Macroinvertebrates in the Kennet Catchment

Part 1

Water Quality Monitoring

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KENNET CATCHMENT BIOLOGICAL REPORT SERIES

This report is one of a series of reports about the biology of the River Kennet catchment. The series covers all aspects of biological monitoring of the catchment carried out by the NRA Biology Section. Some reports cover the general status of the catchment, whilst others relate to specific problems identified in the Draft Kennet Catchment Management Plan. A list of reports being produced is given below.

Kennet Catchment Biology Studies

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Bacteriology of the Kennet Catchment

Algal Surveys and Eutrophication in the Kennet Catchment

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A Comparison of the Ecology of the River Kennet and Kennet and Avon Canal

Standing Waters of the Kennet Catchment (Summary)

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SUMMARY

- Twenty nine routine biological monitoring sites and fifteen additional sites were monitored as part of the Kennet Catchment Survey.

- Biological samples were taken at each site using the three minute kick-sweep technique. The routine sites were sampled twice whilst the additional sites were sampled on one occasion. RIVPACS was used to predict the biological scores that each site would have achieved assuming there were no pollution.

- The sites were classified into Environmental Quality Index Bands using the Monte Carlo Simulation confidence limits.

- Twenty three of the routine sites were in band A demonstrating good biological quality, three in band B and one, the Clayhill Brook below Burghfield STW, in band C. None were classified in band D of poor biological quality.

- Ten of the additional sites were in band A, demonstrating good biological quality, and the other five sites were not suitable for prediction. Of these, the canal sites had high BMWP scores whilst two watercourses had low BMWP scores.

- The river Kennet demonstrated high BMWP scores exceeding the average predicted scores throughout its length. As such, no detrimental effect was seen on the macroinvertebrate fauna of the Kennet as a result of urbanisation from Newbury or Reading.

- Discharges were not found to be a major problem although Burghfield STW is in need of attention. It is recommended that either a new site or a new method is used to monitor the Foudry Brook below Reading STW.

- Low flows were found to affect the small tributaries of the lower Kennet, and this accounts for the low scores at two of the additional sites.

- South of Reading, the lower reaches of the Burghfield Brook and Foudry Brook were found to be below their potential. Th biological evidence supports the need for pollution prevention measures in these areas.

- No increase in the coverage of routine monitoring is recommended in the Kennet Catchment as a result of this survey.

- It was concluded that in terms of the aquatic macroinvertebrate fauna, the Kennet Catchment required protection more so than enhancement.

- The few areas that need attention are Burghfield Brook, Clayhill Brook below Clayhill STW, the lower reaches of Foudry Brook Silchester Brook and Wasing Stream for water quality reasons, and Beenham Stream, Padworth Stream, Pear Tree Bottom Stream and West End Brook for water resourses (low flow) reasons.

1 INTRODUCTION

1.1 Background

Analysis of the routine macroinvertebrate samples from 1991 and 1992 revealed high biological quality at most of the sites throughout the catchment. There are several pressures in the Kennet catchment, identified in the Kennet Catchment Management Plan that threaten the aquatic fauna. These are: development and urbanisation of Newbury and Reading, discharges, low flows in the upper Kennet, gravel extraction, and the balance between recreational uses of watercourses and protection of the aquatic fauna.

The discharges; public and private sewage treatment works, trade effluents including gravel pit discharge and fish farms, are dealt with in separate reports as part of this series. The issue of the canal water affecting the river is also dealt with in a separate report (listed at the front of this document).

In the Catchment Management Plan, there are a number of specific issues listed in the table of water quality protection action plans. One of these is pollution prevention, with a number of campaigns in the areas of; South Reading, Foudry Brook and the River Enbourne and its tributaries. Another is the water from either the Kennet and Avon Canal or the Shalbourne Stream affecting the River Dun. The issue of foaming from Reading STW and the quality of Foudry Brook is also designated for action.

1.2 Reason For Survey

The routine sampling sites were monitored as part of the Kennet Catchment Survey. This was listed in the CMP table of routine water quality activities. The object was to determine the current biological status of the catchment and identify any problem areas. Additional sites were chosen to give the catchment greater coverage and pin point any problem areas that sampling of the routine sites may not detect. A map showing the location of the discharges monitored for the Kennet catchment survey is given in figure 1.

1.3 Routine Sampling Sites

All the routine sites in the catchment were to be sampled. These were previously chosen as representative of their river reaches and suitably placed to detect problems throughout the reach. Table 1 in the results section contains the sites that were sampled, the watercourses and the sampling site codes. These are also given in figure 1.

1.3 Additional Sites

Fifteen additional sites were monitored for the Kennet Catchment survey. These were selected to cover areas not covered by established routine sites such as the Kennet and Avon Canal. Some were previously used as routine sites, others were minor tributaries and upper

reaches not normally sampled. The sites are given in table 2 in the results section with the watercourse, location and sampling site code, and in figure 1. More information about the main watercourses and ditches near Reading is available in an internal report "Kennet Park Development - A biological survey of the Kennet Valley Between Reading and Theale" produced in April 1992.

2 METHODS

2.1 Sampling Frequency

For all routine sites, invertebrate samples were to be taken for two seasons. These were sampled in spring and summer or autumn, or summer and autumn, 1993. Additional sites were to be sampled during one season rather than two because they were sampled to pin-point any problem areas rather than for long term monitoring. These were all sampled in October or November of autumn 1993 apart from the Kennet and canal sites which were sampled earlier in the year.

2.2 Sampling Technique

Biological samples were taken at each site using the three minute kick-sweep technique. This is the method developed by the Institute of Freshwater Ecology (IFE) and used for the 1990 national biological survey. The samples were checked in the field and then taken back to the laboratory for sorting and identification of the invertebrates. The Biological Monitoring Working Party (BMWP) score and Average Score Per Taxon (ASPT) were calculated for each sample (Armitage et al, 1983). The River and InVertebrate Prediction And Classification System (RIVPACS) was used to predicted the BMWP score for the site assuming there was no pollution (Wright et al, 1989).

The Ecological Quality Indices (EQI) for BMWP score, ASPT and number of taxa were obtained from the observed/predicted ratio. The nearer to one the EQI, the better the biological quality. Using the two seasons results combined or single seasons results where appropriate, the EQI band for the sites was calculated. This classification uses the confidence limits from the Monte Carlo simulation to produce a band for the site from A, good, to D, poor, biological quality. This is the nationally accepted banding procedure and the method of banding is given in appendix 1.

The EQI banding system is less reliable using single season results than two seasons combined. However, as results for the additional sites were consistently well into band A, it was decided to use this method for the additional sites.

Where a site was not suitable for prediction and an EQI band could not be produced, the BMWP score and ASPT were used to determine the biological quality.

3 RESULTS & DISCUSSION

The observed and predicted scores are given in the routine reports and taxa lists attached in appendix 1.

3.1 Ecological Quality Index Bandings

3.1.1 Routine Sites

Table 1 contains the EQI bandings for the routine sites based on two samples taken in different seasons. The results are also shown in figure 1. Where only a single season's data was available, the EQI band has been calculated for that season but not included in the table to avoid confusion.

Table 1. Two seasons Combined BMWP Scores and EQI Bands for the Routine Sites

SITE CODE	WATERCOURSE	LOCATION	BMWP	EQI BAND
PKER.0002	Aldbourne	at G. S. Ramsbury	150	A
PKER.0003	Aldershot Stream	below Colthrop Mills	170	A
PKER.0148	Bagnor Stream	at Bagnor	195	A
PKER.0005	Baughurst Brook	below Ashford Hill Tip	143	A
PKER.0006	Beenham Stream	below Beenham Tip	-	-
PKER.0007	Burghfield Brook	above Foudry Brook	101	B
PKER.0098	Clayhill Brook	above Burghfield STW	101	A
PKER.0099	Clayhill Brook	below Burghfield STW	50	C
PKER.0009	R. Dun	at G. S. Hungerford	164	A
PKER.0013	Ecchinswell Brook	at A339 Headley	187	A
PKER.0016	R. Enborne	at G. S. Brimpton	185	A
PKER.0192	Fishermans Brook	above Padworth Stream	-	-
PKER.0019	Foudry Brook	at Hartley Court Fm	187	A
PKER.0103	Foudry Brook	below Reading STW	71	B
PKER.0150	Froxfield Stream	above the Dun	117	A
PKER.0024	Holy Brook	above R. Kennet	150	A

SITE CODE	WATERCOURSE	LOCATION	BMWP	EQI BAND
PKER.0002	Aldbourne	at G. S. Ramsbury	150	A
PKER.0003	Aldershot Stream	below Colthrop Mills	170	A
PKER.0057	Kingsclere Brook	below Tan House Headley	165	A
PKER.0052	R. Kennet	at Stitchcombe Mill	179	A
PKER.0043	R. Kennet	at Hambridge Road N'bury	236	A
PKER.0056	R. Kennet	above Aldershot Water	251	A
PKER.0054	R. Kennet	at Water Intake Fobney	202	A
PKER.0025	R. Kennet	100m above Thames	170	A
PKER.0059	R. Lambourn	at Bagnor	210	A
PKER.0074	R. Og	100m above Kennet	147	A
PKER.0076	Padworth Stream	at Bridge 368 Padworth	116	A
PKER.0079	Shalbourne Stream	at Smitham Bridge	127	A
PKER.0083	Silchester Brook	below Silchester STW	96	A
PKER.0151	West End Brook	at Tanhouse Bridge	138	A
PKER.0089	Winterbourne	at G. S. Bagnor	192	A

BAND A : Twenty three of the sites were in band A demonstrating good biological quality. A majority of these had values of greater than one for all EQIs. This reflects the diverse communities with pollution sensitive families found throughout most of the Kennet Catchment. Since a majority of the sites fell into band A, the BMWP scores for these sites were then used to identify any differences between them.

The River Kennet demonstrated high scores throughout its length ranging from 170 to 251. The Rivers Lambourn and Winterbourne, and Bagnor Stream also demonstrated high scores at the routine sites (210, 192 and 195 respectively). The River Enbourne at G. S. Brimpton had a score of 185 and two of its tributaries demonstrated equally high scores. The Foudry Brook at Hartley Court Farm scored 187.

Several sites in band A demonstrated lower BMWP scores. However, top-scoring (pollution-sensitive) taxa were found in Clayhill Brook above Burghfield STW which scored 101. The Froxfield Stream above the Dun has suffered habitat damage through damming, which has resulted in a reduced BMWP score. Padworth Stream at bridge 368 Padworth had dried up and is steadily recovering, and top-scoring taxa were found in Shalbourne Stream at Smitham Bridge.

BAND B : Three sites were in band B. These were Burghfield Brook above Foudry Brook, Foudry Brook below Reading STW and Silchester Brook below Silchester STW. The site in Burghfield Brook has three sewage treatment works (STWs) and several cooling water discharges from the Atomic Weapons Establishment (AWE) entering upstream. Further sampling may be required to establish which of these discharges was having a detrimental effect on the fauna of Burghfield Brook. Reading STW had a poor BMWP score below the discharges but high ASPT. This was therefore probably caused by sampling problems at this site rather than organic pollution. The site above Silchester STW was sampled for the discharges report produced as part of the Kennet Catchment series. Poor biological quality was found upstream of the discharge. Therefore, Silchester STW was found not to be the main cause of the poor biological quality at the site below the works.

BAND C : One site, Clayhill Brook below Burghfield STW, fell into Band C whilst the site above Burghfield STW was in band A. These sites were also sampled for the discharges report. Burghfield STW was found to have a detrimental effect on the fauna of the Clayhill Brook when the two seasons data were considered together. A depressed score was seen and pollution-tolerant taxa were abundant downstream, whilst the community was diverse upstream. Sewage fungus was seen below Burghfield STW in the Clayhill Brook.

BAND D : No sites were classified in band D of poor biological quality.

SINGLE SEASON : Two routine sites were only sampled during one season. These were Beenham Stream below Beenham Tip and Fishermans Brook above Padworth Stream. The site in Beenham Stream was dry during the summer and so a single season sample was taken in autumn. The resulting EQI band was C. There was a tip and a trade effluent discharge upstream of the sampling site. However, the lack of flow prior to sampling was more likely to have affected the biological quality since the fauna will have been recolonising. Fishermans Brook was not sampled in the summer due to time constraints. The autumn sample had an EQI band of B. This site was deep, silty and slow flowing and the fauna reflects these conditions. Aldermaston STW is upstream but this was found to have no detrimental effect on the fauna of Fishermans Brook when sampled for the discharges report.

3.1.2 Additional Sites

Table two contains the single season BMWP scores and EQI bandings for the additional sites. The results are also shown in figure 1.

Table 2. Single Season BMWP Scores and EQI Bands for the Additional Sites

SITE CODE	WATERCOURSE	LOCATION	BMWP	EQI BAND
PKER.0117	Adbury Stream	250m above Enbourne	115	A
PKER.0196	Calcot Stream	at Southcote Mill	117	A
PKER.0015	Enbourne	at Bishops Green	130	A
PKER.0110	Hollington Stream	below the Mount Stream	139	A
PKER.0048	R. Kennet	at Chilton Foliat	182	A
PKER.0144	R. Kennet	at Avington	153	A
PKER.0142	R. Kennet (Kint)	at Kintbury	184	A
PKER.0143	R. Kennet	at Kintbury	167	A
PKER.0097	R. Kennet	at Burghfield Bridge	170	A
PKER.0091	K & A Canal	at Froxfield Bridge	102	N/S
PKER.0032	K & A Canal	at Midgham Bridge	93	N/S
PKER.0096	K & A Canal	at Ufton Bridge	119	N/S
PKER.0068	Lambourn	d/s Lambourn TF Bagnor	160	A
PKER.0139	PearTree Bottom St	20m above K & A Canal	16	N/S
PKER.0164	Wasing Stream	20m above Enborne	48	N/S

Ten of the fifteen sites were suitable for RIVPACS and all ten classified as band A. For most of these, the EQIs were greater than one. The two seasons combined BMWP scores were used to determine any difference in them.

As with the routine sites, the Rivers Kennet and Lambourn demonstrated high BMWP scores ranging from 153 to 184. The other watercourses were small and all contained pollution-sensitive taxa. For example, six top-scoring taxa were found at the site in Hollington Stream, a small tributary of the upper reaches of the River Enbourne.

Five of the sites were not suitable for prediction. There were three canal sites,at Froxfield Bridge, at Midgham Bridge and at Ufton Bridge, for which the distance from source is not applicable. The BMWP scores were high for all three (102, 93 and 119 respectively). Therefore, there was no biological quality problem. Pear Tree Bottom Stream is a small watercourse, 6.35Km long, with three sewage treatment works entering upstream of the site above the Kennet and Avon Canal. The BMWP score at this site was 16 with an ASPT of 3.2. However, taxa of various scoring levels were missing compared with the previous sample which scored 107, and there was no increase in pollution-tolerant taxa. Therefore,

it is suspected that this watercourse may have dried out since the previous sample. Wasing Stream is also small, 3.48Km long, with one STW entering upstream of the site above the Enborne. The BMWP score was 48 with an ASPT of 4.8. This suggests a problem other than organic pollution such as low flows, a toxic problem or poor habitat quality. These watercourses may require further investigation.

No increase in the coverage of routine monitoring is recommended in the Kennet Catchment. This is because the additional sites mostly reflected the good biological quality of the routine sites. Where a couple of poor quality sites were detected amongst the additional sites, there were routine sites in the receiving watercourses downstream. If further investigation is required, the individual problems identified in this survey will be treated separately and not included in the routine programme.

3.2 Previous History

The comparing of BMWP scores at a site were used to determine whether the biological quality had changed over time.

Of the routine sites, twenty five were consistent, one was variable, three have improved over time and none has declined.

The Foudry Brook had a variable score thought to be due to the difficulty in sampling this site. The three that have improved were Clayhill Brook, which has improved from a BMWP score of 9 in 1990 to 47 in 1993, and Padworth Stream and West End Brook, both of which dried out in 1990 and have been recovering since. Beenham Stream was consistently poor because this also dried out in 1993. Although no sites have declined significantly, a number of sites had a reduced score in the autumn of 1993. Further sampling will be needed to determine whether this is a trend to decline or not.

Of the additional sites, nine were consistent, one was variable, two were sampled for the first time, one showed an increase in biological quality and two showed a decline.

The Enbourne at Bishops Green has shown an overall increase in biological quality since 1986 when a score of 89 was found until 1993 when a score of 130 was achieved but the quality has been variable throughout. This site has been subject to a series of pollution incidents. Hollington Stream below the Mount Farm showed an increase in score from 63 in 1986 to 139 in 1993. The Kennet and Avon Canal at Ufton Bridge has shown a gradual decline in biological quality from a score of 167 in 1990 to 119 in 1993. Pear Tree Bottom Stream has declined from 107 in 1988 to 16 in 1993. It is thought to have dried out in between these samples because the type of taxa missing is not indicative of an organic pollution problem.

3.3 Kennet Catchment Issues

The following are responses to the issues raised in the Kennet Catchment Management Plan.

3.3.1 Urbanisation

The River Kennet did not demonstrate any decrease in biological quality below Newbury or Reading. Below Newbury, the Kennet has a diverse fauna and high biological scores. Therefore, there appears to be no detrimental effect on the fauna of the Kennet as a result of these urban areas. It is possible that the faunas smaller watercourses may have been affected.

3.3.2 Discharges

In general, the discharges were not found to have a major effect in the Kennet Catchment. The discharge from Burghfield STW was found to have an effect on the fauna of Clayhill Brook and requires attention. The report on discharges in the Kennet catchment produced as part of this series gives further information.

3.3.3 Low Flows

Low flows were found to have been a problem in the Kennet catchment. Beenham Stream dry this year and in 1990, Padworth Stream was dry in 1990 but has recovered since and the fauna was almost up to the predicted score in 1993. It is suspected that West End Brook dried out because the score has increased from 31 in the summer of 1990 to 115 in the summer of 192 and has been fairly consistent since. Pear Tree Bottom Stream is also though to have dried out since it was last sampled in 1986 because the score has decreased dramatically. Therefore there is a low flow problem not only in the upper reaches of the Kennet but in the minor tributaries of the lower reaches as well. However, it must be remembered that the early 1990s were exceptionally dry.

3.3.4 River Kennet and K & A Canal Conflicts

There has been a decline in the biological quality of the Kennet and Avon Canal at Ufton Bridge. Elsewhere on the canal the biological scores have been consistently high. The River Kennet has consistently high biological quality throughout its length. The interaction of the river and the canal is dealt with in a separate report produced as part of this series.

3.3.4 Pollution Prevention Campaigns

It would seem that the areas South Reading and Lower Kennet and the Foudry Brook are in need of pollution prevention measures since these were areas of some of the poorest biological quality found in the Kennet catchment.

3.3.5 Turbid Water in the Dun

Although an aesthetic problem was identified in the Dun at Hungerford, this was not found to be affecting the fauna adversely in this survey. Shalbourne Stream, the Kennet and Avon Canal and the Dun were all found to be of good biological quality in this area. The biological quality of Shalbourne Stream has been variable but no severe declines have been recorded.

3.3.6 Reading STW Foaming and Foudry Brook

It is suggested that new methods of monitoring or new sites are tried in order to determine whether Reading STW is having a detrimental effect on the fauna of Foudry Brook. Extensive foaming was seen on each sampling occasion but because of difficulty in sampling, it has not been determined whether the STW was having a detrimental effect on the fauna. Different sampling methods or sites are recommended. The site below Reading STW fell into band B, but the site in Burghfield Brook above Foudry Brook was also in band B. Burghfield Brook flows into Foudry Brook above Reading STW and the AWE sewage works and trade effluents discharge to Burghfield Brook upstream of the sampling site. Two other watercourses enter the Foudry Brook in between Burghfield Brook and Reading STW; Stadium Stream which was found to be of poor biological quality in 1991 when last sampled, and Smallmead Ditch which has not been sampled.

4 CONCLUSIONS

There is need to protect the aquatic environment in the Kennet Catchment rather than look for enhancements because the biological quality, as indicated by the macroinvertebrate fauna, is good. The few areas that need attention are; Burghfield Brook, Clayhill Brook below Clayhill STW, the lower reaches of Foudry Brook and Silchester Brook for water quality reasons, and Beenham Stream, Padworth Stream and West End Brook for water resourses (low flow) reasons. Pear Tree Bottom Stream and Wasing Stream require investigation for both water quality and flow levels to determine the cause of the low biological scores. No increase in the coverage of routine monitoring is recommended in the Kennet Catchment in addition to these investigations.

5 REFERENCES

Armitage, P. D. et al (1983). The Performance of a New Biological Water Quality Score System Based on Macroinvertebrates Over a Wide Range of Unpolluted Running-Water Sites. *Water Res.* Vol. 17. N° 3. pp. 333-347.

Wright, J. F. et al (1989). Prediction of Invertebrate Communities Using Stream Measurements. *Regulated Rivers: Research & Management* Vol4, pp. 147-155.

1 Aldbourne at G. S. Ramsbury
2 Aldershot Stream below Colthrop Mills
3 Bagnor Stream at Bagnor
4 Baughurst Brook below Ashford Hill Tip
5 Beenham Stream below Beenham Tip
6 Burghfield Brook above Foudry Brook
7 Clayhill Brook above Burghfield STW
8 Clayhill Brook below Burghfiels STW
9 Dun at G. S. Hungerford
10 Ecchinswell Brook A339 Headley
11 Enbourne at G. S. Brimpton
12 Fishermans Brook above Padworth Stream
13 Foudry Brook at Hartley Court Farm Grazeley
14 Foudry Brook below Reading STW
15 FroxfieldStream above the Dun
16 Holy Brook above the Kennet
17 Kingsclere Brook below Tan House Headley
18 Kennet at Stitchcombe Mill
19 Kennet at Hambridge Road Newbury
20 Kennet above Aldershot Water
21 Kennet at Water Intake Fobney
22 Kennet 100m above Thames
23 Lambourn at Bagnor
24 Og above Kennet
25 Padworth Stream at Bridge 368 Padworth
26 Shalbourne Stream at Smitham Bridge
27 Silchester Brook below Silchester STW
28 West End Brook at Tanhouse Bridge
29 Winterbourne at G. S. Bagnor
30 Adbury Stream 250m above Enbourne
31 Calcot Stream at Southcote Mill
32 Enbourne at Bishops Green
33 Hollington Stream below the Mount Stream
34 Kennet at Chilton Foliat
35 Kennet at Avington
36 Kennet (Kintbury Loop) at Kintbury
37 Kennet at Kintbury
38 Kennet at Burghfield Bridge
39 K & A Canal at Froxfield Bridge
40 K & A Canal at Midgham Bridge
41 K & A Canal at Ufton Bridge
42 Lambourn below Lambourn Trout Farm
42 Pear Tree Bottom Stream 20m above K & A Canal
43 Wasing Stream 20m above Enbourne

Two Seasons Sampling
Single Sample
Band A : Good
Band B
Band C
Band D : Poor
Not Suitable for Prediction
River
Canal

Figure 1. EQI Bands for Routine and Additional Kennet Catchment Sampling Sites

APPENDIX 1

Ecological Quality Indices

Using the RIVPACS prediction program in a Monte Carlo Simulation it is possible to produce simulated faunal lists representative of repeated sampling of a single site (Armitage, Pardo, Furse and Wright, 1990). From these simulated samples mean values of BMWP scores, Numbers of Taxa and ASPTs can be calculated and confidence intervals about the means estimated (Figure 4). These values are assumed to be those that the site would achieve if no pollution occurred at the site, they can thus be used as "target" values against which the actual values can be measured. The major advantage of this system is that for each site the target set is specific to the habitat available at the site and the geographical area in which the site is located. The confidence limits give a range around the target which would be expected by natural variability. To make the comparisons between the observed values at a site and those predicted for the site by RIVPACS the following Ecological Quality Indices (EQI) are calculated:

EQI (Score) = Observed BMWP score / Predicted BMWP score
EQI (Taxa) = Observed No. Taxa / Predicted No. Taxa
EQI (ASPT) = Observed ASPT / Predicted ASPT

At unpolluted sites the EQI values are close to unity. At polluted sites, where the numbers of taxa and scores decline, the EQI values will be reduced.

Biological Classification and Banding

To facilitate the summarizing and presentation of the biological results the EQIs have been described in a simple classification system. The classification is illustrated by colour banding.

Biological classification band criteria

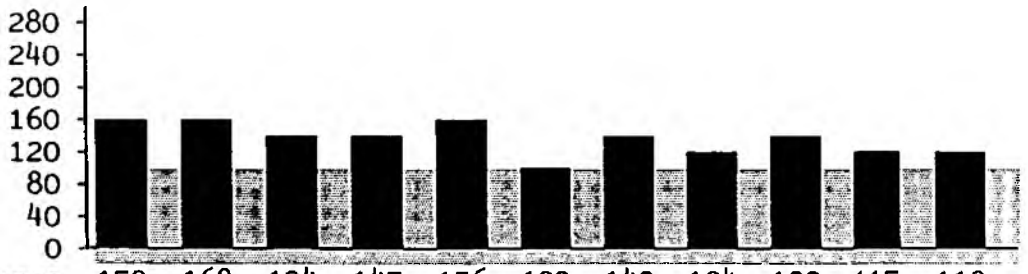
Band/Colour	EQI(ASPT)	EQI(Taxa)	EQI(Score)
Band A Blue	>0.89	>0.79	>0.75
Band B Green	0.77-0.89	0.58-0.79	0.50-0.75
Band C Yellow	0.66-0.76	0.37-0.57	0.25-0.49
Band D Red	>0-<0.66	>0-<0.37	>0-<0.25

The limits for the Blue band have been chosen using the confidence intervals from the Monte Carlo simulation of RIVPACS. The lower limit of the EQI(ASPT) is set at the lower 5 percentile of the Observed/Predicted distribution of the 438 RIVPACS sites. The lower limits of the EQI(Taxa) and EQI(Score) are similarly set at their lower 10 percentiles. Between the extremes of the Blue band (unpolluted) and the Red band (severely polluted) there is a continuum of communities which have been divided as follows : the Green and Yellow bands are set at the same width as the Blue band's difference from unity.

The placing of a site within the overall classification is according to the median of the three EQI bands pertaining to the site if this is lower than the EQI(ASPT) band otherwise it is placed in the EQI(ASPT) band (this allows a site only to be downgraded from the band given by the EQI(ASPT)). The site is then taken to represent a specified length of watercourse (reach). For the 1990 National Survey 4,772 sites were classified and all the reaches they represented were less than 30km.

APPENDIX 2

01930441 **Aldbourne At G.s. Ramsbury**
Site Ref **PKER.0002** Grid Ref **SU29007160** Sampled **14/10/1993 at 13:00**
Scores Current **112** Previous **115** Change is **2% Deterioration.** Biotic Class **B**



Predicted Score 111

Scores 159 168 134 147 156 109 140 124 139 115 112
Dates 0389 0390 0690 0990 0491 0891 0991 0592 0792 0793 1093

Comments Litle change to score. Top scoring Ephemerellidae absent in this sample. However Leptoceridae & Goeridae missing in the last sample found again in this sample.

01930468 **Aldershot Water Below Colthrop Mills**
Site Ref **PKER.0003** Grid Ref **SU54406600** Sampled **01/11/1993 at 10:00**
Scores Current **167** Previous **110** Change is **51% Improvement.** Biotic Class **A**

Predicted Score 91

Scores 167 163 157* 157* 110 167 * Non-Routine Sample
Dates 0890 1091 0192 0292 0893 1193

Comments The observed score was much greater than that predicted, as was the ASPT. There were seven top-scoring (pollution-sensitive) families found. Ranunculus was the dominant plant (65% cover).

01930408 **Bagnor Stream At Bagnor**
Site Ref **PKER.0148** Grid Ref **SU45306920** Sampled **23/09/1993 at 11:30**
Scores Current **122** Previous **175** Change is **30% Deterioration.** Biotic Class **B**

Predicted Score 132

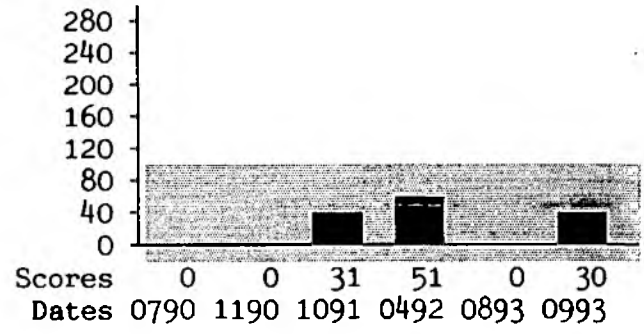
Scores 187 164 200 163 169 160* 130 150 174 175 122 * Non-Routine Sample
Dates 0478 0479 0580 0183 0384 0886 0890 1191 0392 0593 0993

Comments Lowest score ever for this site. Top scoring HeptageniidaeLeptophlebiidae & Lepidostomatidae not found in this sample.

01930383 **Baughurst Brook Below Ashford Hill Tip**
Site Ref **PKER.0005** Grid Ref **SU55606310** Sampled **09/09/1993 at 10:00**
Scores Current **115** Previous **86** Change is **33% Improvement.** Biotic Class **B**

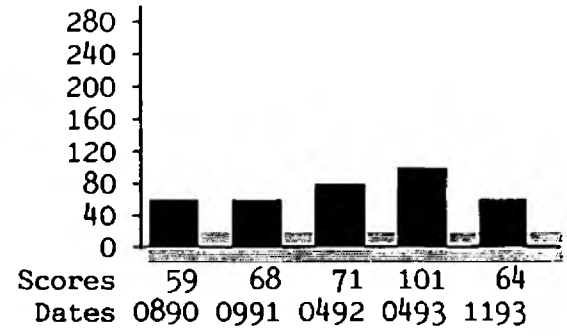
Comments Leuctrid stoneflies and Psychomiid caddisflies found for the first time at this site. Four top-scoring (pollution-sensitive) families present.

01930381 **Beenham Stream Below Beenham Tip**
Site Ref **PKER.0006** Grid Ref **SU60906940** Sampled **09/09/1993 at 13:30**
Scores Current **30** Previous **0** Biotic Class **D**



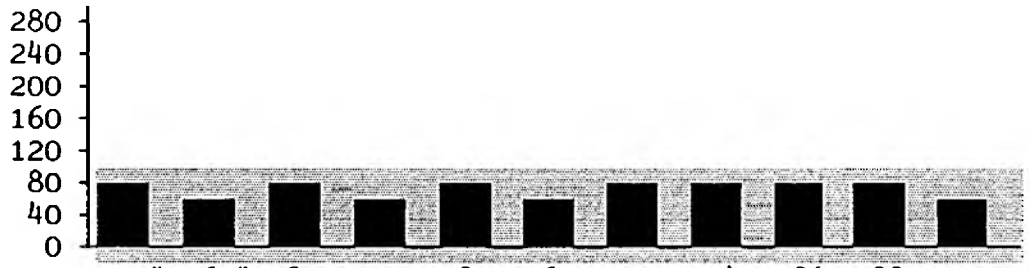
Comments The fauna was recovering from drying out in August. No taxa found scoring >5.

01930496 **Burghfield Brook Above Foudry Brook**
Site Ref **PKER.0007** Grid Ref **SU69906920** Sampled **10/11/1993 at 10:45**
Scores Current **64** Previous **101** Change is **36% Deterioration.** Biotic Class **C**



Comments Depressed score compared to Spring 93 sample. Agriidae, Psychomyiidae, Simulidae, Baetidae missing in this sample compared to the last sample.

01930415 **Clayhill Brook Above Burghfield Stw**
Site Ref **PKER.0098** Grid Ref **SU65506840** Sampled **04/10/1993 at 10:15**
Scores Current **50** Previous **88** Change is **43% Deterioration.** Biotic Class **D**



Predicted Score **91**

Scores	75*	61*	81	50	83	65	79	74	86	88	50
Dates	0285	0989	0490	0790	1190	0391	0691	0991	0492	0593	1093

* Non-Routine Sample

Comments Lower score than May sample. Leptophlebiidae, Polycentropidae, Tipulidae missing in this sample compared to the May sample.

01930416 **Clayhill Brook Below Burghfield Stw**
Site Ref **PKER.0099** Grid Ref **SU66006880** Sampled **04/10/1993 at 10:45**
Scores Current **47** Previous **42** Change is **11% Improvement.** Biotic Class **D**

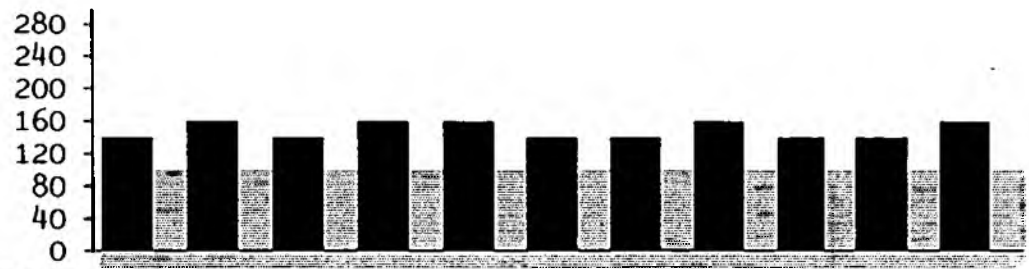
Predicted Score **111**

Scores	25*	9	24	23	23	31	34	66	42	47
Dates	0285	0490	0790	1190	0391	0691	0991	0492	0593	1093

* Non-Routine Sample

Comments Similar score to last smaple. Hydropsychidae found for the first time at this site. Abundance of Gammaridae reduced by two orders of magnitude compared to the last sample.

01930434 **Dun At Gs, Hungerford**
Site Ref **PKER.0009** Grid Ref **SU33206850** Sampled **12/10/1993 at 11:00**
Scores Current **159** Previous **131** Change is **21% Improvement.** Biotic Class **A**



Predicted Score **109**

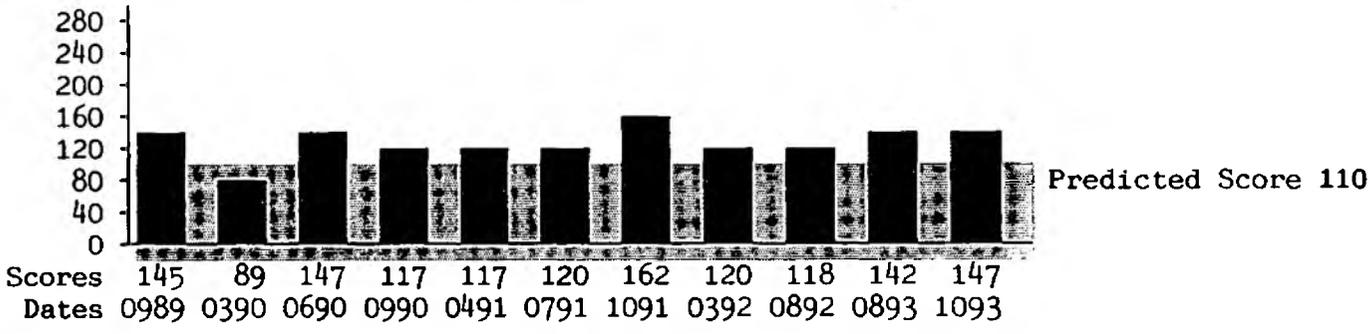
Scores	133	157	144	157	159	137	139	159	133	131	159
Dates	0389	0590	0890	0990	0491	0891	0991	0592	0792	0893	1093

Comments Five top-scoring families found. Beraeid caddisflies found for the first time; otherwise, a typical fauna for this site.

01930380 **Ecchinswell Brook At A339 Headley**
Site Ref **PKER.0013** Grid Ref **SU50706340** Sampled **09/09/1993 at 11:00**
Scores Current **138** Previous **132** Change is **4% Improvement.** Biotic Class **B**

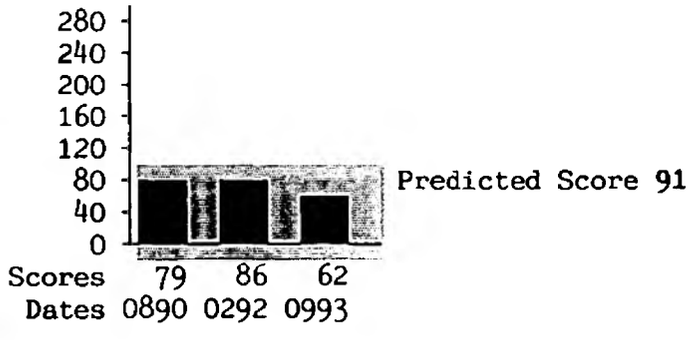
Comments Six top-scoring (pollution-sensitive) families found. Erpobdellid leeches found for the first time.

01930433 **Enborne At Gauging Station Brimpton**
Site Ref **PKER.0016** Grid Ref **SU56806480** Sampled **12/10/1993 at 10:00**
Scores Current **147** Previous **142** Change is **3% Improvement.** Biotic Class **B**



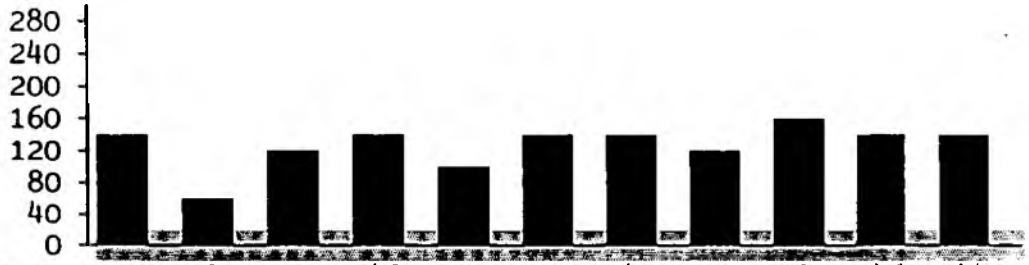
Comments Six top-scoring (pollution-sensitive) families found. The site was deep with fast flowing water.

01930379 **Fishermans Brook Above Padworth Stream**
Site Ref **PKER.0192** Grid Ref **SU60806630** Sampled **09/09/1993 at 12:00**
Scores Current **62** Previous **86** Change is **27% Deterioration.** Biotic Class **C**



Comments American signal crayfish (all approx. 2cm long) and Phryganeid caddisflies found for the first time at this site.

01930494 **Foudry Brook At Hartley Court Farm Grazely**
Site Ref **PKER.0019** Grid Ref **SU70206880** Sampled **10/11/1993** at **10:15**
Scores Current **144** Previous **146** Change is **1% Deterioration.** Biotic Class **B**

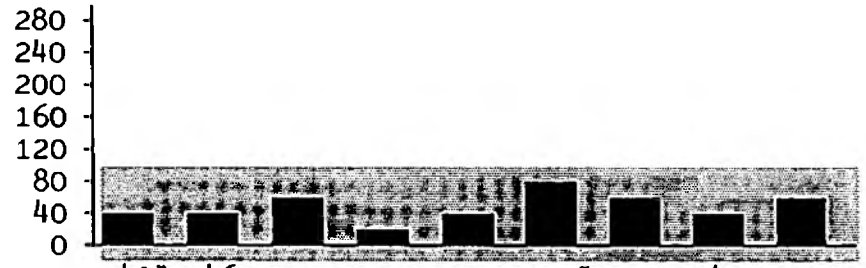


Predicted Score 0
* Non-Routine Sample

Scores	132	60	123	148	109	131	140	129	160	146	144
Dates	0989	0390	0790	0990	0391	0691	0991	0592	0892	0493	1193

Comments Little change to score. Unionidae and Planorbidae found for the first time since 1991 and Dendrocoelidae since 1989. Leptophlebiidae and Limnephilidae missing in this sample compared to the last Spring 93 sample.

01930483 **Foudry Brook Below Reading Stw**
Site Ref **PKER.0103** Grid Ref **SU71107080** Sampled **03/11/1993** at **12:00**
Scores Current **52** Previous **45** Change is **15% Improvement.** Biotic Class **C**

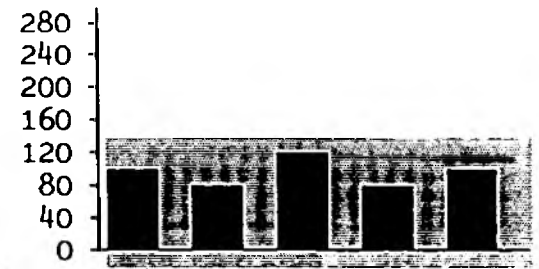


Predicted Score **106**
* Non-Routine Sample

Scores	49*	46	53	27	37	72*	59	45	52
Dates	1283	0688	0989	1190	0691	0891	0892	0493	1193

Comments Lttle change to score. Agriidae & Hydroptilidae missing in this sample compared to the last sample.

01930440 **Froxfield Stream Above Dun**
Site Ref **PKER.0150** Grid Ref **SU30566778** Sampled **14/10/1993** at **12:30**
Scores Current **97** Previous **88** Change is **10% Improvement.** Biotic Class **C**

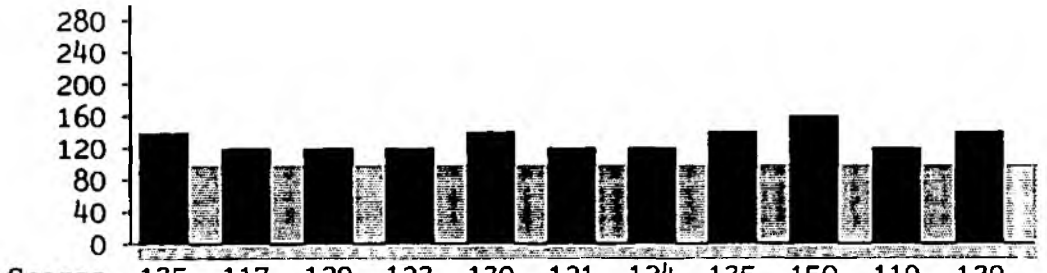


Predicted Score **123**
* Non-Routine Sample

Scores	94*	71	116	88	97
Dates	0690	1191	0592	0793	1093

Comments Little change to score. Although Ephemerellidae not found in this sample Polycentropidae & Simulidae found for the first time at this site & Rhyacophilidae for the first time since 1990.

01930482 **Holy Brook Above Kennet**
Site Ref **PKER.0024** Grid Ref **SU72007350** Sampled **03/11/1993 at 11:00**
Scores Current **130** Previous **119** Change is **9% Improvement.** Biotic Class **B**

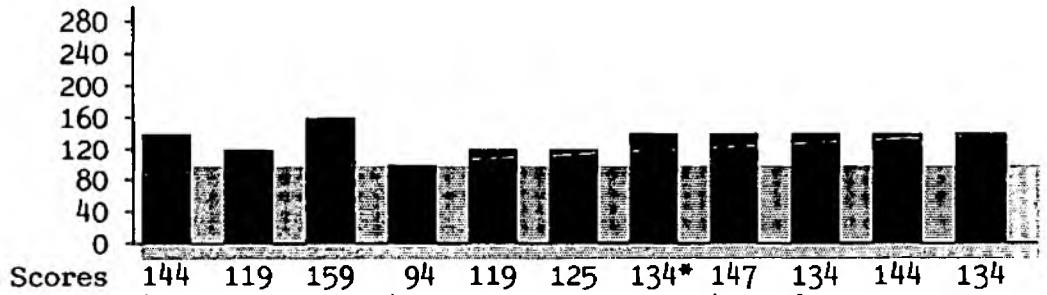


Predicted Score **91**

Scores	135	117	129	123	130	121	124	135	150	119	130
Dates	0989	0590	0790	1190	0591	0791	1191	0592	0892	0393	1193

Comments Little change to score. Sialidae found for the first time since 1989 and Corixidae for the first time since 1991. Physidae show a slight increase in abundance. Access to this site is proving difficult/dangerous.

01930382 **Kingsclere Brook Below Tan House Farm, Headley**
Site Ref **PKER.0057** Grid Ref **SU52906280** Sampled **09/09/1993 at 10:30**
Scores Current **134** Previous **144** Change is **6% Deterioration.** Biotic Class **B**



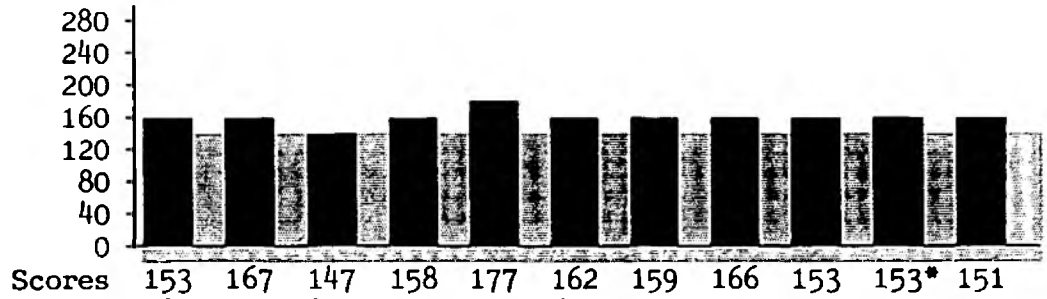
Predicted Score **107**

Scores	144	119	159	94	119	125	134*	147	134	144	134
Dates	0490	0790	0990	0491	0791	1091	1091	0492	0892	0593	0993

* Non-Routine Sample

Comments Six top-scoring (pollution-sensitive) families found.

01930504 **Kennet At Stitchcombe Mill**
Site Ref **PKER.0052** Grid Ref **SU22706950** Sampled **22/11/1993 at 12:30**
Scores Current **151** Previous **153** Change is **1% Deterioration.** Biotic Class **A**



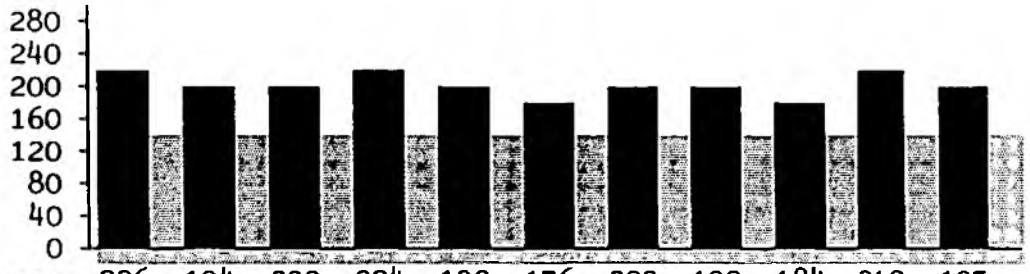
Predicted Score **124**

Scores	153	167	147	158	177	162	159	166	153	153*	151
Dates	0289	0590	0890	1090	0391	0691	0991	0592	0792	0793	1193

* Non-Routine Sample

Comments Astacide found for the first time since 1991. A single post orbital ridge- Native. Otherwise similar score to Spring sample although Lepidostomatidae, Lymnaeidae & Physidae notably missing in this sample.

01930507 **Kennet At Hambridge Road, Newbury**
Site Ref **PKER.0043** Grid Ref **SU49106730** Sampled **17/11/1993 at 11:30**
Scores Current **195** Previous **210** Change is **7% Deterioration.** Biotic Class A

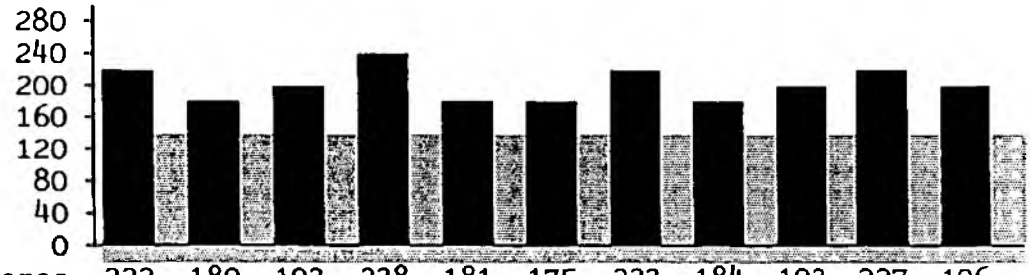


Predicted Score 122

Scores	226	194	202	224	192	176	203	192	184	210	195
Dates	0289	0590	0990	1090	0391	0691	0991	0592	0792	0493	1193

Comments A slightly reduced score compared to the spring 93 sample. Leptophlebiidae found for the first time since 1991.

01930506 **Kennet Above Aldershot Water**
Site Ref **PKER.0056** Grid Ref **SU54406590** Sampled **17/11/1993 at 10:30**
Scores Current **196** Previous **227** Change is **13% Deterioration.** Biotic Class A

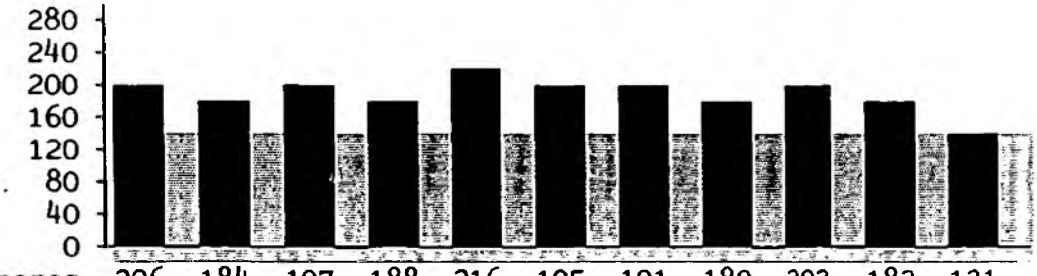


Predicted Score 122

Scores	222	180	193	238	181	175	223	184	193	227	196
Dates	0289	0590	0890	1090	0391	0691	0991	0592	0792	0493	1193

Comments A reduced score compared to the spring 93 sample. Top scoring Heptageniidae, Ephemerellidae & Lepidostomatidae missing in this sample compared to the last. Psychomyiidae & Polycentropidae found for the first time since 1991.

01930384 **Kennet At Water Intake, Fobney**
Site Ref **PKER.0054** Grid Ref **SU70507100** Sampled **15/09/1993 at 15:15**
Scores Current **131** Previous **182** Change is **28% Deterioration.** Biotic Class B



Predicted Score 131

Scores	206	184	197	188	216	195	191	180	203	182	131
Dates	0289	0590	0790	0990	0591	0891	1191	0592	0792	0793	0993

* Non-Routine Sample

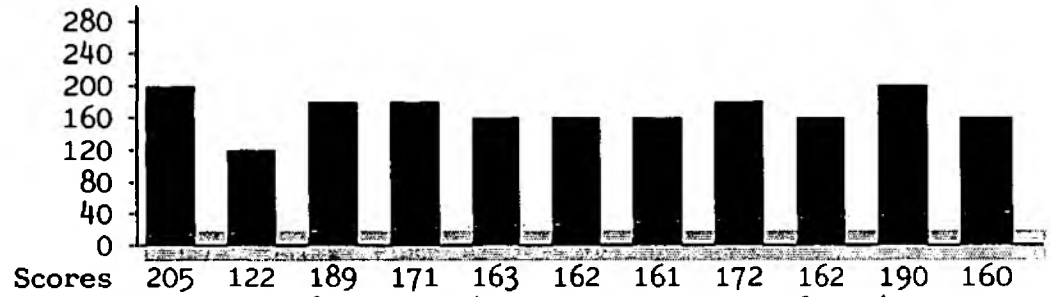
Comments Viviparidae snails found for the first time, and Hydrophilid beetles found for the first time since 1981. Two top-scoring taxa found. Taxa of various scoring levels missing compared with the last sample. This may be due to increase siltation seen at this site. (Nb.Borehole pumping in vicinity.)

01930481 **Kennet Above Thames**
Site Ref **PKER.0025** Grid Ref **SU73107380** Sampled **03/11/1993 at 10:00**
Scores Current **146** Previous **125** Change is **16% Improvement.** Biotic Class **B**

Scores 112 102 114 113 100 110 108 107 129 125 146
Dates 0289 0590 0890 1090 0491 0791 0991 0692 0992 0493 1193

Comments High score for this site. Ephemeridae found for the first since 1990.

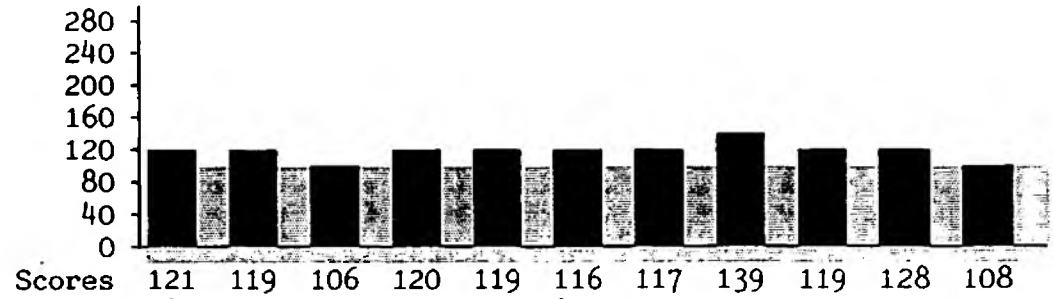
01930495 **Lambourn At Bagnor**
Site Ref **PKER.0059** Grid Ref **SU45306910** Sampled **10/11/1993 at 10:45**
Scores Current **160** Previous **190** Change is **15% Deterioration.** Biotic Class **A**



Scores 205 122 189 171 163 162 161 172 162 190 160
Dates 0989 0390 0890 1190 0491 0791 1191 0392 0892 0493 1193

Comments Depressed score compared to Spring 93 sample. Several high scoring taxa missing, namely Lepidostomatid and Sericostomatid caddisflies, in addition to lower scoring taxa in this sample compared to the last sample.

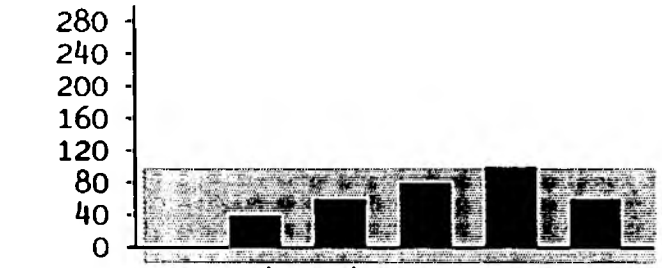
01930505 **Og 100m. Above Kennet**
Site Ref **PKER.0074** Grid Ref **SU19506960** Sampled **22/11/1993 at 13:15**
Scores Current **108** Previous **128** Change is **15% Deterioration.** Biotic Class **B**



Scores 121 119 106 120 119 116 117 139 119 128 108
Dates 0389 0390 0690 0990 0591 0891 1191 0592 0792 0793 1193

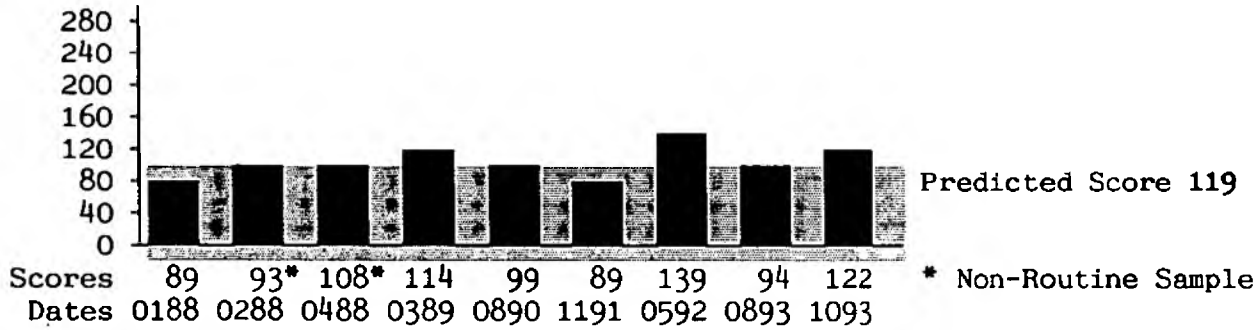
Comments Little change to score although top scoring Ephemerellidae missing in this sample compared to the last Spring sample.

01930378 **Padworth Stream At Bridge 368 Padworth**
Site Ref **PKER.0076** Grid Ref **SU61106600** Sampled **09/09/1993 at 12:30**
Scores Current **57** Previous **95** Change is **40% Deterioration.** Biotic Class **C**



Comments Three top-scoring taxa missing compared with the last sample. There was little flow in the watercourse. A Cordulegasteridae dragonfly was found for the first time at this site. This taxa is rarely found in the Thames Region.

01930439 **Shalbourne Stream At Smitham Bridge**
Site Ref **PKER.0079** Grid Ref **SU33006820** Sampled **14/10/1993 at 11:30**
Scores Current **122** Previous **94** Change is **29% Improvement.** Biotic Class **B**



Comments Higher score than Summer 93 sample. Two top scoring taxa absent in that last sample being found again in this sample. Piscicolidae found for the first time since 1990.

01930418 **Silchester Brook Below Silchester Stw**
Site Ref **PKER.0083** Grid Ref **SU62406070** Sampled **04/10/1993 at 11:45**
Scores Current **86** Previous **75** Change is **14% Improvement.** Biotic Class **C**

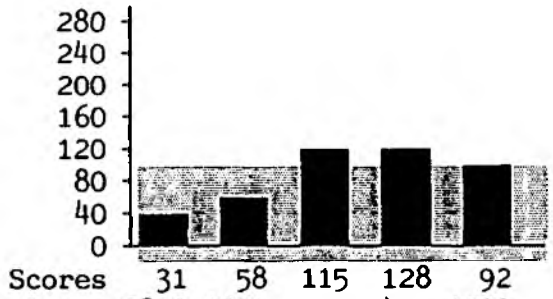
Predicted Score **100**

Scores	62*	47	63	35	50	53	81	64	78	75*	86
Dates	0889	0390	0690	0990	0491	0791	1191	0692	0992	0293	1093

* Non-Routine Sample

Comments Little change to score. Hydrometridae seen for the first time in this sample, Elmidae since 1989 and Coenagriidae since 1987. Some sewage fungus seen growing on tree roots.

01930417 **West End Brook At Tanhouse Bridge**
Site Ref **PKER.0151** Grid Ref **SU65806330** Sampled **04/10/1993 at 11:15**
Scores Current **92** Previous **128** Change is **28% Deterioration.** Biotic Class **C**

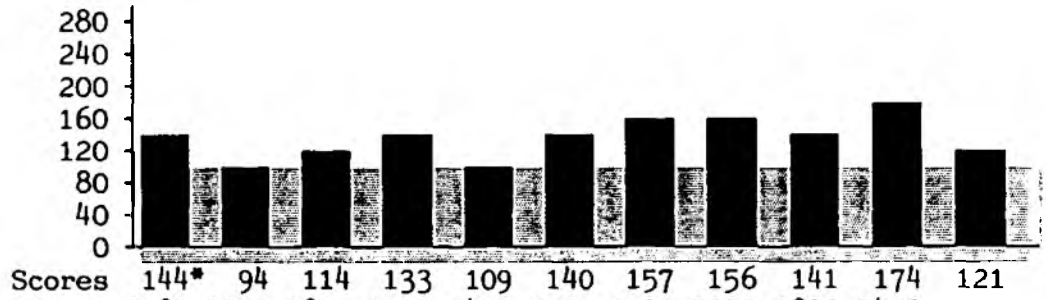


Predicted Score **100**

Scores	31	58	115	128	92
Dates	0890	1091	0792	0493	1093

Comments Lower score than last sample. Caenidae, Nemouridae, Limnephilidae & Hydroptilidae missing in this sample compared to the last sample. Corixidae found for the first time at this site.

01930407 **Winterbourne At Gs, Bagnor**
Site Ref **PKER.0089** Grid Ref **SU45306950** Sampled **23/09/1993 at 11:00**
Scores Current **121** Previous **174** Change is **30% Deterioration.** Biotic Class **B**



Predicted Score **112**

Scores	144*	94	114	133	109	140	157	156	141	174	121
Dates	0589	0390	0890	1190	0491	0791	1191	0392	0892	0493	0993

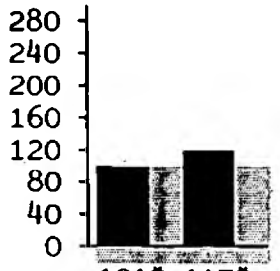
* Non-Routine Sample

Comments Lower score compared to most recent samples. Top scoring Leptophlebiidae, Ephemerellidae & Goeridae absent in this sample together with several middle scoring taxa. Psychomyiidae found for the first time at this site.

01930471 **Adbury Stream 250m Above Enbourne**
Site Ref **PKER.0117** Grid Ref **SU48526360** Sampled 01/11/1993 at 12:00
Scores Current **115** Predicted **93** Biotic Class **B**

Comments Three top-scoring taxa found in this small watercourse. Pollution-tolerant Hydrobiid snails were abundant suggesting some organic enrichment. The observed score was greater than that predicted for this site.

01930480 **Calcot Stream At Southcote Mill**
Site Ref **PKER.0196** Grid Ref **SU69367134** Sampled 03/11/1993 at 10:00
Scores Current **117** Previous **101** Change is **15%** Improvement. Biotic Class **B**



Predicted Score **91**

Scores 101* 117* * Non-Routine Sample
Dates 1091 1193

Comments More high-scoring (pollution-sensitive) families and less low scorers were found in this sample than the previous one resulting in a high ASPT. There was 25% plant cover inc. sedges and water-mint. The stream bed consisted of 100% fine silt. The observed score was greater than that predicted.

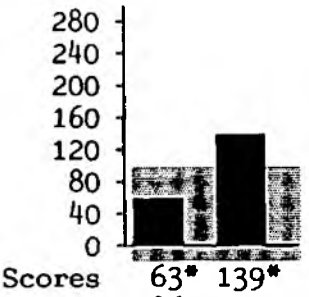
01930539 **Enborne At Bishops Green**
Site Ref **PKER.0015** Grid Ref **SU50106350** Sampled 30/11/1993 at 11:00
Scores Current **130** Previous **113** Change is **15%** Improvement. Biotic Class **B**

Predicted Score **104**

Scores 175 89* 124* 92* 113* 130* * Non-Routine Sample
Dates 0679 1286 0487 0292 0893 1193

Comments Slightly improved score compared to Summer sample.Sialidae & valvatidae found for the first time and Lepidoatomatidae for the first time since 1987. American crayfish found in last sample missing in this sample.

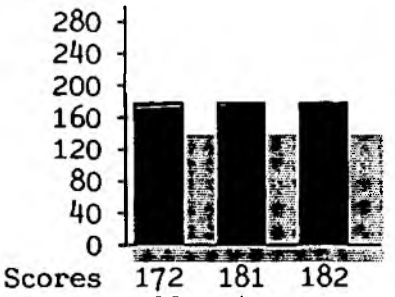
01930469 **Hollington Stream Below The Mount Farm**
Site Ref **PKER.0110** Grid Ref **SU43606140** Sampled **01/11/1993 at 10:45**
Scores Current **139** Previous **63** Change is **120% Improvement.** Biotic Class **B**



Scores 63* 139* * Non-Routine Sample
Dates 0186 1193

Comments The stream bed was covered by a red/brown iron deposit. There has been a vast improvement in the biological quality at this site compared with the 1986 sample. Ten high-scoring taxa (including 6 top-scorers) were found where previously no taxa were found scoring >6.

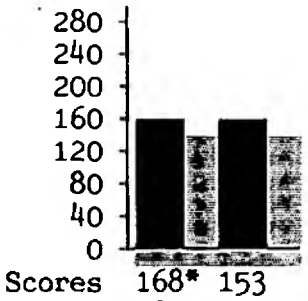
01930485 **Kennet Water Gardens Inlet,chilton Foliat**
Site Ref **PKER.0048** Grid Ref **SU32807010** Sampled **08/10/1993 at 11:50**
Scores Current **182** Previous **181** Change is **0% Improvement.** Biotic Class **A**



Scores 172 181 182
Dates 0988 0289 1093

Comments A GOOD SCORE WITH TOP SCORING TAXA.

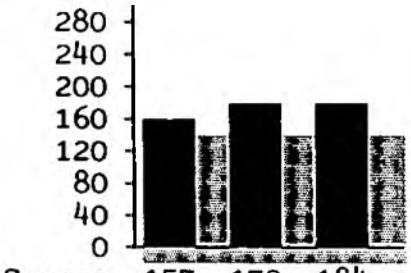
01930486 **Kennet At Avington**
Site Ref **PKER.0144** Grid Ref **SU37406765** Sampled **08/10/1993 at 12:45**
Scores Current **153** Previous **168** Change is **8% Deterioration.** Biotic Class **A**



Scores 168* 153 * Non-Routine Sample
Dates 0989 1093

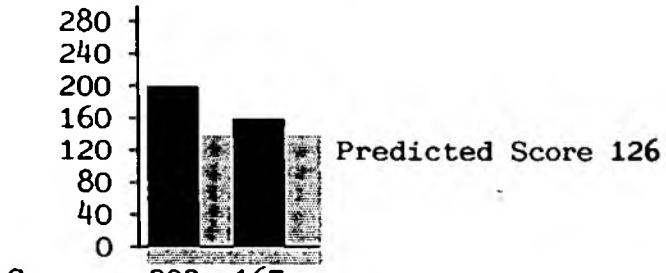
Comments A GOOD SCORE CONSIDERING THE HIGH FLOW. SEVERAL MIDDLE SCORING TAXA ABSENT - EG. ANCYLIDAE, ELMIDAE AND SIMULIIDAE.

01930488 **Kennet (Kintbury Loop) At Kintbury**
Site Ref **PKER.0142** Grid Ref **SU38606740** Sampled **08/10/1993 at 14:00**
Scores Current **184** Previous **170** Change is **8% Improvement.** Biotic Class A



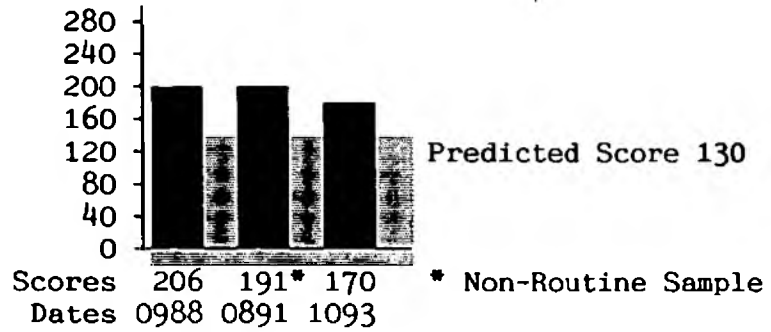
Comments HIGH SCORE WITH PRESENCE OF SEVERAL MIDDLE SCORING TAXA, EG. CAENIDAE AND GYRINIDAE NOT FOUND PREVIOUSLY.

01930487 **Kennet At Kintbury**
Site Ref **PKER.0143** Grid Ref **SU38706755** Sampled **08/10/1993 at 13:20**
Scores Current **167** Previous **202** Change is **17% Deterioration.** Biotic Class A



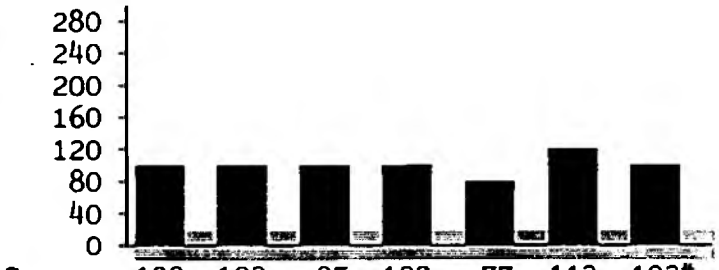
Comments A GOOD SCORE BUT RELATIVELY FEW HIGH SCORING TAXA PRESENT WHEN SAMPLED.

01930484 **Kennet At Burghfield Bridge**
Site Ref **PKER.0097** Grid Ref **SU68207080** Sampled **08/10/1993 at 10:30**
Scores Current **170** Previous **191** Change is **10% Deterioration.** Biotic Class A



Comments A HIGH SCORE BUT MANY TOP SCORING MAYFLY AND CADDIS TAXA ABSENT. RIVER IN SPATE WHEN SAMPLED.

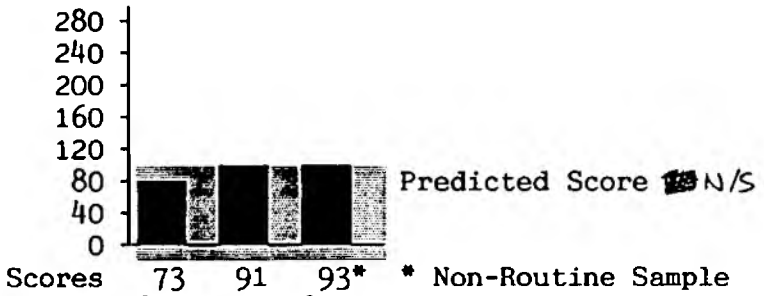
01930377 **Kennet & Avon Canal (Summit) At Froxfield Bridge**
Site Ref **PKER.0091** Grid Ref **SU30606780** Sampled **26/08/1993 at 10:00**
Scores Current **102** Previous **113** Change is **9% Deterioration.** Biotic Class **B**



Scores 102 103 95 103 77 113 102*
Dates 0590 0890 1090 0391 0691 0991 0893
* Non-Routine Sample

Comments Slightly lower score comapred to last year. Ancylidae seen for the first time and Ephemeridae for the first time since 1990. Flatworms, Notonectidae and Lymnaeidae missing from this sample.

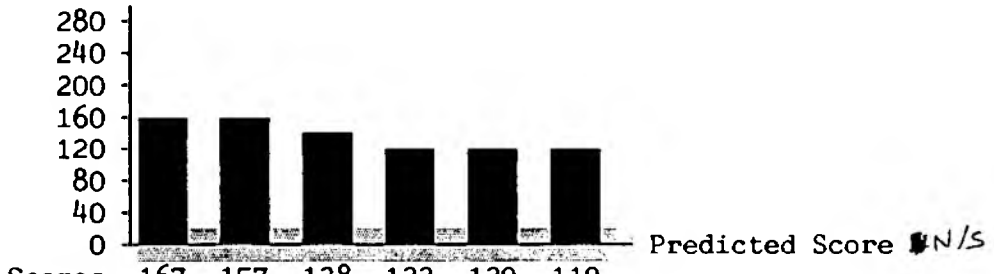
01930346 **Kennet & Avon Canal (Wid-wool) At Midgham Bridge**
Site Ref **PKER.0032** Grid Ref **SU55106620** Sampled **27/08/1993 at 09:45**
Scores Current **93** Previous **91** Change is **2% Improvement.** Biotic Class **C**



Scores 73 91 93*
Dates 0890 1191 0893
* Non-Routine Sample

Comments Little change in score. Leptoceridae, Caenidae & Hydroptilidae found for the first time at this site. Channel covered by 60% Rannunculus.

01930119 **Kennet & Avon Canal (Wool-uft) At Ufton Bridge**
Site Ref **PKER.0096** Grid Ref **SU61806870** Sampled **27/04/1993 at 12:00**
Scores Current **119** Previous **129** Change is **7% Deterioration.** Biotic Class **B**



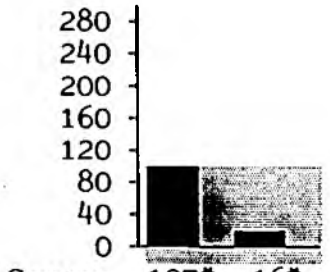
Scores 167 157 138 122 129 119
Dates 0490 0990 0591 0691 0991 0493

Comments Platycnemid damselflies found for the first time at this site. Two top-scorers seen. American crayfish present.

01930272 **Lambourn Below Lambourn Trout Farm, Bagnor**
Site Ref **PKER.0068** Grid Ref **SU45706900** Sampled 22/07/1993 at 15:30
Scores Current **160** Predicted **112** Biotic Class A

Comments Seven top-scoring (pollution-sensitive) families found. Observed score greater than that predicted. 80% plant cover, mainly Berula erecta with traces of other species.

01930500 **Peartree Bottom Str 20m Above Confluence With K/a Canal**
Site Ref **PKER.0139** Grid Ref **SU41006710** Sampled 03/11/1993 at 13:00
Scores Current **16** Previous **107** Change is **85% Deterioration.** Biotic Class D

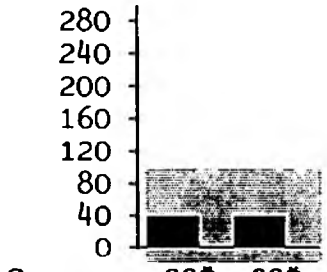


Predicted Score **118**

Scores 107* 16* * Non-Routine Sample
Dates 0988 1193

Comments Decrease in score at this site since previous sampling occasion.This is probably due to drying up of the water course just above the sampling site,rather than a pollution incident.The sample shows a reduction in all scoring groups and no increase in pollution tollerant taxa.

01930501 **Wasing Stream 20m Above Enborne**
Site Ref **PKER.0164** Grid Ref **SU57786581** Sampled 03/11/1993 at 14:00
Scores Current **33** Previous **33** Change is **0% Improvement.** Biotic Class D



Predicted Score **95**

Scores 33* 33* * Non-Routine Sample
Dates 0491 1193

Comments Gammaridae,Sphaeriidae,Glossiphoniidae and Asellidae all new to this site.Remaining taxa all seen on the previous sampling occasion.