1989	49	Abingdon Weir	08/05/89	1	5600	143	4.767	30
		Thames WA/NRA/EA routine monitoring	1990	49	Abingdon Weir	05/06/90	1	6700	119	4.577	26
		Thames WA/NRA/EA routine monitoring	1992	49	Abingdon Weir	23/11/92	3	11000	89	4.944	18
		Thames WA/NRA/EA routine monitoring	1993	49	Abingdon Weir	24/05/93	1	11400	117	5.087	23
		Thames WA/NRA/EA routine monitoring	1994	49	Abingdon Weir	19/10/94	3	12400	113	5.136	22
		Thames WA/NRA/EA routine monitoring	1995	49	Abingdon Weir	09/05/95	1	14000	82	5.125	16
		Thames WA/NRA/EA routine monitoring	1995	49	Abingdon Weir	01/11/95	3	16200	118	4.720	25

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH24	**Abingdon**	FBA-1977 survey	1977	17	Abingdon	27/07/77	2	4	132	5.077	26
		Pond Action SWORDS Survey	1992	136	Sutton Pools	03/08/92	2	1	190	5.588	34
		Pond Action SWORDS Survey	1992	137	Culham Reach	20/07/92	2	1	200	5.263	38

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH25	**Culham**	FBA-1977 survey	1977	16	Culham	26/07/77	2	3	122	5.083	24
		Pond Action SWORDS Survey	1992	134	Long Wittenham	03/08/92	2	1	187	5.054	37
		Pond Action SWORDS Survey	1992	135	Clifton Reach	28/07/92	2	1	105	4.565	23
		Thames WA/NRA/EA routine monitoring	1987	52	Sutton Bridge, Culham	07/07/87	2	3200	13	2.600	5
		Thames WA/NRA/EA routine monitoring	1995	52	Sutton Bridge, Culham	10/04/95	1	13300	110	5.000	22
		Thames WA/NRA/EA routine monitoring	1995	52	Sutton Bridge, Culham	02/11/95	3	16400	91	4.550	20

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH26	Clifton	FBA-1977 survey	1977	15	Clifton	26/07/77	2	2	97	4.619	21
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	1230	36	4.500	8
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	1231	13	2.600	5
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	1232	33	4.125	8
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	1233	29	4.143	7
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	1234	50	4.167	12
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	1235	75	4.412	17
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	1236	50	3.846	13
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	1237	14	3.500	4
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	1238	33	4.125	8
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	1239	27	3.857	7
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	2230	1	1.000	1
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	2231	21	3.500	6
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	2232	13	3.250	4
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	2233	25	4.167	6
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	2234	3	1.500	2
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	2235	10	3.333	3
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	2236	10	3.333	3
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	2237	36	5.143	7
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	2238	23	4.600	5
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	2239	17	4.250	4
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	3230	14	3.500	4
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	3231	6	2.000	3
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	3232	1	1.000	1
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	3233	23	4.600	5
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	3234	28	4.667	6
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	3235	13	3.250	4
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	3236	13	3.250	4
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	3237	3	1.500	2
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	3238	3	1.500	2
		FBA-1977 survey	1977	33	Clifton	05/09/77	2	3239	25	4.167	6
		Les Ruse's Chironomid exuviae	1977	128	Clifton Hampden		8	2	2	2.000	1

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH26	**Clifton**	Les Ruse's Chironomid exuviae	1978	128	Clifton Hampden		8	3	2	2.000	1
		Les Ruse's Chironomid exuviae	1986	128	Clifton Hampden		8	1	2	2.000	1
		Les Ruse's Chironomid exuviae	1992	128	Clifton Hampden	08/05/92	1	1	2	2.000	1
		Les Ruse's Chironomid exuviae	1992	128	Clifton Hampden	24/06/92	2	1	2	2.000	1
		Les Ruse's Chironomid exuviae	1992	128	Clifton Hampden	24/08/92	2	2	2	2.000	1
		Les Ruse's Chironomid exuviae	1994	128	Clifton Hampden	12/05/94	1	2	2	2.000	1
		Les Ruse's Chironomid exuviae	1994	128	Clifton Hampden	13/06/94	2	3	2	2.000	1
		Les Ruse's Chironomid exuviae	1994	128	Clifton Hampden	12/09/94	3	1	2	2.000	1
		Pond Action SWORDS Survey	1992	53	Day's Lock	03/08/92	2	1	124	5.167	24
		Pond Action SWORDS Survey	1992	132	Days Reach	28/07/92	2	1	131	5.038	26
		Pond Action SWORDS Survey	1992	133	Clifton Bridge	03/08/92	2	1	147	5.250	28
		Thames WA/NRA/EA routine monitoring	1980	51	Clifton Hampden Bridge	06/11/80	3	500	79	4.647	17
		Thames WA/NRA/EA routine monitoring	1987	51	Clifton Hampden Bridge	24/07/87	2	3800	110	4.783	23
		Thames WA/NRA/EA routine monitoring	1989	53	Day's Lock	05/05/89	1	5500	179	5.594	32
		Thames WA/NRA/EA routine monitoring	1990	53	Day's Lock	14/11/90	3	8200	111	4.826	23
		Thames WA/NRA/EA routine monitoring	1995	53	Day's Lock	09/05/95	1	14100	108	4.909	22
		Thames WA/NRA/EA routine monitoring	1995	53	Day's Lock	01/11/95	3	16300	81	4.500	18

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH27	Day's	FBA-1977 survey	1977	14	Day's	26/07/77	2	1	73	4.563	16
		FBA-RIVPACS 1984 survey	1984	145	Shillingford	09/05/84	1	7013	126	5.250	24
		FBA-RIVPACS 1984 survey	1984	145	Shillingford	09/05/84	1	7015	135	5.400	25
		FBA-RIVPACS 1984 survey	1984	145	Shillingford	26/07/84	2	7016	107	4.458	24
		FBA-RIVPACS 1984 survey	1984	145	Shillingford	26/07/84	2	7017	125	5.208	24
		FBA-RIVPACS 1984 survey	1984	145	Shillingford	17/10/84	3	7018	74	4.353	17
		FBA-RIVPACS 1984 survey	1984	145	Shillingford	17/10/84	3	7019	139	5.560	25

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH29	Cleeve	Thames WA/NRA/EA routine monitoring	1995	54	South Stoke	27/04/95	1	13600	93	4.650	20
		Thames WA/NRA/EA routine monitoring	1995	54	South Stoke	13/09/95	2	15300	100	4.762	21
		Thames WA/NRA/EA routine monitoring	1995	56	US Goring Weir	27/04/95	1	13500	105	5.250	20
		Thames WA/NRA/EA routine monitoring	1995	56	US Goring Weir	13/09/95	2	15200	112	5.091	22

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH30	Goring	Les Ruse's Chironomid exuviae	1977	129	Whitchurch		8	1	2	2.000	1
		Les Ruse's Chironomid exuviae	1978	129	Whitchurch		8	2	2	2.000	1
		Les Ruse's Chironomid exuviae	1986	129	Whitchurch		8	3	2	2.000	1
		Les Ruse's Chironomid exuviae	1992	129	Whitchurch	08/05/92	1	1	2	2.000	1
		Les Ruse's Chironomid exuviae	1992	129	Whitchurch	24/06/92	2	1	2	2.000	1
		Les Ruse's Chironomid exuviae	1992	129	Whitchurch	24/08/92	2	2	2	2.000	1
		Les Ruse's Chironomid exuviae	1994	129	Whitchurch	12/05/94	1	2	2	2.000	1
		Les Ruse's Chironomid exuviae	1994	129	Whitchurch	13/06/94	2	3	2	2.000	1
		Les Ruse's Chironomid exuviae	1994	129	Whitchurch	12/09/94	3	1	2	2.000	1
		Thames WA/NRA/EA routine monitoring	1987	55	Whitchurch Weir	24/07/87	2	3700	104	5.200	20
		Thames WA/NRA/EA routine monitoring	1990	55	Whitchurch Weir	23/05/90	1	6600	156	5.200	30
		Thames WA/NRA/EA routine monitoring	1990	55	Whitchurch Weir	23/07/90	2	7500	83	4.882	17
		Thames WA/NRA/EA routine monitoring	1990	55	Whitchurch Weir	29/11/90	3	8300	97	5.105	19
		Thames WA/NRA/EA routine monitoring	1991	55	Whitchurch Weir	15/05/91	1	8900	123	5.348	23
		Thames WA/NRA/EA routine monitoring	1991	55	Whitchurch Weir	03/07/91	2	9000	154	5.310	29
		Thames WA/NRA/EA routine monitoring	1991	55	Whitchurch Weir	14/11/91	3	9900	92	4.600	20
		Thames WA/NRA/EA routine monitoring	1992	55	Whitchurch Weir	28/05/92	1	10300	116	5.524	21
		Thames WA/NRA/EA routine monitoring	1992	55	Whitchurch Weir	11/08/92	2	10600	102	4.636	22
		Thames WA/NRA/EA routine monitoring	1993	55	Whitchurch Weir	04/10/93	3	11600	140	5.600	25
		Thames WA/NRA/EA routine monitoring	1994	55	Whitchurch Weir	28/07/94	2	11900	146	5.214	28
		Thames WA/NRA/EA routine monitoring	1995	55	Whitchurch Weir	12/04/95	1	13400	104	5.474	19
		Thames WA/NRA/EA routine monitoring	1995	55	Whitchurch Weir	16/10/95	3	15700	110	5.000	22

Reach ID	Reach name	Data source name	Year	Site ID	Site name	Sample date	Season ID	Sample ID	BMWP	ASPT	Number of Taxa
TH32	**Mapledurha**	Thames WA/NRA/EA routine monitoring	1980	57	Caversham Weir	31/12/80	3	900	119	4.760	25
		Thames WA/NRA/EA routine monitoring	1987	57	Caversham Weir	18/02/87	1	2300	85	4.474	19
		Thames WA/NRA/EA routine monitoring	1987	57	Caversham Weir	12/08/87	2	4000	143	5.107	28
		Thames WA/NRA/EA routine monitoring	1988	57	Caversham Weir	09/05/88	1	4400	159	5.300	30
		Thames WA/NRA/EA routine monitoring	1989	57	Caversham Weir	19/07/89	2	5900	113	4.708	24
		Thames WA/NRA/EA routine monitoring	1989	57	Caversham Weir	02/10/89	3	6000	116	4.833	24

APPENDIX 3.5 The frequency of occurrence of standard macro-invertebrate taxa in samples from three distinct zones: margins, mid-channel and vegetation.

Species name	Margin	Mid-channel	Vegetation
Spongillidae	2.0%	6.0%	1.9%
Hydridae			
Hydra sp.			1.9%
Planaria torva (Muller)	2.0%		1.9%
Polycelis tenuis (Ijima)			1.9%
Dugesia tigrina (Girard)	10.0%		18.5%
Dugesia polychroa group	2.0%		3.7%
Dendrocoelum lacteum (Muller)	2.0%		
Prostoma sp.			1.9%
Nematoda	16.0%	60.0%	3.7%
Ectoprocta	4.0%	10.0%	9.3%
Theodoxus fluviatilis (L.)	6.0%	6.0%	9.3%
Viviparus viviparus (L.)	14.0%	18.0%	9.3%
Valvata sp.	2.0%	2.0%	14.8%
Valvata cristata Muller			
Valvata piscinalis (Muller)	4.0%		
Potamopyrgus jenkinsi (Smith)	68.0%	52.0%	64.8%
Bithynia leachii (Sheppard)	6.0%	2.0%	20.4%
Bithynia tentaculata (L.)	22.0%	6.0%	37.0%
Physa sp.			3.7%
Physa fontinalis (L.)			16.7%
Physa acuta group			3.7%
Lymnaea palustris (Muller)			
Lymnaea peregra (Muller)	16.0%	2.0%	37.0%
Lymnaea stagnalis (L.)			3.7%
Planorbidae			1.9%
Planorbis carinatus Muller	2.0%		3.7%
Planorbis planorbis (L.)	2.0%		1.9%
Anisus vortex (L.)			1.9%
Bathyomphalus contortus (L.)	2.0%		
Gyraulus albus (Muller)	4.0%	4.0%	20.4%
Armiger crista (L.)			
Ancylus fluviatilis Muller		6.0%	16.7%
Acroloxus lacustris (L.)			18.5%
Succinea sp.			
Unio sp.		10.0%	
Unio pictorum (L.)	18.0%	8.0%	
Unio tumidus Philipsson		14.0%	
Anodonta sp.		2.0%	
Anodonta anatina (L.)	18.0%	20.0%	1.9%
Anodonta cygnea (L.)		2.0%	
Sphaerium corneum (L.)	36.0%	16.0%	42.6%
Sphaerium lacustre (Muller)		2.0%	3.7%
Sphaerium rivicola (Lamarck)	18.0%	12.0%	1.9%
Sphaerium transversum (Say)			
Pisidium amnicum (Muller)	2.0%	2.0%	1.9%
Pisidium casertanum (Poli)		2.0%	5.6%
Pisidium henslowanum (Sheppard)	14.0%	8.0%	7.4%
Pisidium moitessierianum Paladilhe			
Pisidium nitidum Jenyns		2.0%	5.6%
Pisidium subtruncatum Malm		2.0%	
Pisidium supinum Schmidt	12.0%	10.0%	5.6%
Lumbriculidae	56.0%	52.0%	9.3%
Stylodrilus sp.			
Stylodrilus heringianus Claparede	4.0%	14.0%	
Lumbriculus group			
Enchytraeidae	2.0%		
Chaetogaster sp.			
Uncinais uncinata (Orsted)			
Ophidonais serpentina (Muller)			5.6%
Nais barbata Muller			

Species name	Margin	Mid-channel	Vegetation
Nais bretscheri Michaelsen			
Nais pardalis Piguet			
Nais simplex Piguet			5.6%
Nais communis group			
Stylaria lacustris (L.)	6.0%		46.3%
Tubificidae	30.0%	52.0%	18.5%
Tubifex ignotus (Stolc)	6.0%	2.0%	
Tubifex tubifex (Muller)		8.0%	
Limnodrilus cervix Brinkhurst	16.0%	10.0%	5.6%
Limnodrilus claparedeianus Ratzel			
Limnodrilus hoffmeisteri Claparede	42.0%	34.0%	9.3%
Limnodrilus profundicola (Verrill)	2.0%		
Limnodrilus udekemianus Claparede	20.0%	12.0%	3.7%
Psammoryctides barbatus (Grube)	36.0%	44.0%	11.1%
Potamothrix hammoniensis (Michaelsen)		6.0%	7.4%
Potamothrix moldaviensis (Vejdovsky & Mrazek	58.0%	40.0%	20.4%
Aulodrilus pluriseta (Piguet)	8.0%		22.2%
Rhyacodrilus coccineus (Vejdovsky)		2.0%	
Branchiura sowerbyi Beddard	8.0%	2.0%	
Lumbricidae	6.0%		
Piscicola geometra (L.)	2.0%	4.0%	
Theromyzon tessulatum (Muller)	4.0%		11.1%
Hemiclepsis marginata (Muller)			3.7%
Glossiphonia complanata (L.)	10.0%	14.0%	5.6%
Glossiphonia heteroclita (L.)	2.0%	4.0%	1.9%
Helobdella stagnalis (L.)	10.0%	16.0%	22.2%
Erpobdella sp.	4.0%	4.0%	13.0%
Erpobdella octoculata (L.)	6.0%	4.0%	7.4%
Dina lineata (Muller)	4.0%		
Trocheta subviridis Dutrochet	2.0%		
Hydracarina	72.0%	84.0%	64.8%
Argulus sp.			7.4%
Asellus aquaticus (L.)	28.0%	26.0%	61.1%
Asellus meridianus Racovitza			1.9%
Corophium curvispinum Sars	12.0%	4.0%	9.3%
Crangonyx pseudogracilis Bousfield	24.0%	10.0%	40.7%
Gammaridae	2.0%		1.9%
Gammarus sp.			
Gammarus pulex (L.)	12.0%	2.0%	29.6%
Baetidae		2.0%	
Baetis rhodani (Pictet)			1.9%
Baetis vernus Curtis	4.0%		24.1%
Baetis scambus group	4.0%		42.6%
Centroptilum luteolum (Muller)	36.0%		81.5%
Cloeon dipterum (L.)	6.0%		25.9%
Cloeon simile Eaton			18.5%
Procloeon bifidum Bengtsson	18.0%		74.1%
Heptagenia fuscogrisea (Retzius)			
Habrophlebia fusca (Curtis)			
Ephemera sp.			
Ephemera danica Muller		4.0%	
Ephemera vulgata L.	4.0%	2.0%	
Ephemerella ignita (Poda)		2.0%	9.3%
Caenis sp.	16.0%	24.0%	13.0%
Caenis horaria (L.)	2.0%		
Caenis luctuosa group	6.0%	24.0%	11.1%
Nemoura sp.		2.0%	
Leuctra geniculata (Stephens)		2.0%	
Platycnemis pennipes (Pallas)			1.9%
Coenagriidae			9.3%
Ischnura elegans (Van der Linden)			

Species name	Margin	Mid-channel	Vegetation
Enallagma cyathigerum (Charpentier)			
Coenagrion puella group			
Calopteryx sp.			1.9%
Calopteryx splendens (Harris)			
Calopteryx virgo (L.)			1.9%
Gomphus vulgatissimus (L.)			
Aphelocheirus aestivalis (Fabricius)		2.0%	
Notonecta sp.			1.9%
Notonecta glauca L.			
Notonecta maculata Fabricius			
Corixidae	4.0%	2.0%	13.0%
Micronecta sp.	6.0%	2.0%	1.9%
Micronecta (Micronecta) poweri (Douglas & Sco	2.0%		
Sigara (Sigara) sp.	2.0%		24.1%
Sigara (Subsigara) distincta (Fieber)			3.7%
Sigara (Subsigara) falleni (Fieber)			14.8%
Sigara (Subsigara) fossarum (Leach)			
Haliplidae	26.0%	18.0%	25.9%
Haliplus sp.			
Haliplus fluviatilis Aube			
Haliplus lineatocollis (Marsham)			
Dytiscidae	10.0%		37.0%
Laccophilus sp.			
Laccophilus hyalinus (Degeer)			
Hydroporus sp.	16.0%	8.0%	5.6%
Potamonectes depressus (Fabricius)			
Stictotarsus duodecimpustulatus (Fabricius)			
Platambus maculatus (L.)			
Dytiscus sp.			
Gyrinus distinctus Aube			
Gyrinus urinator Illiger			
Orectochilus villosus (Muller)			
Hydrophilidae	6.0%	4.0%	3.7%
Helophorus sp.	2.0%		
Helophorus (Atracthelophorus) brevipalpis Bedel			
Dryops sp.			1.9%
Elmis aenea (Muller)		2.0%	
Oulimnius sp.		2.0%	
Oulimnius tuberculatus (Muller)	20.0%	24.0%	11.1%
Sialis lutaria (L.)	6.0%	12.0%	5.6%
Sialis nigripes Pictet		8.0%	
Sisyra sp.			
Hydroptilidae		4.0%	7.4%
Agraylea multipunctata Curtis	2.0%		
Hydroptila sp.	4.0%	4.0%	13.0%
Oxyethira sp.	2.0%		
Ithytrichia sp.			
Lype sp.			
Tinodes waeneri (L.)	2.0%		
Ecnomus tenellus (Rambur)			
Polycentropodidae		2.0%	
Cyrnus flavidus Mclachlan			5.6%
Cyrnus trimaculatus (Curtis)	50.0%	60.0%	13.0%
Neureclipsis bimaculata (L.)		2.0%	9.3%
Plectrocnemia sp.			3.7%
Plectrocnemia geniculata Mclachlan	2.0%		1.9%
Polycentropus sp.	4.0%		20.4%
Polycentropus flavomaculatus (Pictet)			
Polycentropus irroratus (Curtis)			
Hydropsyche pellucidula (Curtis)			
Phryganea sp.	4.0%	4.0%	11.1%

Species name	Margin	Mid-channel	Vegetation
Brachycentrus subnubilus Curtis			
Lepidostoma hirtum (Fabricius)			
Allogamus auricollis (Pictet)	2.0%		
Halesus sp.			
Anabolia nervosa (Curtis)	4.0%		3.7%
Limnephilus sp.			
Limnephilus lunatus Curtis			
Potamophylax group			
Goera pilosa (Fabricius)	2.0%	2.0%	
Silo sp.		2.0%	
Molannidae		2.0%	
Molanna angustata Curtis	12.0%	4.0%	3.7%
Leptoceridae	4.0%	8.0%	3.7%
Athripsodes aterrimus (Stephens)			
Athripsodes cinereus (Curtis)			
Ceraclea sp.			1.9%
Ceraclea annulicornis (Stephens)			
Mystacides sp.	12.0%	10.0%	9.3%
Mystacides azurea (L.)			
Mystacides longicornis (L.)			1.9%
Mystacides nigra (L.)			1.9%
Oecetis lacustris (Pictet)			
Oecetis ochracea (Curtis)			
Diptera	16.0%	8.0%	13.0%
Tipulidae			
Tipula sp.			
Tipula (Yamatotipula) montium group			
Ceratopogonidae			
Simulium (Boophthora) erythrocephalum (de Ge	2.0%		1.9%
Clinotanypus nervosus (Meigen)		4.0%	1.9%
Apsectrotanypus trifascipennis (Zetterstedt)		2.0%	
Macropelopia sp.	10.0%	18.0%	
Procladius sp.	26.0%	38.0%	14.8%
Ablabesmyia sp.	22.0%	24.0%	13.0%
Thienemannimyia group	4.0%	6.0%	3.7%
Natarsia sp.	2.0%		
Paramerina sp.	4.0%		
Potthastia gaedii group			
Potthastia longimana group		2.0%	
Prodiamesa olivacea (Meigen)	32.0%	22.0%	11.1%
Orthocladiinae			
Brillia sp.			3.7%
Cricotopus sp.	46.0%	4.0%	68.5%
Cricotopus (Cricotopus) sp.			3.7%
Eukiefferiella sp.			1.9%
Cricotopus group			
Nanocladius sp.			3.7%
Orthocladius sp.	16.0%	6.0%	18.5%
Paracladius sp.			
Psectrocladius sp.			
Psectrocladius (Allopsectrocladius) obvius (Walker)			
Synorthocladius semivirens (Kieffer)			1.9%
Chaetocladius sp.			
Corynoneura sp.			3.7%
Limnophyes sp.	6.0%	2.0%	5.6%
Thienemanniella sp.			14.8%
Chironomus sp.	34.0%	70.0%	5.6%
Cladopelma sp.			
Cryptochironomus sp.	30.0%	34.0%	9.3%
Cryptotendipes sp.		14.0%	
Dicrotendipes sp.			
Dicrotendipes (Limnochironomus) sp.	78.0%	38.0%	35.2%

Species name	Margin	Mid-channel	Vegetation
Endochironomus sp.	8.0%	2.0%	1.9%
Glyptotendipes sp.	32.0%	14.0%	1.9%
Harnischia sp.	2.0%		
Kiefferulus tendipediformis (Goetghebuer)			
Microchironomus sp.		6.0%	
Microtendipes sp.	16.0%	12.0%	1.9%
Parachironomus sp.	2.0%		13.0%
Paracladopelma sp.	14.0%	20.0%	7.4%
Paralauterborniella sp.			
Paralauterborniella nigrohalteralis (Malloch)			
Paratendipes sp.	18.0%	10.0%	11.1%
Phaenopsectra sp.			7.4%
Polypedilum sp.			
Polypedilum (Pentapedilum) sp.	54.0%	34.0%	24.1%
Polypedilum (Polypedilum) sp.	8.0%	14.0%	
Stenochironomus sp.			
Stictochironomus sp.	2.0%	2.0%	
Xenochironomus xenolabis (Kieffer)	4.0%	2.0%	1.9%
Cladotanytarsus sp.	34.0%	44.0%	3.7%
Micropsectra sp.	2.0%		1.9%
Paratanytarsus sp.			
Rheotanytarsus sp.	12.0%	18.0%	29.6%
Stempellinella sp.			
Tanytarsus sp.	12.0%	10.0%	13.0%
Micropsectra group			
Chrysops sp.			
Muscidae			
Total no of samples	**50**	**50**	**54**

APPENDIX 3.6 The frequency of occurrence of standard macro-invertebrate taxa in samples from eight distinct habitats: clay, silt, gravel, bedrock/concrete, detritus/organic matter, emergent vegetation, submerged vegetation and floating vegetation.

Species name	HABITAT							
	Clay	Silt	Gravel	Bedrock/concrete	Detritus	Emergent vegetation	Submerged vegetation	Floating vegetation
Spongillidae	3%		4%		20%		3%	
Hydra sp.								6%
Planaria torva (Muller)			2%				3%	
Polycelis tenuis (Ijima)							3%	
Dugesia tigrina (Girard)	12%		2%			50%	19%	12%
Dugesia polychroa group			2%				6%	
Dendrocoelum lacteum (Muller)			2%					
Prostoma sp.							3%	
Nematoda	15%	60%	55%		60%		6%	
Ectoprocta	6%		8%		20%		10%	12%
Theodoxus fluviatilis (L.)	3%	20%	6%				10%	6%
Viviparus viviparus (L.)	15%	20%	14%		20%		10%	12%
Valvata sp.			2%				16%	12%
Valvata piscinalis (Muller)			2%		20%			
Potamopyrgus jenkinsi (Smith)	68%	60%	51%	100%	60%	50%	65%	65%
Bithynia leachii (Sheppard)	6%		2%				32%	6%
Bithynia tentaculata (L.)	18%		4%	67%	20%		42%	41%
Physa sp.							3%	
Physa fontinalis (L.)						50%	10%	24%
Physa acuta group								12%
Lymnaea peregra (Muller)	18%		2%			50%	19%	59%
Lymnaea stagnalis (L.)							3%	6%
Planorbidae							3%	
Planorbis carinatus Muller			2%				3%	6%
Planorbis planorbis (L.)	3%						3%	
Anisus vortex (L.)						25%		
Bathyomphalus contortus (L.)			2%					
Gyraulus albus (Muller)	3%		6%			50%	10%	24%
Ancylus fluviatilis Muller			6%			25%	19%	12%
Acroloxus lacustris (L.)							29%	
Unio sp.			10%					
Unio pictorum (L.)	9%	40%	12%		20%			
Unio tumidus Philipsson			14%					
Anodonta sp.			2%					
Anodonta anatina (L.)	15%	40%	20%		20%		3%	
Anodonta cygnea (L.)			2%					
Sphaerium corneum (L.)	32%	40%	18%		20%		52%	35%
Sphaerium lacustre (Muller)			2%				6%	
Sphaerium rivicola (Lamarck)	12%		14%		40%		3%	
Pisidium amnicum (Muller)	3%		2%				3%	
Pisidium casertanum (Poli)			2%				3%	12%
Pisidium henslowanum (Sheppard)	15%		10%		20%		10%	6%
Pisidium nitidum Jenyns		20%					3%	6%
Pisidium subtruncatum Malm					20%			
Pisidium supinum Schmidt	6%		16%				3%	6%

Species name	HABITAT							
	Clay	Silt	Gravel	Bedrock/concrete	Detritus	Emergent vegetation	Submerged vegetation	Floating vegetation
Lumbriculidae	59%		57%	67%	20%		16%	
Stylodrilus heringianus Claparede	3%	20%	10%	33%	20%			
Enchytraeidae			2%					
Ophidonais serpentina (Muller)						25%	6%	
Nais simplex Piguet						25%	3%	6%
Stylaria lacustris (L.)	9%					50%	42%	47%
Tubificidae	29%	40%	49%	67%	40%	25%	19%	18%
Tubifex ignotus (Stolc)	3%		4%					
Tubifex tubifex (Muller)			6%		20%			
Limnodrilus cervix Brinkhurst	9%	40%	12%		20%		6%	
Limnodrilus hoffmeisteri Claparede	35%	60%	33%		60%		13%	
Limnodrilus profundicola (Verrill)			2%					
Limnodrilus udekemianus Claparede	9%	40%	14%		40%		3%	
Psammoryctides barbatus (Grube)	38%	60%	39%	100%	20%	25%	16%	
Potamothrix hammoniensis (Michaelsen)			6%				13%	
Potamothrix moldaviensis (Vejdovsky & Mrazek	53%	40%	51%		60%		23%	18%
Aulodrilus pluriseta (Piguet)	6%	20%					32%	6%
Rhyacodrilus coccineus (Vejdovsky)			2%					
Branchiura sowerbyi Beddard	3%		6%					
Lumbricidae	6%		2%					
Piscicola geometra (L.)	3%		4%					
Theromyzon tessulatum (Muller)	3%		2%			25%	3%	24%
Hemiclepsis marginata (Muller)							3%	6%
Glossiphonia complanata (L.)	12%	20%	10%		20%			12%
Glossiphonia heteroclita (L.)			2%		40%		3%	
Helobdella stagnalis (L.)	12%	20%	14%		20%	25%	26%	18%
Erpobdella sp.		40%	4%				10%	18%
Erpobdella octoculata (L.)	3%		6%				6%	12%
Dina lineata (Muller)	6%							
Trocheta subviridis Dutrochet	3%							
Hydracarina	79%	80%	80%	67%	40%	75%	68%	65%
Argulus sp.							3%	12%
Asellus aquaticus (L.)	26%	20%	24%	33%	60%	50%	77%	29%
Asellus meridianus Racovitza							3%	
Corophium curvispinum Sars	18%		4%			25%	10%	6%
Crangonyx pseudogracilis Bousfield	26%		12%		20%	25%	58%	18%
Gammaridae	3%						3%	
Gammarus pulex (L.)	15%		2%		20%	25%	29%	24%
Baetidae			2%					
Baetis rhodani (Pictet)							3%	
Baetis vernus Curtis	6%					25%	23%	24%
Baetis scambus group	6%						45%	47%
Centroptilum luteolum (Muller)	47%		2%			75%	90%	65%
Cloeon dipterum (L.)	3%	40%				25%	19%	35%
Cloeon simile Eaton						25%	6%	35%

Species name	HABITAT							
	Clay	Silt	Gravel	Bedrock/concrete	Detritus	Emergent vegetation	Submerged vegetation	Floating vegetation
Procloeon bifidum Bengtsson	24%					75%	81%	59%
Ephemera danica Muller			4%					
Ephemera vulgata L.	6%		2%					
Ephemerella ignita (Poda)			2%			25%	6%	12%
Caenis sp.	15%		20%	100%	20%	25%	16%	6%
Caenis horaria (L.)	3%							
Caenis luctuosa group	9%	20%	20%				10%	6%
Nemoura sp.	3%							
Leuctra geniculata (Stephens)			2%					
Platycnemis pennipes (Pallas)							3%	
Coenagriidae							10%	6%
Calopteryx virgo (L.)								6%
Aphelocheirus aestivalis (Fabricius)			2%					
Notonecta sp.						25%		
Corixidae	3%		4%				19%	6%
Micronecta sp.	9%	20%					3%	
Micronecta (Micronecta) poweri (Douglas & Sco	3%							
Sigara (Sigara) sp.	3%					25%	13%	41%
Sigara (Subsigara) distincta (Fieber)								12%
Sigara (Subsigara) falleni (Fieber)							10%	24%
Haliplidae	21%	20%	22%		20%	50%	23%	24%
Dytiscidae	9%		2%		20%	25%	45%	24%
Hydroporus sp.	18%		8%		20%	25%	3%	6%
Hydrophilidae	6%		6%				3%	6%
Helophorus sp.		20%						
Dryops sp.							3%	
Elmis aenea (Muller)			2%					
Oulimnius sp.			2%					
Oulimnius tuberculatus (Muller)	24%		20%	67%	20%		13%	12%
Sialis lutaria (L.)	12%		8%		20%		10%	
Sialis nigripes Pictet			8%					
Hydroptilidae			4%				10%	
Agraylea multipunctata Curtis	3%							
Hydroptila sp.	6%		4%			25%	13%	12%
Oxyethira sp.	3%							
Polycentropodidae			2%					
Cyrnus flavidus Mclachlan								18%
Cyrnus trimaculatus (Curtis)	59%	40%	63%			25%	6%	18%
Neureclipsis bimaculata (L.)				33%		25%	6%	6%
Plectrocnemia sp.							3%	6%
Plectrocnemia geniculata Mclachlan	3%							6%
Polycentropus sp.	6%					25%	10%	35%
Phryganea sp.			4%		20%		16%	6%
Allogamus auricollis (Pictet)	3%							
Anabolia nervosa (Curtis)	3%	20%					6%	

Species name	HABITAT							
	Clay	Silt	Gravel	Bedrock/concrete	Detritus	Emergent vegetation	Submerged vegetation	Floating vegetation
Goera pilosa (Fabricius)			4%					
Silo sp.			2%					
Molannidae			2%					
Molanna angustata Curtis	9%		6%		20%		3%	6%
Leptoceridae	6%		6%		20%		6%	
Ceraclea sp.							3%	
Mystacides sp.	21%		8%				16%	
Mystacides longicornis (L.)								6%
Mystacides nigra (L.)							3%	
Diptera	21%	40%	6%			25%	10%	12%
Simulium (Boophthora) erythrocephalum (de Ge			2%					6%
Clinotanypus nervosus (Meigen)			4%				3%	
Apsectrotanypus trifascipennis (Zetterstedt)	3%							
Macropelopia sp.	9%		16%		20%			
Procladius sp.	21%	60%	39%		40%	25%	19%	
Ablabesmyia sp.	18%	20%	24%	67%		25%	3%	24%
Thienemannimyia group		20%	6%	33%				12%
Natarsia sp.	3%							
Paramerina sp.	3%	20%						
Potthastia longimana group			2%					
Prodiamesa olivacea (Meigen)	24%		31%		40%		13%	6%
Brillia sp.							3%	6%
Cricotopus sp.	50%		8%		60%	100%	68%	71%
Cricotopus (Cricotopus) sp.							3%	6%
Eukiefferiella sp.							3%	
Nanocladius sp.								12%
Orthocladius sp.	21%		6%	33%		50%	6%	29%
Synorthocladius semivirens (Kieffer)							3%	
Corynoneura sp.								12%
Limnophyes sp.	3%		6%			25%	6%	
Thienemanniella sp.							19%	12%
Chironomus sp.	29%	60%	67%	67%	60%		6%	
Cryptochironomus sp.	21%		45%		20%		6%	12%
Cryptotendipes sp.			10%		40%			
Dicrotendipes (Limnochironomus) sp.	88%	60%	41%	33%	40%	75%	29%	35%
Endochironomus sp.		20%	6%				3%	
Glyptotendipes sp.	38%		16%		20%		3%	
Harnischia sp.	3%							
Microchironomus sp.		20%	4%					
Microtendipes sp.	21%		14%				3%	
Parachironomus sp.	3%					25%	10%	18%
Paracladopelma sp.	15%	20%	18%		40%		10%	
Paratendipes sp.	15%	40%	12%		20%		10%	12%
Phaenopsectra sp.						25%	6%	6%
Polypedilum (Pentapedilum) sp.	53%	60%	31%		80%		19%	29%

Species name	HABITAT							
	Clay	Silt	Gravel	Bedrock/concrete	Detritus	Emergent vegetation	Submerged vegetation	Floating vegetation
Polypedilum (Polypedilum) sp.	9%		16%					
Stictochironomus sp.			4%					
Xenochironomus xenolabis (Kieffer)	3%				20%			6%
Cladotanytarsus sp.	38%		47%	33%			3%	
Micropsectra sp.	3%							6%
Rheotanytarsus sp.	15%		18%			25%	19%	47%
Tanytarsus sp.	12%	40%	8%		20%		19%	
No of samples for habitat	**34**	**5**	**49**	**3**	**5**	**4**	**31**	**17**

APPENDIX 3.7 The frequency of occurrence of standard with macro-invertebrate taxa in samples where a given emergent macrophyte was present, as the dominant <u>or</u> non-dominant species.

Taxon	Typha	Scirpus	Phragmites	S.erectum	Acorus	Iris	Glyceria	Carex
Spongillidae		6%		14%				
Hydra sp.								
Planaria torva (Muller)				14%				
Polycelis tenuis (Ijima)		6%		14%				
Dugesia tigrina (Girard)	33%	6%	40%	14%	33%	100%		50%
Dugesia polychroa group		6%		29%				
Prostoma sp.		6%		14%				
Nematoda		6%						
Ectoprocta		13%			33%			
Theodoxus fluviatilis (L.)		13%	20%		33%	100%		50%
Viviparus viviparus (L.)		13%					100%	
Valvata sp.	33%	6%		14%	67%		100%	
Potamopyrgus jenkinsi (Smith)	67%	63%	40%	71%	100%	100%	100%	100%
Bithynia leachii (Sheppard)		38%	20%	29%	67%	100%		100%
Bithynia tentaculata (L.)		25%	20%	29%	100%	100%	100%	50%
Physa sp.		6%		14%				
Physa fontinalis (L.)		13%		14%			100%	
Physa acuta group								
Lymnaea peregra (Muller)		19%	20%	14%	33%		100%	
Lymnaea stagnalis (L.)							100%	
Planorbidae		6%		14%				
Planorbis carinatus Muller							100%	
Planorbis planorbis (L.)							100%	
Anisus vortex (L.)								
Gyraulus albus (Muller)	33%	6%			33%		100%	
Ancylus fluviatilis Muller	67%	25%	20%		33%			
Acroloxus lacustris (L.)		25%	20%	14%	67%	100%	100%	100%
Anodonta anatina (L.)			20%					
Sphaerium corneum (L.)		50%	40%	57%	67%	100%		100%
Sphaerium lacustre (Muller)		6%		29%				
Sphaerium rivicola (Lamarck)								
Pisidium amnicum (Muller)		6%						
Pisidium casertanum (Poli)					33%	100%		50%
Pisidium henslowanum (Sheppard)		6%		29%				50%
Pisidium nitidum Jenyns								
Pisidium supinum Schmidt			20%					
Lumbriculidae		19%	20%	29%				
Ophidonais serpentina (Muller)	33%	6%	20%		33%			
Nais simplex Piguet		6%						
Stylaria lacustris (L.)	67%	50%	60%	14%	67%			
Tubificidae	33%	19%	20%	14%	33%	100%	100%	50%
Limnodrilus cervix Brinkhurst								50%
Limnodrilus hoffmeisteri Claparede		6%	20%					50%
Limnodrilus udekemianus Claparede								50%
Psammoryctides barbatus (Grube)	67%	6%		14%	33%		100%	50%
Potamothrix hammoniensis (Michaelsen)		13%		29%				50%
Potamothrix moldaviensis (Vejdovsky & Mrazek)		13%	20%	29%			100%	50%
Aulodrilus pluriseta (Piguet)	33%	19%	20%	43%	33%	100%	100%	100%
Theromyzon tessulatum (Muller)				14%				
Hemiclepsis marginata (Muller)		6%		14%				
Glossiphonia complanata (L.)								
Glossiphonia heteroclita (L.)					33%			
Helobdella stagnalis (L.)	33%	19%		57%	100%	100%		50%
Erpobdella sp.		6%	20%				100%	
Erpobdella octoculata (L.)					67%	100%		50%

Taxon	Typha	Scirpus	Phragmites	S.erectum	Acorus	Iris	Glyceria	Carex
Hydracarina	100%	63%	40%	71%	100%	100%	100%	100%
Argulus sp.							100%	
Asellus aquaticus (L.)	100%	63%	80%	71%	100%	100%	100%	100%
Asellus meridianus Racovitza		6%		14%				
Corophium curvispinum Sars		6%	20%	14%				
Crangonyx pseudogracilis Bousfield	67%	50%	20%	71%	100%	100%	100%	100%
Gammaridae		6%		14%				
Gammarus pulex (L.)		19%	20%	43%	33%	100%	100%	100%
Baetis rhodani (Pictet)		6%						
Baetis vernus Curtis	33%	31%	20%	29%				
Baetis scambus group		69%	20%	57%				
Centroptilum luteolum (Muller)	100%	81%	100%	100%	100%	100%	100%	100%
Cloeon dipterum (L.)		19%		14%	33%	100%	100%	50%
Cloeon simile Eaton		6%					100%	
Procloeon bifidum Bengtsson	100%	75%	80%	71%	100%	100%	100%	50%
Ephemerella ignita (Poda)		13%						
Caenis sp.	100%	6%		14%	67%			
Caenis luctuosa group		19%		14%				
Platycnemis pennipes (Pallas)		6%						
Coenagriidae		6%		14%	67%			
Calopteryx virgo (L.)								
Notonecta sp.								
Corixidae		25%	20%					
Micronecta sp.				14%				
Sigara (Sigara) sp.		6%		14%	33%	100%	100%	50%
Sigara (Subsigara) distincta (Fieber)								
Sigara (Subsigara) falleni (Fieber)		6%		29%	33%	100%		50%
Haliplidae		19%	20%	57%			100%	
Dytiscidae		50%		71%	67%	100%	100%	50%
Hydroporus sp.		6%						
Hydrophilidae		6%						
Dryops sp.				14%				
Oulimnius tuberculatus (Muller)		6%	20%	29%	33%	100%		50%
Sialis lutaria (L.)				14%				50%
Hydroptilidae		6%		14%	33%			
Hydroptila sp.		6%	60%	14%				
Cyrnus flavidus Mclachlan								
Cyrnus trimaculatus (Curtis)	67%	6%		14%				
Neureclipsis bimaculata (L.)	33%	6%	20%		33%			
Plectrocnemia sp.		6%		14%				
Plectrocnemia geniculata Mclachlan								
Polycentropus sp.		19%		14%				
Phryganea sp.		13%	20%	29%			100%	
Anabolia nervosa (Curtis)		6%		14%	33%			
Molanna angustata Curtis							100%	
Leptoceridae		6%	20%	14%				
Ceraclea sp.					33%	100%		50%
Mystacides sp.	33%	6%	20%				100%	
Mystacides longicornis (L.)								
Mystacides nigra (L.)					33%	100%		50%
Diptera		13%		29%				
Simulium (Boophthora) erythrocephalum (de Geer)								
Clinotanypus nervosus (Meigen)							100%	
Procladius sp.	33%	13%	20%	14%	33%		100%	
Ablabesmyia sp.			20%					

Taxon	Typha	Scirpus	Phragmites	S.erectum	Acorus	Iris	Glyceria	Carex
Thienemannimyia group								
Prodiamesa olivacea (Meigen)		6%					100%	50%
Brillia sp.	33%							
Cricotopus sp.	100%	75%	40%	57%	100%	100%	100%	50%
Cricotopus (Cricotopus) sp.		6%		14%				
Eukiefferiella sp.		6%						
Nanocladius sp.								
Orthocladius sp.		6%			33%	100%		50%
Synorthocladius semivirens (Kieffer)		6%						
Corynoneura sp.								
Limnophyes sp.	67%	6%						
Thienemanniella sp.	33%	31%	20%	29%				
Chironomus sp.		6%		14%				50%
Cryptochironomus sp.		6%		14%				50%
Dicrotendipes (Limnochironomus) sp.	100%	13%	40%		33%	100%	100%	50%
Endochironomus sp.							100%	
Glyptotendipes sp.					33%	100%		50%
Microtendipes sp.		6%		14%				
Parachironomus sp.		19%		14%				
Paracladopelma sp.		13%		29%				50%
Paratendipes sp.			20%					50%
Phaenopsectra sp.	33%	6%	20%		33%			
Polypedilum (Pentapedilum) sp.		19%	20%	29%				50%
Xenochironomus xenolabis (Kieffer)								
Cladotanytarsus sp.								
Micropsectra sp.								
Rheotanytarsus sp.		19%	20%	29%	33%		100%	
Tanytarsus sp.	33%	13%	20%	14%				50%
	3	**16**	**5**	**7**	**3**	**1**	**1**	**2**

APPENDIX 3.8 The frequency of occurrence of standard with macro-invertebrate taxa in samples where a given submerged macrophyte was present, as the dominant or non-dominant species.

Taxa	S.erectum	S.emersum	Myriophyllum	Cladophora
Polycentropus sp.			100%	100%
Phryganea sp.				
Anabolia nervosa (Curtis)				
Molanna angustata Curtis				
Leptoceridae				
Ceraclea sp.				
Mystacides sp.	100%			
Mystacides longicornis (L.)				
Mystacides nigra (L.)				
Diptera		50%		100%
Simulium (Boophthora) erythrocephalum (de Geer)				
Clinotanypus nervosus (Meigen)				
Procladius sp.	100%			
Ablabesmyia sp.			100%	100%
Thienemannimyia group				100%
Prodiamesa olivacea (Meigen)	100%			
Brillia sp.				
Cricotopus sp.		100%	100%	100%
Cricotopus (Cricotopus) sp.				
Eukiefferiella sp.				
Nanocladius sp.				
Orthocladius sp.		100%		100%
Synorthocladius semivirens (Kieffer)				
Corynoneura sp.				
Limnophyes sp.				
Thienemanniella sp.				
Chironomus sp.				
Cryptochironomus sp.				
Dicrotendipes (Limnochironomus) sp.	100%	50%	100%	100%
Endochironomus sp.				
Glyptotendipes sp.				
Microtendipes sp.				
Parachironomus sp.			100%	
Paracladopelma sp.				
Paratendipes sp.	100%			
Phaenopsectra sp.				
Polypedilum (Pentapedilum) sp.	100%			100%
Xenochironomus xenolabis (Kieffer)				
Cladotanytarsus sp.	100%			
Micropsectra sp.				
Rheotanytarsus sp.			100%	100%
Tanytarsus sp.	100%			
	1	2	1	1

Taxa	S.erectum	S.emersum	Myriophyllum	Cladophora
Theromyzon tessulatum (Muller)		50%		
Hemiclepsis marginata (Muller)				100%
Glossiphonia complanata (L.)				
Glossiphonia heteroclita (L.)				
Helobdella stagnalis (L.)	100%			100%
Erpobdella sp.				100%
Erpobdella octoculata (L.)				
Hydracarina	100%	50%	100%	100%
Argulus sp.				
Asellus aquaticus (L.)			100%	100%
Asellus meridianus Racovitza				
Corophium curvispinum Sars		50%		100%
Crangonyx pseudogracilis Bousfield	100%			
Gammaridae				
Gammarus pulex (L.)			100%	100%
Baetis rhodani (Pictet)				
Baetis vernus Curtis			100%	
Baetis scambus group				100%
Centroptilum luteolum (Muller)	100%	50%	100%	100%
Cloeon dipterum (L.)			100%	100%
Cloeon simile Eaton			100%	100%
Procloeon bifidum Bengtsson	100%	50%	100%	
Ephemerella ignita (Poda)			100%	
Caenis sp.				
Caenis luctuosa group				
Platycnemis pennipes (Pallas)				
Coenagriidae				
Calopteryx virgo (L.)				
Notonecta sp.		50%		
Corixidae	100%			
Micronecta sp.				
Sigara (Sigara) sp.			100%	100%
Sigara (Subsigara) distincta (Fieber)				
Sigara (Subsigara) falleni (Fieber)				
Haliplidae		50%	100%	100%
Dytiscidae			100%	100%
Hydroporus sp.			100%	100%
Hydrophilidae				
Dryops sp.				
Oulimnius tuberculatus (Muller)				100%
Sialis lutaria (L.)	100%			
Hydroptilidae				
Hydroptila sp.			100%	100%
Cyrnus flavidus Mclachlan				
Cyrnus trimaculatus (Curtis)				
Neureclipsis bimaculata (L.)				
Plectrocnemia sp.				
Plectrocnemia geniculata Mclachlan				

Taxa	S.erectum	S.emersum	Myriophyllum	Cladophora
Spongillidae				
Hydra sp.				
Planaria torva (Muller)				
Polycelis tenuis (Ijima)				
Dugesia tigrina (Girard)	100%	50%		100%
Dugesia polychroa group				
Prostoma sp.				
Nematoda	100%			
Ectoprocta				
Theodoxus fluviatilis (L.)				
Viviparus viviparus (L.)				
Valvata sp.				100%
Potamopyrgus jenkinsi (Smith)	100%	50%		100%
Bithynia leachii (Sheppard)	100%			
Bithynia tentaculata (L.)	100%			100%
Physa sp.				
Physa fontinalis (L.)		50%	100%	
Physa acuta group				
Lymnaea peregra (Muller)		50%	100%	100%
Lymnaea stagnalis (L.)				
Planorbidae				
Planorbis carinatus Muller				
Planorbis planorbis (L.)				
Anisus vortex (L.)		50%		
Gyraulus albus (Muller)		50%		
Ancylus fluviatilis Muller				
Acroloxus lacustris (L.)				
Anodonta anatina (L.)				
Sphaerium corneum (L.)	100%			100%
Sphaerium lacustre (Muller)				
Sphaerium rivicola (Lamarck)	100%			
Pisidium amnicum (Muller)				
Pisidium casertanum (Poli)				
Pisidium henslowanum (Sheppard)				
Pisidium nitidum Jenyns				
Pisidium supinum Schmidt				
Lumbriculidae				
Ophidonais serpentina (Muller)				
Nais simplex Piguet			100%	
Stylaria lacustris (L.)			100%	100%
Tubificidae				
Limnodrilus cervix Brinkhurst	100%			
Limnodrilus hoffmeisteri Claparede	100%			
Limnodrilus udekemianus Claparede				
Psammoryctides barbatus (Grube)				
Potamothrix hammoniensis (Michaelsen)	100%			
Potamothrix moldaviensis (Vejdovsky & Mrazek)	100%			
Aulodrilus pluriseta (Piguet)	100%			

APPENDIX 3.9 The frequency of occurrence of standard with macro-invertebrate taxa in samples where a given floating macrophyte was present, as the dominant <u>or</u> non-dominant species.

Taxon	Nuphar	Pot.pectinatus	Lemna
Spongillidae			
Hydra sp.	10%		
Planaria torva (Muller)			
Polycelis tenuis (Ijima)			
Dugesia tigrina (Girard)	10%	13%	
Dugesia polychroa group			
Prostoma sp.			
Nematoda			
Ectoprocta	10%	13%	
Theodoxus fluviatilis (L.)	10%		
Viviparus viviparus (L.)	10%	13%	
Valvata sp.		25%	
Potamopyrgus jenkinsi (Smith)	50%	75%	100%
Bithynia leachii (Sheppard)	10%		
Bithynia tentaculata (L.)	50%	38%	
Physa sp.			
Physa fontinalis (L.)	10%	38%	
Physa acuta group		25%	100%
Lymnaea peregra (Muller)	70%	38%	100%
Lymnaea stagnalis (L.)	10%	.	
Planorbidae			
Planorbis carinatus Muller		13%	
Planorbis planorbis (L.)			
Anisus vortex (L.)			
Gyraulus albus (Muller)	20%	25%	
Ancylus fluviatilis Muller	20%		
Acroloxus lacustris (L.)			
Anodonta anatina (L.)			
Sphaerium corneum (L.)	10%	75%	100%
Sphaerium lacustre (Muller)			
Sphaerium rivicola (Lamarck)			
Pisidium amnicum (Muller)			
Pisidium casertanum (Poli)		25%	
Pisidium henslowanum (Sheppard)		13%	
Pisidium nitidum Jenyns		25%	
Pisidium supinum Schmidt		13%	
Lumbriculidae			
Ophidonais serpentina (Muller)			
Nais simplex Piguet	10%		
Stylaria lacustris (L.)	50%	38%	
Tubificidae	10%	25%	100%
Limnodrilus cervix Brinkhurst			
Limnodrilus hoffmeisteri Claparede			
Limnodrilus udekemianus Claparede			
Psammoryctides barbatus (Grube)			
Potamothrix hammoniensis (Michaelsen)			
Potamothrix moldaviensis (Vejdovsky & Mrazek		38%	100%
Aulodrilus pluriseta (Piguet)		13%	

Taxon	Nuphar	Pot.pectinatus	Lemna
Theromyzon tessulatum (Muller)	40%		
Hemiclepsis marginata (Muller)		13%	
Glossiphonia complanata (L.)		25%	100%
Glossiphonia heteroclita (L.)			
Helobdella stagnalis (L.)	10%	25%	100%
Erpobdella sp.	20%	13%	
Erpobdella octoculata (L.)	20%		
Hydracarina	60%	63%	100%
Argulus sp.		25%	100%
Asellus aquaticus (L.)	10%	63%	100%
Asellus meridianus Racovitza			
Corophium curvispinum Sars		13%	
Crangonyx pseudogracilis Bousfield	20%	13%	
Gammaridae			
Gammarus pulex (L.)	10%	50%	
Baetis rhodani (Pictet)			
Baetis vernus Curtis	10%	38%	
Baetis scambus group	50%	50%	
Centroptilum luteolum (Muller)	50%	88%	100%
Cloeon dipterum (L.)		88%	
Cloeon simile Eaton	10%	63%	
Procloeon bifidum Bengtsson	70%	50%	100%
Ephemerella ignita (Poda)	10%	13%	
Caenis sp.	10%		
Caenis luctuosa group		13%	
Platycnemis pennipes (Pallas)			
Coenagriidae	10%		
Calopteryx virgo (L.)	10%		
Notonecta sp.			
Corixidae	10%		
Micronecta sp.			
Sigara (Sigara) sp.		100%	100%
Sigara (Subsigara) distincta (Fieber)		25%	
Sigara (Subsigara) falleni (Fieber)		50%	100%
Haliplidae		50%	
Dytiscidae		63%	100%
Hydroporus sp.		13%	
Hydrophilidae		13%	
Dryops sp.			
Oulimnius tuberculatus (Muller)	10%	13%	
Sialis lutaria (L.)			
Hydroptilidae		13%	
Hydroptila sp.	10%	13%	
Cyrnus flavidus Mclachlan	30%		
Cyrnus trimaculatus (Curtis)	30%		
Neureclipsis bimaculata (L.)	10%		
Plectrocnemia sp.	10%		
Plectrocnemia geniculata Mclachlan	10%		

Taxon	Nuphar	Pot.pectinatus	Lemna
Polycentropus sp.	50%	13%	
Phryganea sp.	10%		
Anabolia nervosa (Curtis)			
Molanna angustata Curtis		13%	100%
Leptoceridae			
Ceraclea sp.			
Mystacides sp.			
Mystacides longicornis (L.)		13%	
Mystacides nigra (L.)			
Diptera		38%	
Simulium (Boophthora) erythrocephalum (de Ge	10%		
Clinotanypus nervosus (Meigen)			
Procladius sp.			
Ablabesmyia sp.	20%	25%	
Thienemannimyia group	10%	13%	
Prodiamesa olivacea (Meigen)		13%	100%
Brillia sp.	10%		
Cricotopus sp.	50%	100%	100%
Cricotopus (Cricotopus) sp.	10%		
Eukiefferiella sp.			
Nanocladius sp.	20%		
Orthocladius sp.	10%	50%	100%
Synorthocladius semivirens (Kieffer)			
Corynoneura sp.	20%		
Limnophyes sp.			
Thienemanniella sp.	20%		
Chironomus sp.			
Cryptochironomus sp.	10%	13%	100%
Dicrotendipes (Limnochironomus) sp.	40%	38%	
Endochironomus sp.			
Glyptotendipes sp.			
Microtendipes sp.			
Parachironomus sp.	30%		
Paracladopelma sp.			
Paratendipes sp.		25%	
Phaenopsectra sp.	10%		
Polypedilum (Pentapedilum) sp.	10%	50%	100%
Xenochironomus xenolabis (Kieffer)	10%		
Cladotanytarsus sp.			
Micropsectra sp.		13%	
Rheotanytarsus sp.	40%	50%	
Tanytarsus sp.			
	10	**8**	**1**

APPENDIX 3.10 The occurrence of each taxon with national conservation status in the macro-invertebrate data-base.

Notable taxa recorded within database

03-Apr-97

Species Gyraulus acronicus (Ferussac) has notability code(s) RDB 2 and is found in the following samples:

Reach ID: TH23 **Reach name:** Sandford

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
49	Abingdon Weir	450400	197200	28/07/92	2	1
140	Radley	453800	199000	20/07/92	2	1

Species Pisidium moitessierianum Paladilhe has notability code(s) NB and is found in the following samples:

Reach ID: TH16 **Reach name:** Northmoor

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
144	Bablock Hythe	443500	204200	09/05/84	1	7007
144	Bablock Hythe	443500	204200	09/05/84	1	7008
144	Bablock Hythe	443500	204200	26/07/84	2	7010
144	Bablock Hythe	443500	204200	17/10/84	3	7012

Reach ID: TH27 **Reach name:** Day's

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
145	Shillingford	459000	193200	09/05/84	1	7013
145	Shillingford	459000	193200	17/10/84	3	7019

Notable taxa recorded within database

03-Apr-97

Species Pisidium supinum Schmidt has notability code(s) NB and is found in the following samples:

Reach ID: TH10 **Reach name:** St. Johns

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
143	Malthouse	422500	198400	09/05/84	1	7001
143	Malthouse	422500	198400	26/07/84	2	7004
143	Malthouse	422500	198400	17/10/84	3	7005
143	Malthouse	422500	198400	17/10/84	3	7006

Reach ID: TH11 **Reach name:** Buscot

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
37	Buscot			15/08/77	2	2199
37	Buscot			15/08/77	2	2196
37	Buscot			15/08/77	2	2194

Reach ID: TH14 **Reach name:** Rushey

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
27	Rushey			02/08/77	2	14

Reach ID: TH15 **Reach name:** Shifford

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
26	Shifford			02/08/77	2	13
36	Shifford			22/08/77	2	1204

Reach ID: TH16 **Reach name:** Northmoor

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
144	Bablock Hythe	443500	204200	09/05/84	1	7008
144	Bablock Hythe	443500	204200	26/07/84	2	7010
144	Bablock Hythe	443500	204200	17/10/84	3	7011

Reach ID: TH18 **Reach name:** Eynsham

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
35	Eynsham			24/08/77	2	1213
35	Eynsham			24/08/77	2	3214
35	Eynsham			24/08/77	2	2219

Reach ID: TH19 **Reach name:** King's

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
22	King's			25/08/77	2	9

Reach ID: TH20 **Reach name:** Godstow

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
21	Godstow			28/07/77	2	8

Reach ID: TH22 **Reach name:** Iffley

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
34	Iffley			30/08/77	2	3220
34	Iffley			30/08/77	2	1229
34	Iffley			30/08/77	2	3222
34	Iffley			30/08/77	2	3224
34	Iffley			30/08/77	2	3229
34	Iffley			30/08/77	2	2225
34	Iffley			30/08/77	2	3228

Notable taxa recorded within database

03-Apr-97

Reach ID: TH23 **Reach name:** Sandford

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
18	Sandford			27/07/77	2	5

Reach ID: TH27 **Reach name:** Day's

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
145	Shillingford	459000	193200	09/05/84	1	7013
145	Shillingford	459000	193200	09/05/84	1	7015
145	Shillingford	459000	193200	26/07/84	2	7016
145	Shillingford	459000	193200	17/10/84	3	7018

Species Heptagenia fuscogrisea (Retzius) has notability code(s) N and is found in the following samples:

Reach ID: TH27 **Reach name:** Day's

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
145	Shillingford	459000	193200	09/05/84	1	7013

Species Gomphus vulgatissimus (L.) has notability code(s) N and is found in the following samples:

Reach ID: TH16 **Reach name:** Northmoor

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
144	Bablock Hythe	443500	204200	26/07/84	2	7010
144	Bablock Hythe	443500	204200	17/10/84	3	7012

Reach ID: TH26 **Reach name:** Clifton

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
133	Clifton Bridge	454700	195400	03/08/92	2	1

Reach ID: TH27 **Reach name:** Day's

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
145	Shillingford	459000	193200	26/07/84	2	7017
145	Shillingford	459000	193200	17/10/84	3	7019

Reach ID: TH30 **Reach name:** Goring

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
55	Whitchurch Weir	463300	176800	23/05/90	1	6600

Species Haliplus laminatus Schaller has notability code(s) NB and is found in the following samples:

Reach ID: TH25 **Reach name:** Culham

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
134	Long Wittenham	454000	193700	03/08/92	2	1

Species Gyrinus distinctus Aube has notability code(s) RDB 3 and is found in the following samples:

Reach ID: TH27 **Reach name:** Day's

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
145	Shillingford	459000	193200	09/05/84	1	7013

Notable taxa recorded within database

03-Apr-97

Species Gyrinus urinator Illiger has notability code(s) NB and is found in the following samples:

Reach ID: TH10 **Reach name:** St. Johns

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
143	Malthouse	422500	198400	17/10/84	3	7005

Reach ID: TH22 **Reach name:** Iffley

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
48	Top of Sandford Lock Cut	452800	202100	08/10/90	3	7900

Species Anacaena bipustulata (Marsham) has notability code(s) NB and is found in the following samples:

Reach ID: TH22 **Reach name:** Iffley

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
48	Top of Sandford Lock Cut	452800	202100	09/07/92	2	1

Species Laccobius (Macrolaccobius) sinuatus Motschulsky has notability code(s) NB and is found in the following samples:

Reach ID: TH22 **Reach name:** Iffley

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
48	Top of Sandford Lock Cut	452800	202100	09/07/92	2	1

Reach ID: TH26 **Reach name:** Clifton

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
132	Days Reach	456600	195500	28/07/92	2	1

Species Oulimnius major (Rey) has notability code(s) NA and is found in the following samples:

Reach ID: TH19 **Reach name:** King's

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
44	Trout Inn, Godstow	448300	209200	09/08/90	2	7600

Notable taxa recorded within database

03-Apr-97

Species Sialis nigripes Pictet has notability code(s) NB and is found in the following samples:

Reach ID: TH10 **Reach name:** St. Johns

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
143	Malthouse	422500	198400	09/05/84	1	7000
143	Malthouse	422500	198400	09/05/84	1	7001
143	Malthouse	422500	198400	26/07/84	2	7004
143	Malthouse	422500	198400	17/10/84	3	7006

Reach ID: TH11 **Reach name:** Buscot

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
37	Buscot			15/08/77	2	2191
37	Buscot			15/08/77	2	2190

Reach ID: TH16 **Reach name:** Northmoor

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
144	Bablock Hythe	443500	204200	26/07/84	2	7010
144	Bablock Hythe	443500	204200	17/10/84	3	7012

Reach ID: TH18 **Reach name:** Eynsham

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
35	Eynsham			24/08/77	2	2219
35	Eynsham			24/08/77	2	2218

Species Ceraclea senilis (Burmeister) has notability code(s) N and is found in the following samples:

Reach ID: TH23 **Reach name:** Sandford

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
124	Radley College Boathouse	453800	198800	30/06/92	2	5006

Reach ID: TH30 **Reach name:** Goring

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
55	Whitchurch Weir	463300	176800	23/05/90	1	6600

Species Leptocerus lusitanicus (Mclachlan) has notability code(s) RDB 2 and is found in the following samples:

Reach ID: TH30 **Reach name:** Goring

Site ID	Site name	Easting	Northing	Sample date	Season ID	Sample ID
55	Whitchurch Weir	463300	176800	23/05/90	1	6600

APPENDIX 4.1 The executive summary and key supporting tables and figures from references cited in Chapter 4: Macrophytes of the main report.

BUNDED RESERVOIR STORAGE STUDIES 9701/B5

RIVER CORRIDOR, PHASE 1 AND PHASE 2 SURVEYS: RIVER THAMES

EXECUTIVE SUMMARY

Ecosurveys Ltd has been contracted by Thames Water Utilities Ltd to undertake a River Corridor survey, and Phase 1 and Phase 2 surveys on the Thames Floodplain between Abingdon Lock and Benson Lock, Oxfordshire. This study is part of the SWORDS Project and is intended to provide a baseline understanding of the nature conservation interest of this reach of the River Thames and its floodplain, such that it can help;

- identify any impacts on the catchment which could potentially arise from the reservoir operation and the construction of abstraction and discharge structures:
- the design of a least damaging development proposal and operating regime; and
- bring forward recommendations for enhancement of the river corridors, particularly around and adjacent to any proposed abstraction and discharge structures.

The study has three integrated components:

- a River Corridor Survey on approximately 30km of statutory main river;
- a Phase 1 Ecological Land-use Survey of the designated Thames floodplain; and
- detailed Phase 2 botanical surveys of water level dependant habitats of conservation interest in the designated Thames floodplain.

The field survey for the various components was undertaken between May and August 1992, according to standard NRA and English Nature methodologies.

The River Corridor Survey shows the Thames to be a broad deep navigable river, with its water level maintained by locks and weirs. The large amount of boat traffic precludes extensive growth of channel vegetation, which is therefore virtually limited to strands of tall marginal species. The river banks are of varied profile and are frequently tree and shrub lined, with tall herbs and coarse grasses underneath and where open.

The River Corridor sections were assessed according to the London Ecology Unit River Reach Evaluation Criteria. The majority of the 61 sections were graded good, with four graded poor, eight graded important and one graded critical on account of the adjacent Culham Brake, a wetland site of Special Scientific Interest.

The Phase 1 Survey reveals the designated floodplain of the Thames between Abingdon Lock and Benson Lock to be an intensively managed agricultural area, largely arable land with some semi-improved and improved grasslands, managed as pasture and hayfields. There

consequently is a generally low level of nature conservation interest; that which exists does so as rather isolated habitats (eg including marshy pastures, open standing waters, swamps, small woodlands supporting the nationally rare summer snowflake, but otherwise unremarkable) scattered at intervals along the floodplain, separated by large tracks of arable land.

16 sites for detailed Phase 2 botanical survey were identified by the Phase 1 survey. These include flushes, marshy pastures, swamps, open water sites, wet woodlands and tall herb marshes. Plant communities identified by the Phase 2 surveys were 2 open water types, 3 woodland types, 10 swamp types and 4 mesotrophic grassland types. With the exception of the flood meadow habitat, MG 4, on site 9 (Long Wittenham Nature Reserve), all are common and widespread in lowland Britain; the flood meadow community is of local occurrence in Britain but this site holds a slightly modified example, especially when compared to the large areas further upstream (out of this Study Area) around Oxford. No nationally or regionally rare plant species were recorded by the Phase 2 surveys, which took place too late in the year for confirmation of the summer snowflake records for sites 15 and 16. The Phase 2 survey sites' general wetland species interest was identified to be vulnerable to agricultural improvements and lack of management, in addition to permanent and marked reductions in the mean water level of the Thames, but as long as the river periodically floods, the seed dispersal requirements of the summer snowflake will be met.

SUMMARY

RIVER THAMES: ABINGDON LOCK TO BENSON LOCK

INTRODUCTION

Ecosurveys Ltd has been contracted by Thames Water Utilities Ltd to undertake, as part of the SWORDS Project in Oxfordshire:

- a River Corridor Survey on 30km of statutory main river of the River Thames between Abingdon Lock and Benson Lock;

- a Phase 1 Ecological Habitat Survey of the designated Thames Floodplain between Abingdon Lock and Benson Lock; and

- detailed Phase 2 botanical surveys of water level dependent habitats of conservation interest in the designated floodplain.

The field survey was undertaken in June, July and August 1992 using standard NRA and English Nature methodologies. The results of the survey are summarized below and are detailed in the report, which comprises this volume (river corridor survey data), a volume of Phase 1 and Phase 2 survey data and a volume of additional photographs.

RIVER CORRIDOR HABITATS

The River Thames between Abingdon Lock and Benson Lock is a broad, deep, navigable river, gently meandering and with its water level maintained by locks and weirs. The river carries a large amount of boat traffic, especially in summer. The flood plain is largely arable land with semi-improved and improved pastures, incorporating the occasional woodland, marsby grassland and built-up area.

The river banks, composed of clay, sand and gravel (and locally artificially reinforced), are generally well vegetated and of varying profile, from vertical cliffs to gently graded sections. Trees and shrubs often line the river, crack willows (as standards, old coppice or pollards) are especially frequent, with hawthorn, alder (often as old coppice), ash, elm, field maple, oak and sycamore. Various ornamental trees occur through built-up areas and other less common native shrubs present are spindle, guelder-rose, dogwood and buckthorn, in addition to shrub willows: grey, goat and osier. Tall herbs and coarse grasses dominate the herbaceous vegetation under the trees, and where open, and it is generally unremarkable and comprises ubiquitous species but with the addition of wild onion, escaped *Brassica* and introduced *Aster* species. Grazed sections of bank are grass dominated. Crevices in artificial banks support small populations of pellitory-of-the-wall and stonecrops.

Marginal vegetation is generally tall and dominated by great willowherb, comfrey, meadow-sweet, hard rush, bittersweet and purple loosestrife. Also present are soft rush, water chickweed, hemp agrimony, marsh yellow-cress, water figwort and false fox sedge. Gently graded banks support gipsywort, water mint, brooklime, marsh woundwort, water forget-me-not, watercress and fool's watercress. Other less common marginal species include yellow loosestrife, skullcap, ragged robin and Himalayan Balsam, the latter especially near built-up areas. The marginal vegetation frequently grades into the emergent aquatics, except where precluded by shade, water depth and boat moorings. Common species in the channel are branched bur-reed, common club rush, sweet flag, reed canary grass, greater pond sedge, reedmace and common reed, forming species-pure or mixed stands, often showing zonation from shallower to deeper water. Also present are flowering rush, great water dock, common water plantain, narrow-leaved water plantain, yellow water lily and unbranched bur-reed (the latter two suffering from damage caused by boat traffic).

TARGET SPECIES

The River Corridor Survey of the River Thames included an element of searching for, and acurately recording the location of, a number of Target Species, which are those in any of the following three categories (from Palmer & Newbold, 1983, Wetland & Riparian Plants in Great Britain, NCC Focus on Nature Conservation No 1):

- Aquatic plants recorded from 100 or fewer 10x10km squares in Great Britain and which need special protection in the NRA Thames Region;
- Riparian and non-aquatic wetland plants recorded from 100 or fewer 10x10km squares in Great Britain and which need special protection in the NRA Thames Region; and
- Aquatic plants recorded from more than 100 10x10km squares in Great Britain but which need special protection in the NRA Thames Region.

No Target Species were recorded from the River Thames River Corridors.

CONSERVATION MANAGEMENT

The management of the riparian tree cover is the principal target of management of the existing wildlife habitat resource. Single, and lines or groups of, old pollarded and coppiced trees are important in wildlife and landscape terms and management recommendations are made for repollarding and recoppicing. A certain number of trees should be worked each year out of the total resource, in order to provide variety of structure and age of regrowth. This will also act as a precautionary measure, in case the trees do not respond to management, so avoiding the situation of having a river bank lined with dead stumps and pollards.

As a spin-off from pollarding and coppicing, the increased light let onto the river bank should promote the growth and spread of channel vegetation, so protecting the bank from erosion by boat wash. Fallen trees are to be removed unless it can be demonstrated that they function as Kingfisher perches and do not significantly impede flow. Occasional standing dead trees, unless a danger, are best left *in situ* for woodpeckers and invertebrates.

A second target of conservation management is tall wetland vegetation and relatively species-rich drier neutral grassland in the floodplain adjacent to the river. These areas are typically unmanaged and with time, this leads to loss of species diversity and succession to different habitats of lower conservation interest. To prevent this and hence to maintain species-richness, the initiation of suitable mowing regimes is required, combined with the removal of cut material and eradication of invading scrub.

A third and equally simple conservation management operation involves thinning out of trees and shrubs along the south sides of channels, to let in more light to the water's edge to promote the growth of channel vegetation.

HABITAT ENHANCEMENT

The principal opportunities for habitat enhancement centre on the areas of tall wetland vegetation, habitats which are important in their own right and are of value for birds and invertebrates. The recommendations are to increase the extent of these areas by excavating the surrounding ground down to, or near, water level, enabling the wetland species to spread.

Areas of ruderal vegetation, unmanaged arable or pasture represent opportunities for the planting of native tree and shrub species, especially where adjacent to existing areas of woodland.

PHASE 1 SURVEY

The designated floodplain of the River Thames between Abingdon Lock and Benson Lock extends for 20km, covers approximately $15km^2$ and varies in width from 400m to over 1000m.

The survey reveals that the floodplain is predominantly intensively agricultural - dominated by arable land with occasional improved and semi-improved pastures, built-up areas, woodlands (ornamental, broadleaved, mixed, coniferous), amenity grasslands, tall herbs, caravans and mineral workings.

PHASE 2 SURVEY

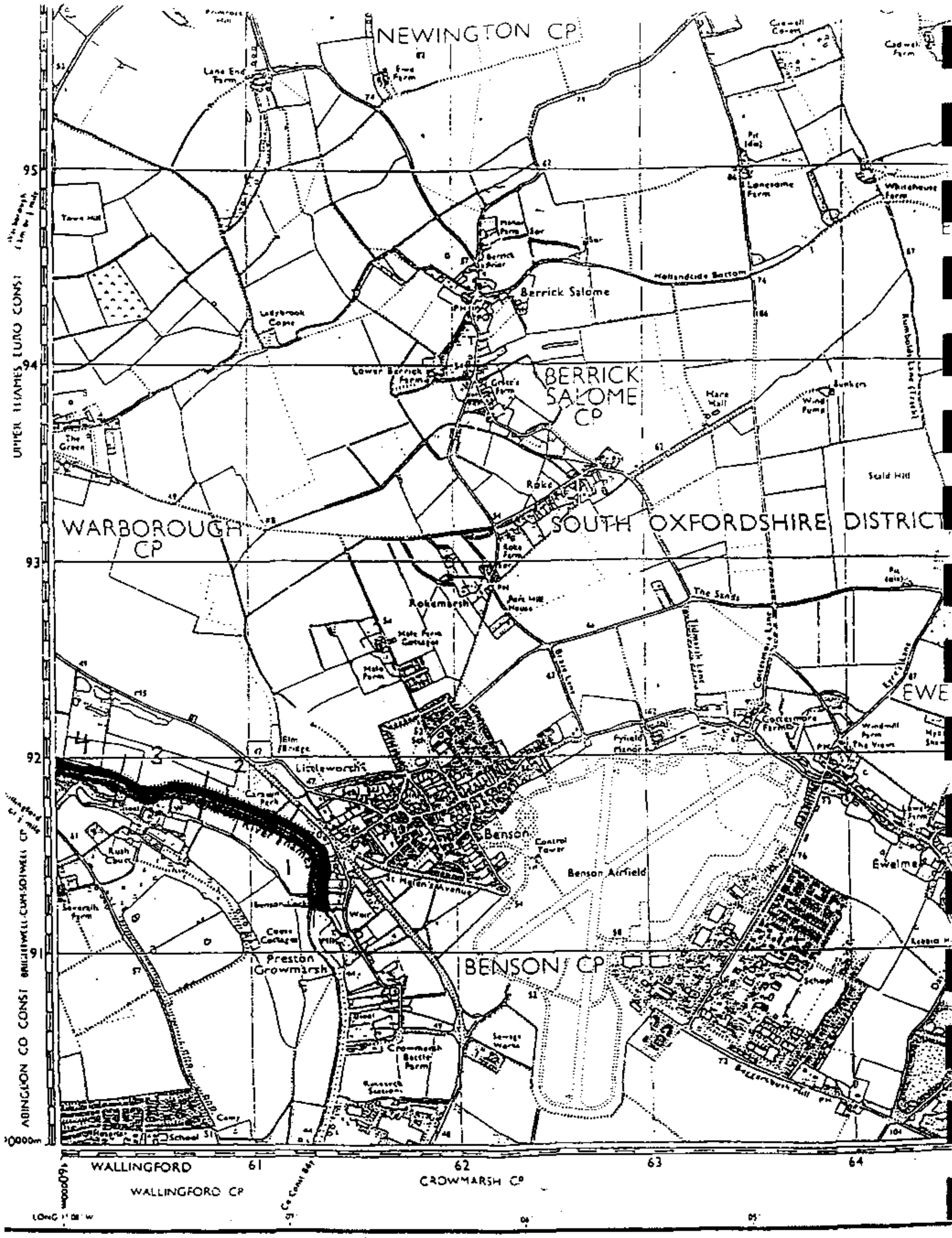
Fourteen sites were identified by the Phase 1 survey for detailed Phase 2 surveys, along with one site notified by a landowner which was deemed to meet the criteria for Phase 2 survey, and a second additional site notified by Thames Region NRA, giving a total of 16 sites. Eleven sites were surveyed in late June/early July with three of these revisited in August, and five were surveyed only in August. The habitats surveyed included willow cars and other woodlands, tall herb swamps, old gravel pits and other open water bodies, inundation grasslands and marshy pastures.

The majority of sites supported only one or two water level dependent plant community types, with one diverse tall herb swamp holding four and one large mosaic of habitats holding six. With the exception of Site 9 (a relatively herb rich flood meadow), none of the plant communities identified were those other than common types known to be widespread in lowland Britain and typical of wetlands in general. No rare species were recorded although two of the sites (15 and 16) are reliably reported to be localities for a nationally rare plant, probably not seen in the present survey because of the time of year.

RIVER THAMES SECTION EVALUATION

SECTION	CRITICAL	IMPORTANT	GOOD	POOR
001				✓
002				✓
003			✓	
004			✓	
005			✓	
006			✓	
007			✓	
008			✓	
009			✓	
010			✓	
011			✓	
012			✓	
013		✓ 1		
014		✓ 2		
015			✓	
016			✓	
017			✓	
018			✓	
019			✓	
020			✓	
021			✓	
022		✓ 3		
023		✓ 4		
024			✓	
025				✓
026			✓	
027			✓	
028			✓	
029			✓	
030		✓ 5		
031		✓ 6		
032			✓	
033			✓	
034			✓	
035			✓	
036			✓	
037			✓	
038			✓	
039			✓	
040			✓	

SECTION	CRITICAL	IMPORTANT	GOOD	POOR
041			✓	
042			✓	
043			✓	
044			✓	
045			✓	
046			✓	
047			✓	
048		✓ 7		
049		✓ 8		
050			✓	
051			✓	
052				✓
053			✓	
054			✓	
055			✓	
056			✓	
057			✓	
058			✓	
059			✓	
060	✓ 9			
061			✓	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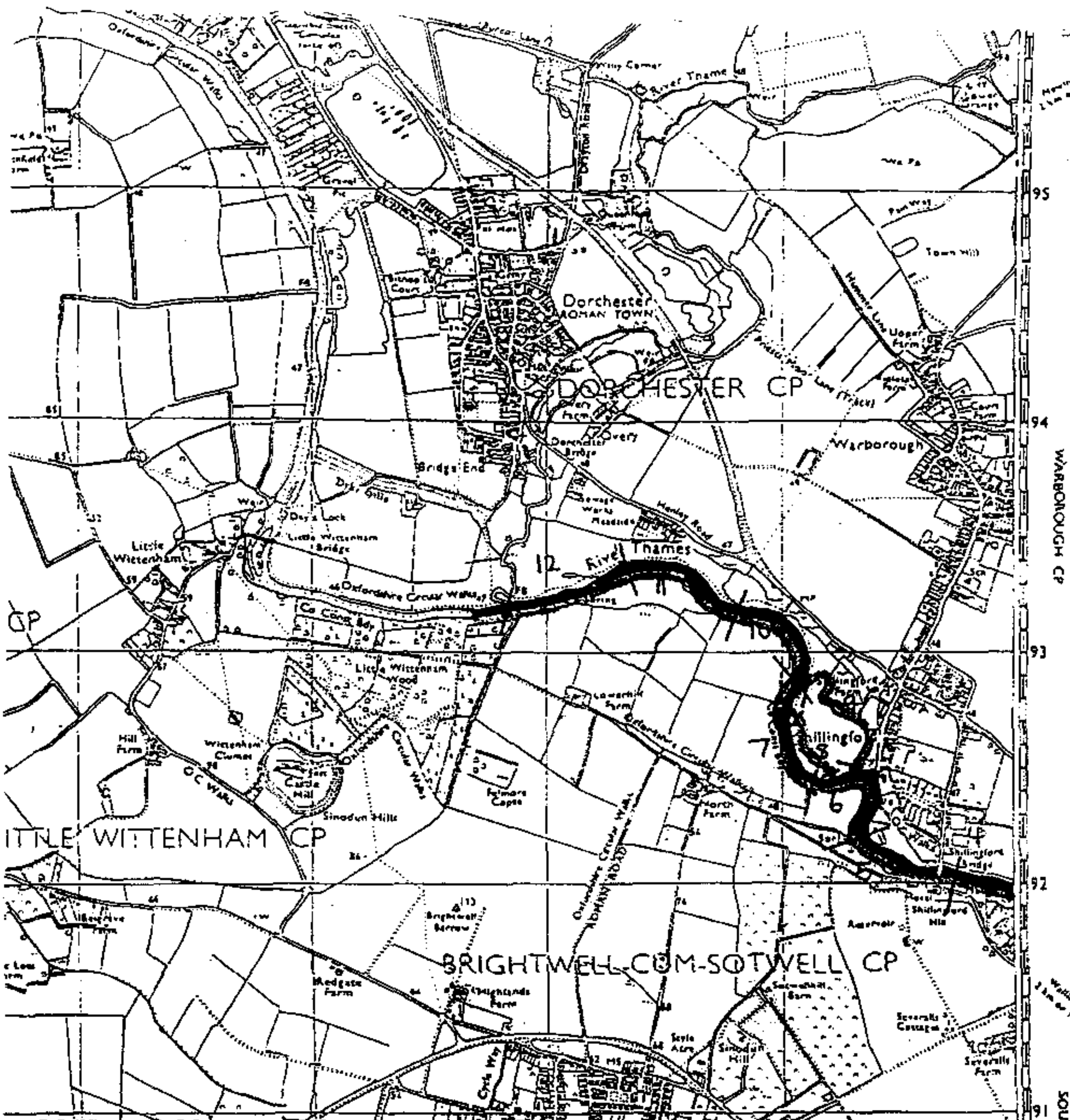
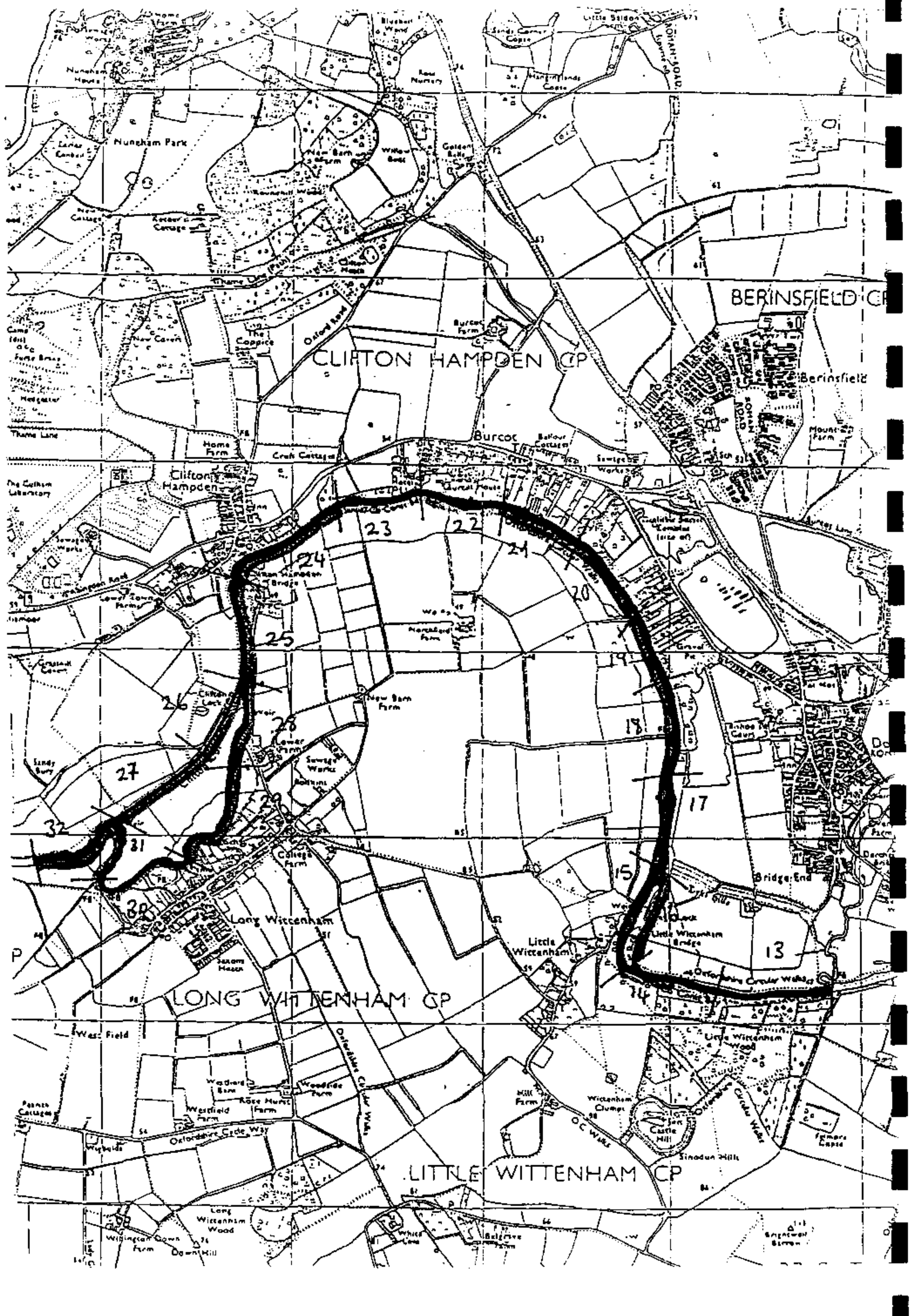
BERRICK SALOME CP
Berrick Salome
WARBOROUGH CP
SOUTH OXFORDSHIRE DISTRICT
Rokemarsh
Littleworth
Benson
Benson Airfield
BENSON CP
Preston Crowmarsh
Ewelme
EWE
WALLINGFORD
WALLINGFORD CP
CROWMARSH CP
95
94
93
92
91
61
62
63
64



Dorchester
ROMAN TOWN
DORCHESTER CP
Warborough
WARBOROUGH CP
River Thames
Little Wittenham
Day's Lock
Bridge End
Sinodun Hills
Wittenham Clumps
ITTLE WITTENHAM CP
BRIGHTWELL-CUM-SOTWELL CP
Brightwell-cum-Sotwell
MORETON CP
Slade End
SOUTH OXFORDSHIRE DISTRICT
WALLINGFORD
Town Hill
Shillingford Bridge
56
57
58
59
95
94
93
92
91
190000m
460000m



BERINSFIELD CP
CLIFTON HAMPDEN CP
LONG WITTENHAM CP
LITTLE WITTENHAM CP
Nuneham Park
Burcot
Berinsfield
Clifton Hampden
Long Wittenham
Little Wittenham
Bridge End
Oxfordshire Cycle Way
13
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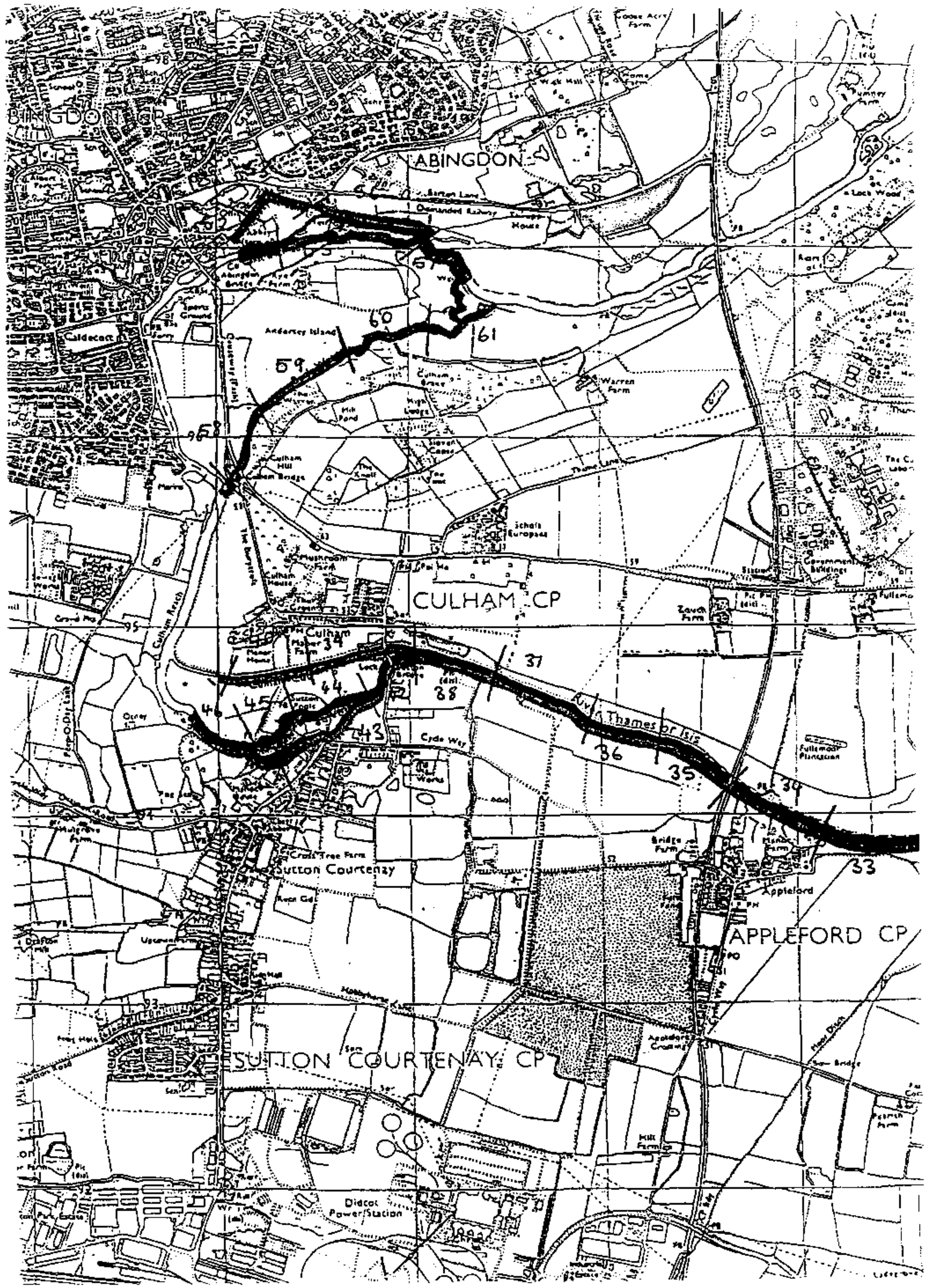
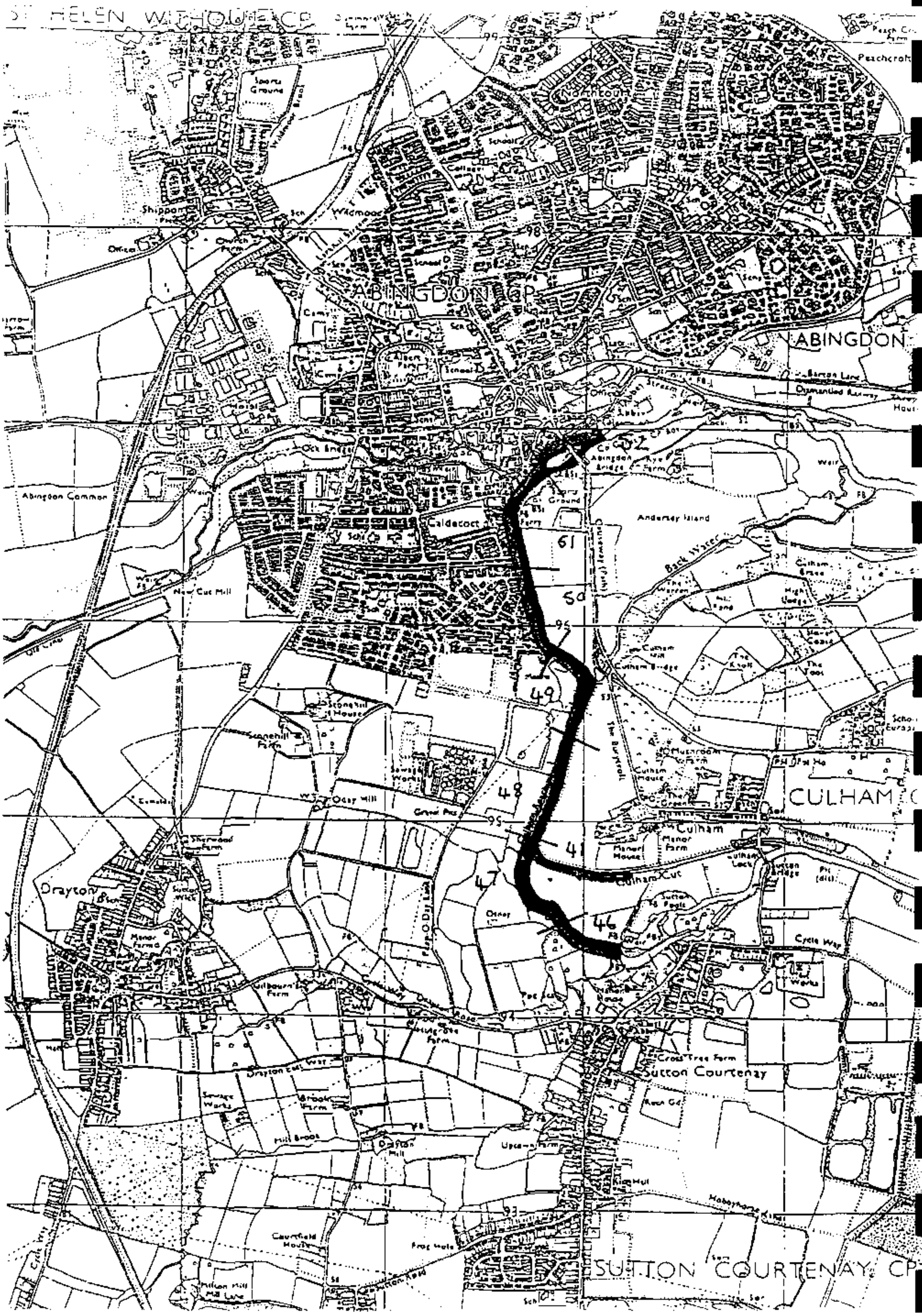


ABINGDON
CULHAM CP
APPLEFORD CP
SUTTON COURTENAY CP
Sutton Courtenay
River Thames or Isis
Didcot Power Station
Culham
Appleford


ABINGDON CP
ABINGDON
CULHAM
SUTTON COURTENAY CP
Culham Cut
Sutton Courtenay
Drayton
Abingdon Common
Andersey Island
Back Water
Caldecott
New Cut Mill
Culham
Manor Farm
61
50
49
48
47
46
41

OXFORD FLOODPLAIN ENVIRONMENTAL SURVEY 1992

EXECUTIVE SUMMARY

Ecosurveys Ltd has been contracted by the National Rivers Authority Thames Region to undertake a study of the nature conservation interest of a part of the floodplain of the River Thames between Eynsham and Sandford-on-Thames, Oxfordshire. This study is part of a modelling process providing information on floodplain envelopes and flow routes. It is to supply baseline information to the NRA to help them assess the effects of any proposed modification in the operation of flood control structures and to optimise their operation.

The study has several integrated components:

- a Desk Study to collate and review information on areas of known conservation importance in the Study Area;
- a River Corridor Habitat Survey of a designated 74km of the River Thames, its tributaries, secondary channels and drains in the Study Area;
- a Phase 1 Ecological Habitat Survey of about 25 km^2 of the designated Oxford Floodplain Environmental Survey Study Area; and
- detailed Phase 2 botanical surveys of sites of water-level dependence within the study Area for which adequate information does not already exist.

The field survey for the various components was undertaken between May and August 1992 using standard NRA and English Nature methodologies.

The data collection and review, on the whole, yielded information of limited use, due mainly to its brevity. The River Corridor Habitat Survey shows that, in general, the river corridor habitats are evaluated as <u>critical</u> or <u>good</u>, according to the London Ecology Unit Evaluation with the exception of urban Oxford where they are evaluated as <u>poor</u> on the whole. The large number of river corridor sections evaluated as <u>critical</u> is in large part due to their proximity to the extensive SSSI's in the floodplain.

The Phase 1 Survey reveals that the designated floodplain is largely agricultural with the exception of the of the urban area of Oxford and is repeatedly criss crossed by large tree and scrub lined watercourses.

From the Desk Study, River Corridor and Phase 1 Surveys, 34 sites as requiring Phase 2 survey were identified and each received detailed botanical investigations with one 2 x 2m quadrat being recorded in each water level dependent plant community and with full species lists recorded for those sites.

STUDY AREA


Yarnton
Gosford
Water Eaton
Worton
Wytham
Wytham Great Wood
Wytham Park
Farmoor
OXFORD
Summertown
Marston
New Marston
Cumnor Hill
Cumnor
Chawley
North Hinksey Village
Hinksey Hill
South Hinksey
Boars Hill
Wootton
Kennington
Sandleigh
Foxcombe Hill
Bayworth
Filchampstead
Oxfordshire Circular Walks

2.3 APPROACH TO THE STUDY COMPONENTS

2.3.1 Desk Study - Review of Data on Sites of Nature Conservation Significance in the Study Area

The collection and review of existing information on sites of nature conservation importance was principally carried out at the commencement of the study though continued throughout as further sources, sites or information came to light. Ecosurveys Ltd believe that all sites of nature conservation significance in the Study Area have been identified and have been studied by one, some or all of the data review, River Corridor, Phase 1 and Phase 2 surveys. Whilst we believe that we have collated the vast majority of the available data, some sources were unwilling to release data or advised us that the data we had from elsewhere exceeded their data in terms of quality, and was therefore either not released or collated.

One purpose of the data collection was to produce a document which held in one place the available information, from previous work, on sites of nature conservation significance in the Study Area. Part 5 of this report constitutes that document.

A second purpose was to use the available data to identify known sites and to determine which water-level dependent sites in the Study Area required additional fieldwork due to the lack, antiquity or unreliability of the existing information. The data from the surveys carried out this year was then to be compared with previous information on past site management and nature conservation value.

2.3.2 River Corridor

The designated River Corridor was divided into 148 sections each of approximately 500m length and surveyed between May and August using the standard NRA River Corridor Habitat survey Methodology. The information for each section thus comprises photograph(s), a short written descriptive text and a habitat map. Aquatic vegetation was sampled using a grapnel from the banks of narrower channels and from a boat on the River Thames. Management recommendations to maintain and/or enhance the nature conservation value of the sections are also supplied.

The River Corridor habitat survey results are compiled in Part 2 of this report with the locations of the River Corridor sections shown on the supporting maps and tabulated with channel names and start and end point grid references.

The River Corridor sections have been assessed for their nature conservation importance according to the London Ecology Unit River Reach Evaluation Criteria, see Appendix Two, and this information is discussed and analysed in this document (Part 1) along with the general management recommendations required to maintain and enhance the nature conservation interest of the River Corridor sections.

2.3.3 Phase 1

The purpose of the Phase 1 survey was to identify habitats within the Study Area, but outside designated SSSI's, which are of value to wildlife. The Phase 1 survey was undertaken in June 1992 using a standard methodology (NCC 1990) in order to supply a readily accessible visual representation of the entire floodplain in the Study Area. For this reason, the colour coding system rather than alpha-numeric was adopted.

The results of this survey (Part 3 of this document) comprise a series of A4 and A3 maps which cover the entire survey area. The maps are supported by target notes which indicate;

- the location of sites deemed to be of nature conservation interest which received a Phase 2 detailed botanical survey,

- features of interest or importance to wildlife which were identified in the review of previous available data, or

- features observed in the course of the fieldwork components, and

- site specific information for researched data on notable bird species or populations breeding within or regularly using the floodplain.

2.3.4 Phase 2

Sites identified from the earlier elements of the study which were described as water-level dependent, at least in part, for which there was only old, or unreliable, or no available information and which were apparently of nature conservation interest, received a detailed botanical survey equivalent to NCC (now English Nature) Phase 2 survey level, (Smith et al, 1985).

3 RESULTS OF REVIEW OF EXISTING INFORMATION

In the event, the data collection yielded information of rather variable quality, which for most sites was rather brief, and the data gathered by Ecosurveys Ltd fieldwork greatly exceeding the previous data in terms of the time spent on the site and the detailed botanical information gathered. In consequence a formalised review of the previous data was not carried out as no sensible comparison could be made for the majority of the sites. However, the information from the data collection has been analysed and integrated into the report as a whole in the form of Target Notes on the Phase 1 maps and as part of the Conservation Assessment of the Phase 2 site reports. Thus, all of the available previous information on a site may be found in Part 5 of the report, as an abridged version in a Target Note on the Phase 1 map and list, and possibly analysed within a Phase 2 site report, with all information being referenced eg to its corresponding Target Note or previous survey data, for easy accessibility.

4. RIVER CORRIDOR SURVEY RESULTS AND DISCUSSION

4.1 INTRODUCTION

The results of the River Corridor Habitat Survey are compiled in Part 2 of this report, in three volumes. The results for each section consist of a brief descriptive text of the adjacent land, bank and channel vegetation, photographs, cross sections and management recommendations.

The 148 River Corridor Habitat Survey sections studied comprise a considerable resource for wildlife at least in a local context. The watercourses vary from large slow flowing deep rivers such as the River Thames, through fast flowing streams to narrow drains providing habitat for a wide variety of wildlife. Generally the various watercourses are largely tree and scrub lined and the adjacent habitats include a complex mosaic of urban, arable and pasture land, tall herb marshes and swamps and woodland. Despite their proximity to Oxford, many of the watercourses outside the urban area are relatively undisturbed, a factor which enhances their value to wildlife. A notable exception, however, is the River Thames which, in particular with regard to marginals and aquatics, appears to be rather poorer in species than would otherwise be expected principally due to the large amount of boat traffic especially in summer and its associated problems with wash, and sediment disturbance etc. It is, however, still of high local importance as a wildlife resource.

The watercourses of the floodplain which were studied can be conveniently but artificially grouped as large rivers, smaller rivers and streams and drains. The table overleaf provides information on the evaluation of the ecological interest of the River Corridor sections according to the London Ecology Unit Ecological Evaluation Criteria for River Reaches which are attached in Appendix Two.

The categories are as follows:

Critically Important for Wildlife - The most ecologically fragile sections of river or adjacent habitats which depend on the maintenance of the present hydrological conditions. This category includes most examples of regionally rare habitats and sections with significant communities of rare flora and fauna.

Important for Wildlife - Sections of high wildlife value but not necessarily closely associated with the river, however potentially vulnerable, and typically composed of either a mixture of well structured habitat types but with few species of particular note or a good example of a single habitat type.

Good for Wildlife - Sections which provide particular local interest and typically comprising habitats of a more robust nature less vulnerable to, and possibly restorable after, engineering works.

Poor for Wildlife - Sections of river and adjacent land with little semi-natural vegetation and of low intrinsic wildlife interest. Enhancement opportunities may present themselves.

Most "typical" River Corridor sections would thus fall into the category of good and in the following table of evaluated sections justifications are only noted for critical, important and poor evaluations with supplementary notes.

The evaluations of the River Corridor Sections were carried out by two members of Ecosurveys Ltd technical staff who had been involved in the project and were familiar with the Study Area (Tim Harvey and Tim Smith). The evaluations are a subjective judgement arising from a assessment of each sections conservation value represented by its habitats and physical features; The columns are colour coded to match the following series of maps with;

Critical	=	Red
Important	=	Green
Good	=	Blue
Poor	=	Brown

TABLE 1

RIVER CORRIDOR NATURE CONSERVATION EVALUATION BASED ON L.E.U EVALUATION CATEGORIES

SECTION		C	I	G	P	NOTES
No	Name	[redacted]				
1	River Thames			✓		Create berm on the left in midsection.
2	Sandford Ditch	✓				*Hottonia palustris* locality. Repollarding of shading trees.
3	River Thames			✓		
4	River Thames			✓		
5	River Thames	✓				Fiddler's Elbow Island adjacent. (Phase 2 Site 2).
6	River Thames	✓				Adjacent to Rose Isle. (Phase 2 Site 4).
7	River Thames	✓				Unimproved wet meadow adjacent to Heyford Hill Lane Pasture. (Phase 2 Site 5).
8	River Thames			✓		
9	River Thames	✓				Adjacent to Fiddler's Elbow Island. (Phase 2 Site 2).
10	River Thames	✓				Adjacent to Wetland and Woodland south of Iffley Meadows SSSI. (Pasture 2 Site 10).
11	River Thames	✓				Adjacent to SSSI, but channel poor.
12	River Thames	✓				Adjacent to SSSI, but channel poor.
13	River Thames	✓				Adjacent to SSSI, but channel poor.
14	River Thames	✓				Adjacent to SSSI.
15	River Thames	✓				Adjacent to SSSI.
16	River Thames				✓	Artificial. Boat traffic. Plant trees upstream on right. Limited scope for enhancement.
17	River Thames				✓	Artificial. Mostly urban. Plant trees and shrubs. Limited scope for enhancement.
18	River Thames				✓	Artificial. Urban. Plant trees and shrubs. Little scope for enhancement.
19	Castle Mill Stream			✓		Urban. Create riffle and pool.
20	Castle Mill Stream				✓	Artificial: Urban. Increase tree and shrub cover. Limited scope for enhancement.
21	Castle Mill Stream			✓		Poor channel, but wooded. Limited scope for enhancement.

SECTION		C	I	G	P	NOTES
No	Name					
22	Castle Mill Stream			✓		Poor channel, but wooded. Limited scope for enhancement.
23	Railway Drain			✓		
24	Railway Drain			✓		
25	Railway Drain			✓		
26	Port Meadow Drain	✓				Adjacent to SSSI.
27	Port Meadow Drain	✓				Adjacent to SSSI.
28	Port Meadow Drain	✓				Adjacent to SSSI.
29	Port Meadow Drain	✓				Adjacent to SSSI.
30	Port Meadow Drain	✓				Adjacent to SSSI.
31	Port Meadow Drain	✓				Adjacent to SSSI.
32	Port Meadow Drain	✓				Adjacent to SSSI.
33	Hinksey Stream	✓				Adjacent to SSSI.
34	Weirs Mill Stream	✓				Adjacent to SSSI.
35	Weirs Mill Stream	✓				Adjacent to SSSI.
36	River Thames	✓				Adjacent to SSSI.
37	River Thames			✓		
38	New Hinksey Drain			✓		Poor as wetland, but wooded.
39	New Hinksey Drain			✓		Poor as wetland, but wooded.
40	Shire Lake Ditch			✓		Channel poor, good wooded corridor.

SECTION		C	I	G	P	NOTES
No	Name					
41	Shire Lake Ditch	✓				Channel poor, good corridor. Ajacent wetland habitat. Jackdaw Lane Marsh (Phase 2 Site 16).
42	River Cherwell			✓		Artificial banks. Heavy use. Adjacent to wet meadow, Christchurch Pasture (Phase 2 Site 15).
43	Christchurch Drain	✓				Adjacent to wet meadow, Christchurch Pasture (Phase 2 Site 15).
44	Trill Mill Stream				✓	Urban - artificial concrete channel. Limited scope for enhancement.
45	River Cherwell			✓		Wooded. Create berms and profile channel. Adjacent to Christchurch Pasture (Phase 2 Site 15).
46	Hinksey Stream	✓				Adjacent to SSSI.
47	Hinksey Stream			✓		
48	Coldharbour Drain			✓		Urban sections - much rubbish in channel.
49	Coldharbour Drain			✓		Urban sections - much rubbish in channel.
50	Railway Drain		✓			Part large pond. (Railway Pond). Contiguous with Sections 051-053.
51	Railway Drain and Pond			✓		All one large pond with emergents and aquatics; an undisturbed backwater.
52	Railway Pond	✓				All one large pond with emergents and aquatics; an undisturbed backwater.
53	Railway Pond	✓				All one large pond with emergents and aquatics; an undisturbed backwater.
54	South Hinksey Drain			✓		Scallop berm midsection.
55	South Hinksey Drain			✓		
56	South Hinksey Drain				✓	Poor as wetland, channel drying out.
57	Hinksey Stream			✓		

SECTION		C	I	G	P	NOTES
No	Name					
58	Hinksey Stream			✓		
59	Hinksey Stream			✓		
60	Hinksey Stream			✓		
61	Hogacre Ditch			✓		
62	Hogacre Ditch				✓	Woodland, but poor as wetland.
63	Eastwyke Drain				✓	Urban Woodland, but poor as wetland.
64	Eastwyke Drain			✓		
65	Eastwyke Drain			✓		
66	Hogacre Ditch			✓		
67	Hogacre Ditch			✓		
68	Hogacre Ditch				✓	Urban Poor as wetland, but wooded.
69	Bulstake Stream			✓		
70	Bulstake Stream			✓		
71	River Thames			✓		
72	Mill Stream				✓	Heavy use - boats moorings. Some artificial bank. Plant trees.
73	River Thames				✓	Urban. Artificial. Includes Lock. Some artificial bank. Plant trees and shrubs.
74	River Thames				✓	Urban. Artificial. Plant trees and shrubs.
75	River Thames				✓	Urban. Artificial. Create riffles, pools, berms on margins.
76	River Thames				✓	Urban. Artificial. Plant trees.
77	Rewley Abbey Stream				✓	Urban. Artificial. Abused. Create berm for marginals.
78	Osney Drain			✓		Channel poor, but wooded. Rubbish in channel.

SECTION		C	I	G	P	NOTES
No	Name	[redacted]	[redacted]	[redacted]	[redacted]	
79	Bulstake Stream			✓		
80	Bulstake Stream			✓		
81	Bulstake Stream			✓		
82	Bulstake Stream				✓	Create pools, deepen channel, plant trees and shrubs.
83	River Thames			✓		Boats. Wooded.
84	Fiddler's Island Stream			✓		Wooded.
85	Fiddler's Island Stream	✓				Adjacent to SSSI.
86	River Thames			✓		
87	Fiddler's Island Stream	✓				Adjacent to SSSI.
88	River Thames	✓				Adjacent to SSSI.
89	River Thames	✓				Adjacent to SSSI.
90	River Thames	✓				Adjacent to SSSI.
91	River Thames	✓				Adjacent to SSSI.
92	River Thames	✓				Adjacent to SSSI.
93	River Thames	✓				Adjacent to SSSI.
94	River Thames			✓		
95	River Thames	✓				Adjacent to SSSI.
96	River Thames	✓				Adjacent to SSSI.
97	Duke's Cut			✓		
98	River Thames	✓				Adjacent to SSSI.
99	River Thames			✓		
100	River Thames	✓				Adajcent to SSSI.
101	River Thames	✓				Adjacent to SSSI.
102	River Thames	✓				Adjacent to SSSI.
103	River Thames	✓				Adjacent to SSSI.
104	River Thames	✓				Adjacent to SSSI.

SECTION No	SECTION Name	C	I	G	P	NOTES
105	River Thames	✓				Adjacent to proposed extension to SSSI.
106	River Thames					
107	River Thames			✓		
108	River Thames	✓				Adjacent to SSSI.
109	River Thames	✓				Adjacent to SSSI.
110	River Thames			✓		
111	River Evenlode			✓		Plant trees and shrubs on north bank.
112	River Evenlode			✓		
113	Old Canal			✓		Potential Otter holt site.
114	Wharf Stream			✓		
115	Wharf Stream			✓		
116	Weir Stream			✓		
117	Seacourt Stream			✓		
118	Seacourt Stream			✓		
119	Seacourt Stream			✓		
120	Seacourt Stream			✓		Plant trees and shrubs on parts of right bank.
121	Seacourt Stream			✓		Create riffle and pool system.
122	Seacourt Stream			✓		
123	Seacourt Stream			✓		
124	Seacourt Stream			✓		
125	Seacourt Stream			✓		
126	Seacourt Stream			✓		
127	Seacourt Stream			✓		

SECTION		C	I	G	P	NOTES
No	Name	[redacted]				
128	Seacourt Stream			✓		Create riffle and pool system.
129	Seacourt Stream	✓				Adjacent to SSSI.
130	Botley Ditch				✓	Poor as wetland/watercourse.
131	Botley Ditch			✓		
132	Botley Ditch			✓		
133	Binsey Drain			✓		
134	Binsey Drain			✓		
135	Binsey Drain			✓		Good but poor as wetland. Limited scope for enhancing wetland features.
136	Binsey Drain			✓		Good but poor as wetland. Limited scope for enhancing wetland features.
137	Binsey Drain			✓		
138	Binsey Drain			✓		
139	Binsey Drain			✓		Long-term thinning?
140	Binsey Drain			✓		Long-term thinning?
141	Binsey Drain			✓		Poor for wetland. Birthwort site.
142	Binsey Drain			✓		
143	Binsey Drain			✓		
144	Binsey Drain			✓		
145	Godstow Holt Drain				✓	Poor as wetland. Part destroyed.
146	Binsey Drain			✓		Not good wetland, but wooded. Long-term thinning?
147	Duke's Lock Drain			✓		
148	River Thames	✓				Adjacent to SSSI.

In summary, for the River Corridor habitat survey of 148 sections (c.74km),

51	sections were evaluated as	<u>critical</u>
1	section was evaluated as	<u>important</u>
77	were evaluated as	<u>good</u>
<u>19</u>	were evaluated as	<u>poor</u>

The following series of 3 coded maps provide an easily accessible visual representation of the River Corridor Section Evaluations and their relationships.

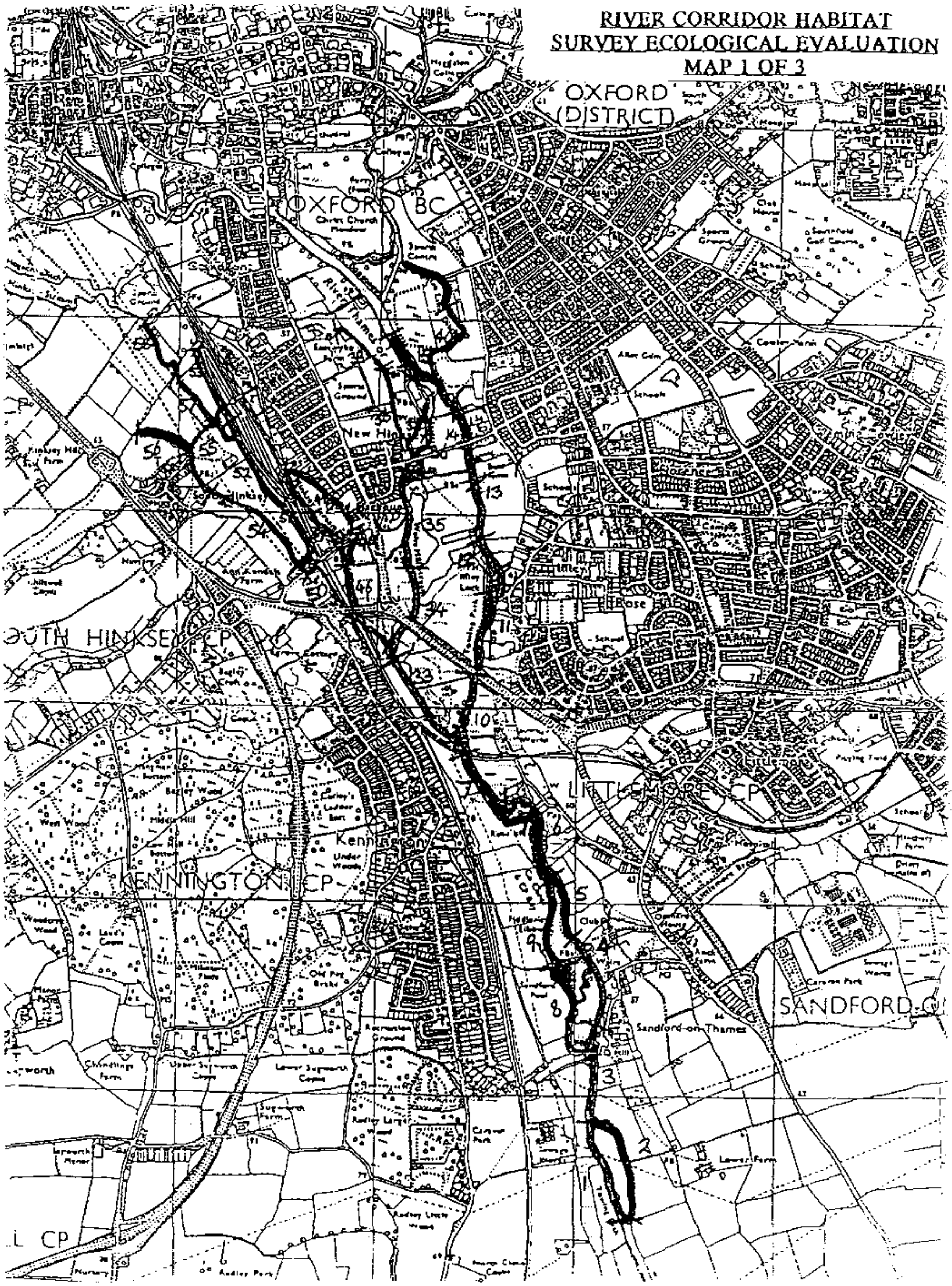
Outlined below are brief descriptions of the watercourses and information on their evaluations, management recommendations and enhancement opportunities. Whilst some of the management recommendations may apply only to specific sections or parts, there are some general recommendations that are applicable to the majority of the sections.

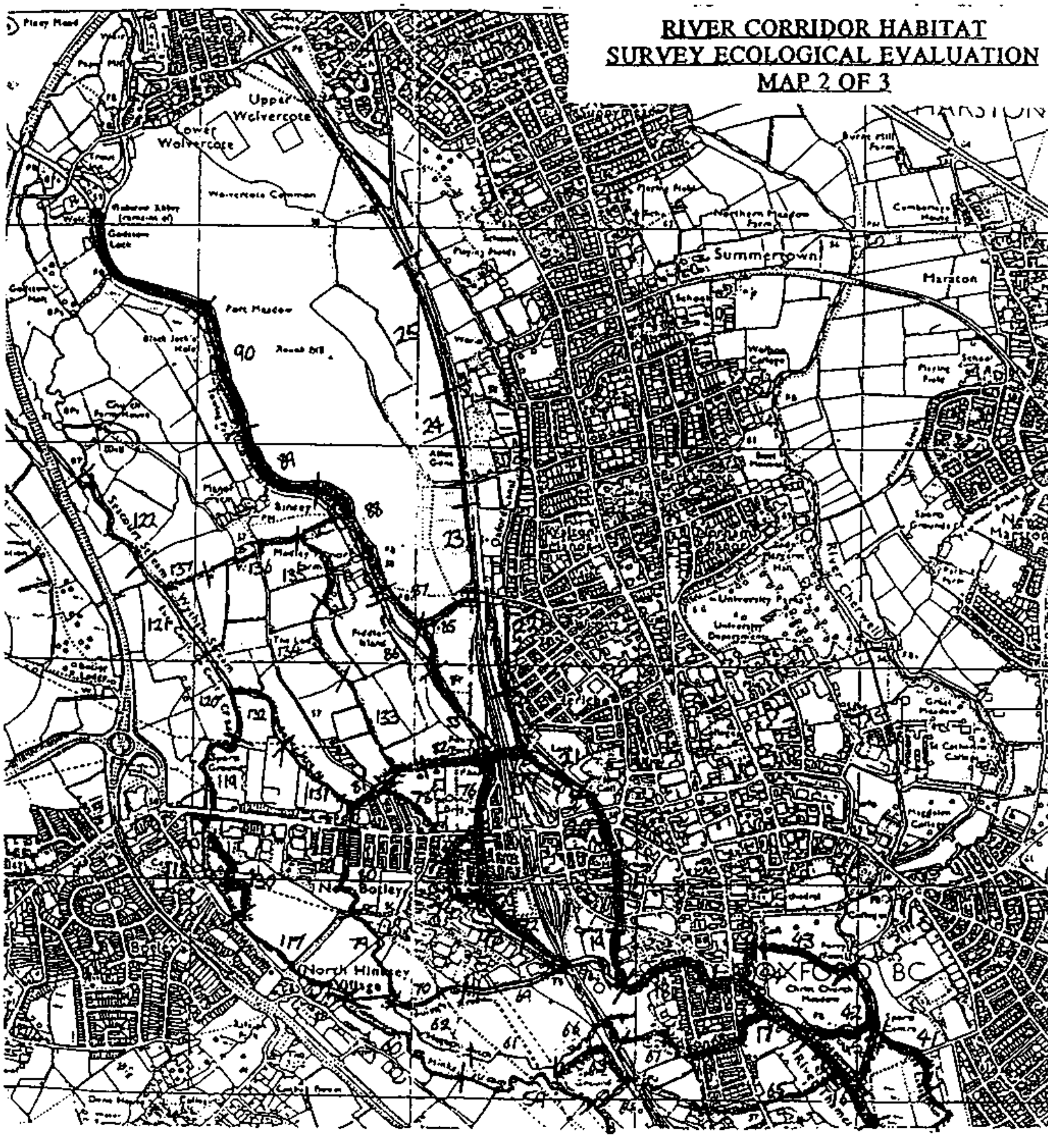
The existing management of channels bordering or passing through SSSI's should continue through close liaison and consultation with English Nature.

The management of the riparian tree cover is one goal of management of the existing wildlife habitat resource. Single, lines or groups of old pollarded and coppiced trees are important in wildlife and landscape terms and recommendations are made for repollarding and recoppicing where appropriate. A certain number of trees should be worked each year out of the total resource in order to provide variety of structure and age of regrowth. This will also act as a precautionary measure in case the trees do not respond to management, so avoiding the situation of having a river bank lined with dead stumps and pollards.

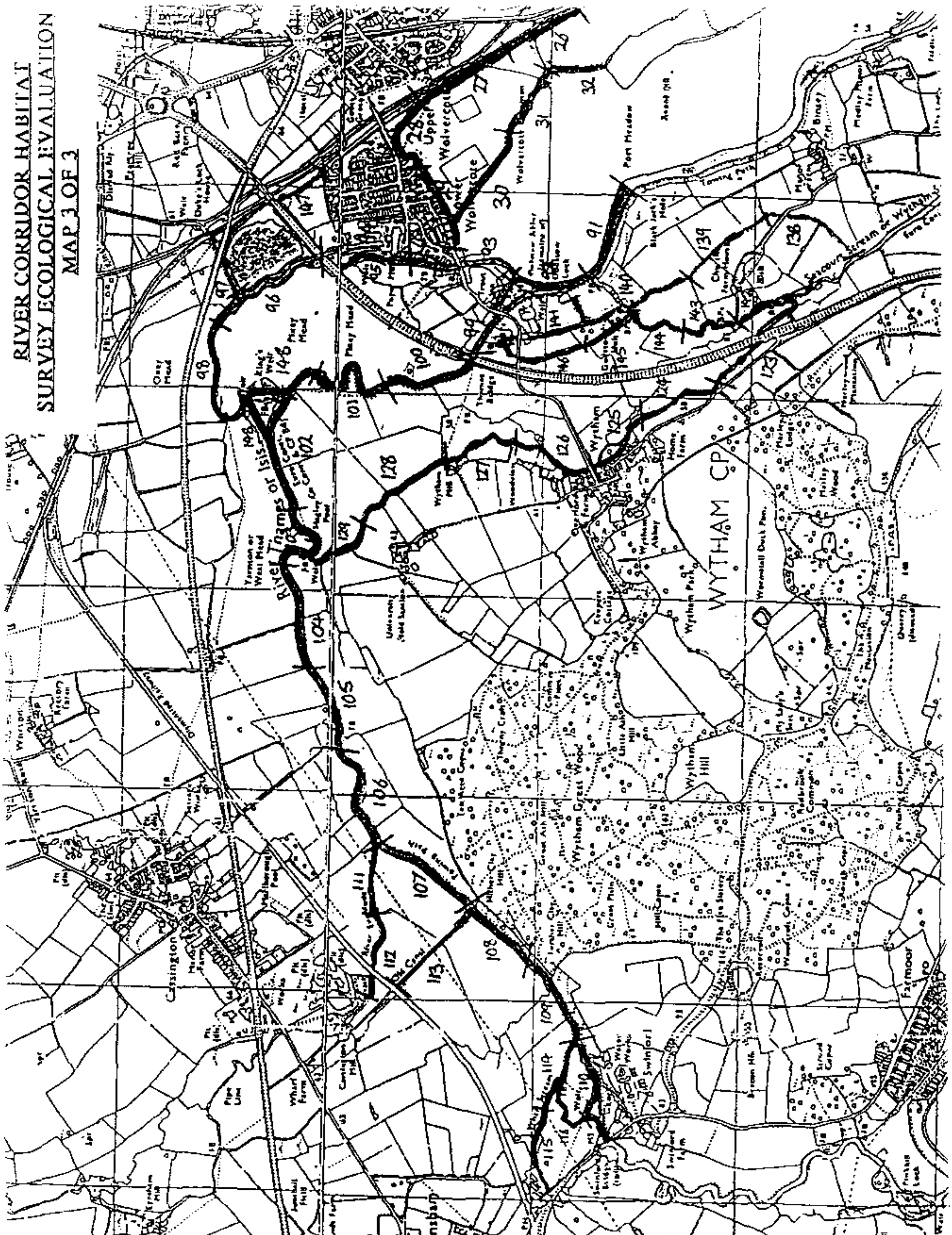
As a spin-off from pollarding and coppicing, the increased light let on to the river bank should promote the growth and spread of channel vegetation, so protecting, where appropriate, the bank from erosion by boat wash and, in any case, potentially increasing botanical diversity over time. Fallen trees are to be removed from channels unless it can be demonstrated that they function as Kingfisher perches and do not significantly impede flow or navigation. Occasional standing dead trees, unless a danger to the public, are best left *in situ* for woodpeckers, invertebrates and bats. Wooded areas could have bird and bat boxes sited.

RIVER CORRIDOR HABITAT SURVEY ECOLOGICAL EVALUATION MAP 1 OF 3




RIVER CORRIDOR HABITAT
SURVEY ECOLOGICAL EVALUATION
MAP 2 OF 3
Upper Wolvercote
Lower Wolvercote
Summertown
Marston
North Hinksey Village
New Botley
Botley

RIVER CORRIDOR HABITAT
SURVEY ECOLOGICAL EVALUATION
MAP 3 OF 3



4.2 LARGE RIVERS

The River Thames (Sections 001,003-018,036-037,071-076,083,086,088-096,098-110, and 148)

The River Thames is mostly gently meandering, wide and deep with islands, locks and weirs and slow flowing through agricultural land, on either side of urban Oxford. Its banks are principally clay and sand of varying profile with large parts being vertical and artificial through the built-up area. The channel carries a large amount of boat traffic especially in summer.

Of the 49 sections of the River Thames 29 are evaluated as critical by virtue of the presence of SSSI or valuable water-level dependent sites such as Fiddler's Elbow Island, Rose Isle and Heyford Hill Lane Pasture adjacent to one or both sides of the river for at least a part of the section. Sections 011-013 are evaluated as critical by virtue of their flowing alongside Iffley Meadows SSSI but the nature conservation value of the river is relatively low due to its urban, artificial nature, Iffley Lock and environs, and use by man. Unfortunately there is also limited scope for enhancement of the river in these sections. It is recommended that the best option for these 29 critical sections be a continuation of the present management in order to maintain their nature conservation value.

13 sections of the River Thames are evaluated as good with the recommended conservation management being, in the main, to retain the section as at present coupled with sympathetic future management of, for example, stands of emergent vegetation. Section 007 would benefit from enhancement measures, for example the creation of a wide berm to permit the growth of large stands of fringing vegetation. Section 083 and 086 would be enhanced by practical measures to improve the extent and diversity of emergent and aquatic vegetation given the heavy use of these sections by boat traffic.

7 sections are evaluated as poor, all of these being urban or lock sections with mostly artificial banks and heavily used by man. All of the existing semi-natural habitat in these sections should be retained. In most of these sections there is little scope for enhancement beyond cosmetic tree and shrub planting with the exception of 075 in which it is recommended that the channel profile be changed to create marginal berms and riffles and pools.

EXAMPLE

Ecosurveys Ltd

DATE: 10 July 1992 CODE: OFP 076 River Thames

CONDITIONS	Surveyed left bank. Dry and sunny. Flow - slow. One photograph from left side.

PHYSICAL FEATURES OF CHANNEL

i	Broad nature	A gently meandering section entering the outskirts of Oxford. The section is crossed by the A420 road bridge in midsection.
ii	Dimensions	Channel 20-25m wide, >2m deep.
iii	Substrate	Clay and mud.
iv	Bank type	Artificial on the left; vegetated entirely, except for downstream, on the right. Banks 0.5-0.75m high, 45-90° slopes.

LAND USE	LS Houses, gardens, hotel and factory. RS Allotment gardens, houses and gardens.
BANK VEGETATION	LB *Urtica dioica*, *Eupatorium cannabinum*, *Scrophularia aquatica*, *Epilobium hirsutum*, *Lolium perenne* and *Dactylis glomerata* occur upstream with *Sambucus nigra*, *Acer pseudoplatanus* and *Salix cinerea* saplings. Near the road bridge, a few standards of *Salix alba*, *Acer pseudoplatanus*, *Cornus sanguinea* and *Laburnum anagyroides* overhang *the bank*. Below the bridge, *Salix fragilis* and *Aesculus hippocastanum* overhang the bank. Downstream the bank is artificial. RB A mixture of *Lolium perenne* grassland with patches of *Urtica dioica*, *Eupatorium cannabinum* and *Epilobium hirsutum* occur upstream and in midsection with recently pollarded *Salix fragilis* stumps. Above the road bridge a pollarded *Populus* sp overhangs the channel. Below the bridge the artificial bank has *Lolium perenne* and *Bellis perennis*.
CHANNEL VEGETATION	Channel vegetation is sparse. *Nuphar lutea* and *Sparganium emersum* occur scattered along both sides upstream and in midsection. *Polygonum amphibium* occurs on the right in midsection with *Iris pseudacorus*, a few patches of *Carex riparia* and *Schoenoplectus lacustris*.
FEATURES OF INTEREST	A number of Crack Willow on the right bank have recently been repollarded. Mute Swan.
POTENTIAL THREATS	Continued speeding by boats.
MANAGEMENT RECOMMENDATIONS	Retain the scrub and trees. Plant trees and shrubs on the right bank upstream. Retain existing marginal vegetation.

J SYKES 10 7 1992

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RIVER THAMES