BART

Bristol Avon Rivers Trust

Chew Smart Rivers Overview Report

Version 1.0

Nov 2020

Document title	Chew Smart Rivers Overview Report
Document reference	BART – 18110 - REP- 1.0
Date	17/8/20

Version history

Revision	Date	Description	Author(s)	Reviewer(s)	Approval
0.0	22/07/2020	DRAFT	JG	SH	JG
1.0	17/08/2020	ISSUE	JG	SH	JG

Table of Contents

1. Introduction

1.1 Project overview

In 2019 and 2020 Bristol Avon Rivers Trust secured funding to carry out Smart Rivers macro-invertebrate monitoring on the river Chew. The purpose of the monitoring was to establish a baseline data set of the macro-invertebrate communities present in the river Chew, to monitor any changes to these macro-invertebrate communities over time and to identify the main pressures impacting on the different sections of the river.

BART collected macro-invertebrate samples at five sites on the river Chew in Autumn 2019 and Autumn 2020. Further macro-invertebrate monitoring is planned for Spring 2021. This report covers the findings of the macro-invertebrate surveys.

1.2 Smart Rivers Macro-invertebrate Site Locations

The five sites were position in different locations along the river Chew. Site 1 was located upstream (US) of Chew Valley Lake in Shrowle, on a section of the river that is monitored regularly by a volunteer as part of the Anglers Riverfly Monitoring Initiative (ARMI). Site 2 was located downstream (DS) of Chew reservoir at a location that was being monitored by Ricardo as part of Bristol Water's investigations into the impact of the compensation flow from Chew Valley Lake. Site 3 was located at Stanton Drew, also at a location on the compensation flow monitoring programme. Site 4 was located at Parsonage Farm at another ARMI volunteer monitoring point with excellent historic data. Site 5 was located at the downstream end of the waterbody at Dapps Bridge, before the confluence with the Bristol Avon. This site has been newly established as an ARMI volunteer monitoring point and the first sets of data were collected in Autumn 2020. The locations of each of the sites is included in Table 1. A photo of each macro-invertebrate site is included as Appendix 1.

Site number	Site Name	NGR
1	At Shrowle	ST 57839 57271
2	DS Chew Reservoir	ST 57158 62020
3	20m DS Bridge, Stanton Drew	ST 59690 63468
4	At Parsonage Farm	ST 62029 64252
5	At Dapps Bridge	ST 65700 68036

Table 1 Smart Rivers Site Locations

2. Methodology

2.1 Macro-invertebrate Sampling and Analysis Methodology

One macro-invertebrate kick sample was taken by BART's Aquatic Ecologist Jessy Grant at each of the Smart Rivers survey locations during each Smart Rivers autumn season. The standard method used at each of the macro-invertebrate sites involved a three minute kick sample of each habitat in proportion to its occurrence, collecting the macro-invertebrates in a standard, long-handled pond net with a mesh size of 1mm. This was followed by a one minute hand search of stones and other moveable objects. The sampling method conformed to: BS EN ISO 10870:2012 Water quality - Guidelines for the selection of sampling methods and devices for benthic macroinvertebrates in fresh waters (BSI 2012).

Autumn 2019 samples were placed in labelled buckets, preserved using Industrial Denatured Alcohol (IDA) and taken to the Salmon and Trout Conservation Offices for external macro-invertebrate identification and data analysis.

Autumn 2020 samples were placed in labelled buckets and taken back to the BART laboratory for further analysis. On return to the laboratory each sample was stored in the fridge. Before analysis, fine silt was washed from the sample by rinsing it with tap water through a 500 *u*m sieve. Larger aperture sieves were then used to split the sample into fractions to enable efficient sorting. Small amounts of the sample were then placed in white trays for analysis, until the entire sample had been processed. Macro-invertebrates were identified as far as taxonomically possible using standard procedures. Results were entered onto the Smart Rivers database for data analysis.

3. Results

3.1 Smart Rivers Bench Mark Reports

A Smart Rivers bench mark report was produced for each of the macro-invertebrate samples collected. The bench mark reports for Autumn 2020 are included as Appendix 2. Sections 3.2 and 3.3 below display data from the bench mark reports in table format to allow comparisons between the sites and years to be made.

3.2 Biotic Indices

Table 2 below shows the observed Biological Monitoring Working Party (BMWP), Average Score per Taxon (ASPT), Number of Scoring Taxa and WHPT biotic scores calculated for the 2019 survey and the 2020 survey. Further information about the biotic indices is included as Appendix 3

Site number	Site Name	BMWP		Number of Scoring Taxa		ASPT		WHPT	
		2019	2020	2019	2020	2019	2020	2019	2020
1	At Shrowle	73	113	12	19	6.08	5.95	80.7	120.5
2	Downstream Chew Reservoir	69	41	14	9	4.93	4.56	68.8	41.7
3	20m DS Bridge at Stanton Drew	100	120	18	21	5.56	5.71	125.2	135.7
4	At Parsonage Farm	103	103	18	17	5.72	6.06	123	113.8
5	At Dapps Bridge	90	62	18	12	5	5.17	93.2	64.1

Table 2: Observed biological indices scores from Chew Smart Rivers sites in 2019 and 2020

The key for the BMWP water quality categories used in Table 2 is included as Table 3 below.

BMWP Score Range	Water Quality Category	Interpretation
0 -10	Very Poor	Heavily Polluted
11 - 40	Poor	Polluted or impacted
41 - 70	Moderate	Moderately impacted
71 - 100	Good	Clean but slightly impacted
100 +	Very Good	Unpolluted / unimpacted

Table 3: BMWP score range, water quality category and interpretation. Source: www.researchgate.net

3.3 Pressure Ratings Results

Table 4 below shows the pressure ratings calculated for the 2019 survey and the 2020 survey, included in graph format in the bench mark reports as Appendix 2.

Site number	Site Name	Pesticide rating (SPEAR)		Siltation (PSI)		Nutrient "P" (TRPI)		Flow (LIFE)		Organic (Saprobic value)	
		2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
1	At Shrowle	High	Good	UI	UI / SI	No score	No score	UI	SI	UI	UI
2	DS Chew Reservoir	Mod	Bad	HI	I	I	UI / SI	MI/I	MI	MI	MI
3	20m DS Bridge at Stanton Drew	Mod / Good	Mod	SI / MI	MI	No score	UI/SI	UI	SI	UI	SI
4	At Parsonage Farm	Mod / Good	Good / High	MI	MI	No score	SI / MI	SI	SI	SI	SI
5	At Dapps Bridge	Poor / Mod	Mod	I	I	UI	UI	SI / MI	SI	SI	SI

Table 4: Pressure ratings for all sites

The key for the pressure ratings categories used in Table 4 is included as Table 5 below.

Pressure Rating Acronym	**Pressure Rating**
HI	Heavily Impacted
I	Impacted
MI	Moderately Impacted
SI	Slightly Impacted
UI	Unimpacted

Table 5: Pressure ratings key

4. Discussion

4.1 Site 1: Chew at Shrowle

Site 1 had a good diversity of macro-invertebrate taxa present in both 2019 and 2020 samples. The BMWP scores were good and very good for 2019 and 2020 respectively and ASPT scores were high; both indices, therefore, suggest good water quality in this location.

The macro-invertebrate assemblages present at the site indicate that there is a good variety of available habitat types and that water quality in this location is able to support a good diversity of macro-invertebrates. The notes recorded at the time of sampling would support these findings as there was a range of different habitat and flow types available at the site including riffle, run, pool and slack flow types, an unvegetated point bar and a variety of different substrate types. A small amount of in stream macrophytes (Apium nodiflorum) were recorded during each of the surveys. These features provide natural habitat variation for macro-invertebrates to live within.

All of the pressure ratings scores were good or high for Site 1 with the exception of nutrients which did not have a score. The pressure ratings and biological indices suggest that in this location the river is fairly natural with only minor pressures from flow and siltation impacting on the ecology here. The lack of pressures in this location is likely to be because the site is the most upstream sites of all the Smart Rivers sites, it is closest to the source of the river and is located upstream of Chew Valley Reservoir.

4.2 Site 2: Chew DS Chew Valley Reservoir

Site 2 had a very limited range of macro-invertebrate taxa present in both 2019 and 2020 samples. The BMWP scores were both moderate for 2019 and 2020, although the 2020 score was right on the border with the poor category. ASPT scores were the lowest recorded at all the Chew sites; both indices, therefore, suggest macro-invertebrates assemblages are severely restricted in this location.

The macro-invertebrate assemblages present at the site indicate that there is a poor variety of available habitat and that the habitat and water quality conditions at the site are not able to support a good diversity of macro-invertebrates. The notes recorded at the time of sampling would support these findings as although there was a range of different flow types available at the site including pool, run and slack flow types, the site was mainly a very slow run habitat with very sluggish, ponded flow and high levels of silt – 65% and 70% recorded in 2019 and 2020 respectively. The site was also very heavily shaded. These features provide very poor habitat variation for macro-invertebrates to live within.

All of the pressure ratings scores were moderate or worse at Site 2 with the exception of nutrients which was “unimpacted” / “slightly impacted” in 2020. The pressure ratings suggest that this site is severely impacted by pesticides, siltation, flow and organics. The pressure ratings and the biological indices together suggest that in this location the river is severely impacted, resulting in a very restricted macro-invertebrate community. The location of Chew Valley Reservoir upstream of the site and the compensation flow concrete weir immediately upstream are likely to be contributing significantly to the pressures on the river Chew at Site 2.

4.3 Site 3: Chew at Stanton Drew

Site 3 had a good diversity of macro-invertebrate taxa present in both 2019 and 2020 samples. The BMWP scores were good and very good for 2019 and 2020 respectively and ASPT scores were high; both indices, therefore, suggest good water quality in this location.

The macro-invertebrate assemblages present at the site indicate that there is a good variety of available habitat types and that water quality in this location is able to support a good diversity of macro-invertebrates. The notes recorded at the time of sample would support these findings as there was a range of different habitat and flow types available at the site including run and slack flow types, the water was moving quickly through the main channel and was slow / slack at the edges and there were a variety of different substrate types. A small amount of in stream macrophytes (two sprigs of *sparganium emersum*) and filamentous algae (*cladophora agg.)* were recorded in the 2020 survey and mosses (*fontinalis antipyretica*) were recorded in both surveys. These features provide natural habitat variation for macro-invertebrates to live within.

The pressure ratings for pesticides and siltation at Site 3 for both 2019 and 2020 were moderate and in the "moderately impacted" categories – with 2019 results for both pressures on the border with good / "slightly impacted". Nutrients were good, on the border of "unimpacted" / "slightly impacted" in 2020 (with no score in 2019). Flow and organics were both good or high with "unimpacted" in 2019 and "slightly impacted" in 2020. The pressure ratings suggest that the ecology of this site is most impacted by pesticides and siltation with only minor pressure from nutrients, flow and organics.

4.4 Site 4: Chew at Parsonage Farm

Site 4 had a good diversity of macro-invertebrate taxa present in both 2019 and 2020 samples. The BMWP scores were very good for both 2019 and 2020 respectively (although both scores were at the lower end of this category) and ASPT scores were high; both indices, therefore, suggest good water quality in this location.

The macro-invertebrate assemblages present at the site indicate that there is a good variety of available habitat types and that water quality in this location is able to support a good diversity of macro-invertebrates. The notes recorded at the time of sample would support these findings as there was a range of different habitat and flow types available at the site including run and pool flow types and a variety of different substrate types. A small amount of in stream macrophytes (*ranunculus sp.)* and filamentous algae (*cladophora agg.)* were recorded. These features provide natural habitat variation for macro-invertebrates to live within. Slow flows were, however, also recorded at the site and overlaying silt was present on the substrate. These features could be impacting on the in-stream ecology.

The pressure ratings for pesticides at Site 4 were moderate / good in 2019 and good / high in 2020. Siltation results for both 2019 and 2020 were in the "moderately impacted" category. Nutrients were on the border of "slightly impacted"/ "moderately impacted" in 2020 (with no score in 2019). Flow and organics were both good with "slightly impacted" ratings in both years. The pressure ratings suggest that the ecology of this site is most impacted by pesticides, siltation and nutrients with only minor pressure from flow and organics.

4.5 Site 5: Chew at Dapps Bridge

Site 5 had a good diversity of macro-invertebrate taxa present in the 2019 samples and a limited range of macro-invertebrate taxa present in the 2020 samples. The BMWP scores were good for 2019 and moderate for 2020 with a drop of 28 between the years. ASPT scores were the lowest recorded of all the Chew sites with the exception of the heavily impacted Site 2 DS of Chew Reservoir. Both indices, therefore, suggest macro-invertebrate assemblages are restricted in this location.

The macro-invertebrate assemblages present at the site indicate that the habitat and water quality conditions at the site in 2020 are not able to support a good diversity of macro-invertebrates. The notes recorded at the time of sample would support these findings as the only flow type recorded was run flow and although there were a range of different substrate types available at the site, the flow was backed up slightly behind a kiddies dam at the time of survey which was restricting the natural flow. These conditions, therefore, provide limited habitat variation at Site 5 for macro-invertebrates to live within.

Pesticides and siltation pressure ratings were moderate or worse at Site 5. The nutrient rating was high / "unimpacted". Flow and organics ratings were good – "slightly impacted" in both years with the exception of 2019 flow which was moderate and on the "slightly impacted / moderately impacted" border. The pressure ratings suggest that the ecology of the site is at least moderately impacted by pesticides and more severely impacted by siltation. Flow and organics are shown to slightly impact on the site whilst nutrients do not have an impact. The Dapps Bridge site is located towards the downstream end of the river Chew approximately 500m US of the large weir in Keynsham Park. The weir can be seen to have a detrimental impact on the river Chew by backing up the water for a large distance and causing slow flows and sediment build up. It is likely that although the river returns to a more natural state at the Dapps Brdge site, the weir may still be having a detrimental impact on the watercourse here. It is also possible that the kiddies dam/s that are regularly built at the Dapps Bridge site may be effecting the flow here and causing sediment to build up.

4 References

BS EN ISO 10870:2012 Water quality - Guidelines for the selection of sampling methods and devices for benthic macroinvertebrates in fresh waters

5 Appendices

Appendix 1 – Site photos

Macro-invertebrate site 1: At Shrowle

Macro-invertebrate site 2: DS Chew Reservoir

Macro-invertebrate site 3: 20m DS Bridge at Stanton Drew

Macro-invertebrate site 4: At Parsonage Farm

Macro-invertebrate site 5: At Dapps Bridge

Appendix 2 – Smart Rivers Bench Mark Reports

SmartRivers Benchmark Report

Professional Sample collection & ID : Jess Grant, Bristol Avon Rivers Trust.

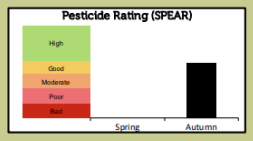
Species	Spring	Autumn
Gammarus pulex	?	300
Limnius volckmari	?	500
Oligochaeta	?	3
Calopteryx	?	1
Sericostoma personatum	?	5
Odontocerum albicorne	?	3
Polycentropus flavomaculatus	?	2
Elmis aenea	?	1
Pisidium	?	1
Hydropsyche siltalai	?	7
Gyrinidae	?	4
Dicranota	?	9
Glossiphonia complanata	?	1
Rhyacophila dorsalis	?	3
Tanypodinae	?	6
Orthocladiinae	?	2
Hydracarina	?	1
Chironominae	?	2
Silo nigricornis	?	2
Tanytarsini	?	1
Baetidae	?	6
Leuctra geniculata	?	1
Leuctra fusca	?	100
Platambus maculatus	?	4
Halesus radiatus	?	1
Limnephilidae	?	1
Prodiamesa olivacea	?	1

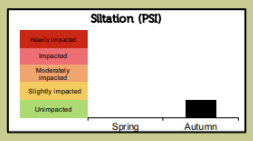
Species	Spring	Autumn

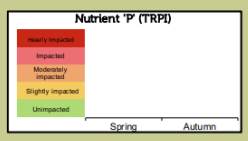
Surveyors' Notes

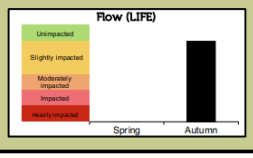
Year	2020
Catchment	Bristol Avon
River	Chew
Site	Shrowle
NGR	ST 57839 57271
TRPI River Type	3
Spring Date	?
Autumn Date	16/09/2020

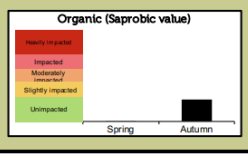
	Spring	Autumn
BMWP	-	113
ASPT	-	5.95
WHPT	-	120.5
WHPT ASPT	-	6.34
Number of Taxa	-	19
EPT species	-	11
EPT abundance	-	131
TOTAL abundance	-	968
CCI	-	9.64
LIFE	-	8.00
PSI	-	79.41
SPEAR	-	41.64
TRPI	-	100.00
Saprobic	-	1.72











SmartRivers Benchmark Report

Professional Sample collection & ID : Jess Grant, Bristol Avon Rivers Trust.

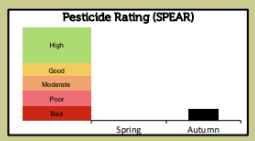
Species	Spring	Autumn
Anodonta cygnea	?	1
Oligochaeta	?	22
Sericostoma personatum	?	1
Erpobdella octoculata	?	2
Helobdella stagnalis	?	1
Theromyzon tessulatum	?	1
Tanytarsini	?	20
Chironominae	?	42
Tanypodinae	?	10
Hydropsyche angustipennis	?	11
Psychomyiidae	?	1
Asellus aquaticus	?	5
Prodiamesa olivacea	?	16

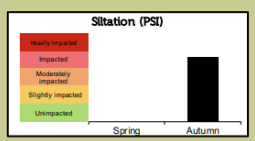
Species	Spring	Autumn

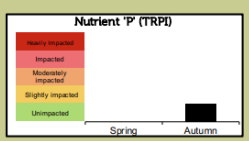
Surveyors' Notes

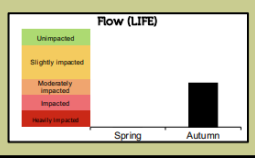
Year	2020
Catchment	Bristol Avon
River	Chew
Site	D/S Chew Reservoir
NGR	ST 57158 62020
TRPI River Type	4
Spring Date	?
Autumn Date	16/09/2020

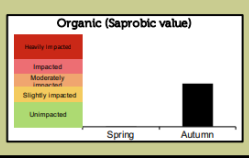
	Spring	Autumn
BMWP	-	41
ASPT	-	4.56
WHPT	-	41.7
WHPT ASPT	-	4.63
Number of Taxa	-	9
EPT species	-	3
EPT abundance	-	13
TOTAL abundance	-	133
CCI	-	1.29
LIFE	-	6.88
PSI	-	26.67
SPEAR	-	8.57
TRPI	-	80.00
Saprobic	-	2.40











SmartRivers Benchmark Report

Professional Sample collection & ID : Jess Grant, Bristol Avon Rivers Trust.

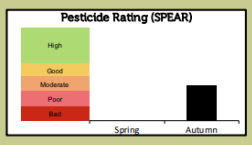
Species	Spring	Autumn
Oligochaeta	?	15
Pisidium	?	5
Sphaeriidae	?	300
Radix balthica	?	50
Potamopyrgus antipodarum	?	30
Gammarus pulex	?	5
Limnius volckmari	?	100
Elmis aenea	?	20
Lumbricidae	?	2
Simuliidae	?	1
Sericostoma personatum	?	30
Dicranota	?	15
Hydropsyche	?	1
Ephemera danica	?	2
Hydropsyche siltalai	?	25
Oulimnius	?	10
Polycentropodidae	?	1
Agapetus fuscipes	?	5
Haliplidae	?	1
Ephemeridae	?	3
Leuctridae	?	2
Chironominae	?	50
Tanypodinae	?	2
Orthocladiinae	?	2
Hydropsyche pellucidula	?	10
Hydropsyche angustipennis	?	1
Athericidae	?	15
Gyrinidae	?	1
Calopteryx	?	2
Bithynia tentaculata	?	2
Anabolia nervosa	?	1
Erpobdella octoculata	?	3
Athripsodes	?	1
Prodiamesa olivacea	?	5

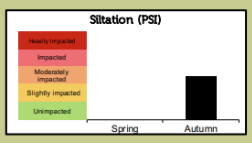
Species	Spring	Autumn

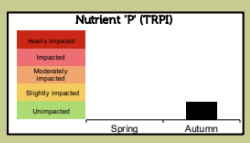
Surveyors' Notes

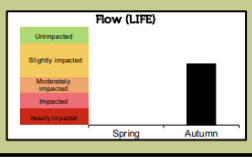
Year	2020
Catchment	Bristol Avon
River	Chew
Site	20m D/S Bridge at Stanton Drew
NGR	ST 59690 63468
TRPI River Type	4
Spring Date	?
Autumn Date	02/09/2020

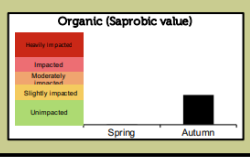
	Spring	Autumn
BMWP	-	120
ASPT	-	5.71
WHPT	-	135.7
WHPT ASPT	-	5.90
Number of Taxa	-	21
EPT species	-	12
EPT abundance	-	82
TOTAL abundance	-	718
CCI	-	6.15
LIFE	-	7.38
PSI	-	50.98
SPEAR	-	26.42
TRPI	-	80.00
Saprobic	-	1.98











SmartRivers Benchmark Report

Professional Sample collection & ID : Jess Grant, Bristol Avon Rivers Trust.

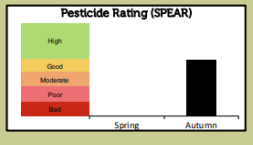
Species	Spring	Autumn
Limnius volckmari	?	4
Ceratopogonidae	?	1
Gammarus pulex	?	3
Radix balthica	?	70
Hydracarina	?	2
Athericidae	?	4
Sericostoma personatum	?	1
Ephemera danica	?	40
Elmis aenea	?	2
Oulimnius tuberculatus	?	3
Haliplus lineatocollis	?	1
Nebrioporus elegans	?	1
Orthocladiinae	?	1
Chironominae	?	2
Tanytarsini	?	1
Polycentropus kingi	?	2
Polycentropus flavomaculatus	?	2
Mystacides longicornis	?	2
Bithynia tentaculata	?	5
Sphaeriidae	?	2
Serratella ignita	?	1
Lymnaea stagnalis	?	4
Hydropsyche angustipennis	?	2
Hydropsyche pellucidula	?	2
Hydropsyche	?	1
Leuctra fusca	?	12
Athripsodes cinereus	?	12
Calopteryx splendens	?	20
Tanypodinae	?	2
Prodiamesa olivacea	?	1

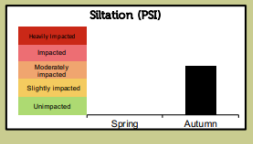
Species	Spring	Autumn

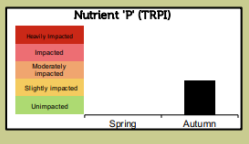
Surveyors' Notes

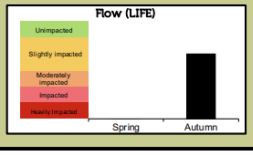
Year	2020
Catchment	Bristol Avon
River	Chew
Site	Parsonage Farm
NGR	ST 62029 64252
TRPI River Type	4
Spring Date	?
Autumn Date	16/09/2020

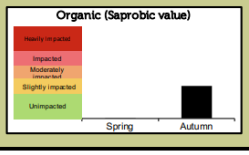
	Spring	Autumn
BMWP	-	103
ASPT	-	6.06
WHPT	-	113.8
WHPT ASPT	-	5.69
Number of Taxa	-	17
EPT species	-	11
EPT abundance	-	77
TOTAL abundance	-	296
CCI	-	7.25
LIFE	-	7.50
PSI	-	43.90
SPEAR	-	42.36
TRPI	-	62.50
Saprobic	-	2.05











SmartRivers Benchmark Report

Professional Sample collection & ID : Jess Grant, Bristol Avon Rivers Trust.

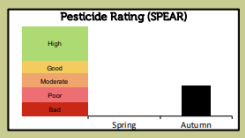
Species	Spring	Autumn
Potamopyrgus antipodarum	?	50
Neritidae	?	2
Oligochaeta	?	200
Hydracarina	?	3
Pisidium	?	3
Sphaerium	?	1
Limnius volckmari	?	5
Ephemera danica	?	4
Asellus aquaticus	?	1
Baetidae	?	1
Hydropsyche pellucidula	?	2
Oulimnius tuberculatus	?	2
Oulimnius	?	5
Elmis aenea	?	1
Chironominae	?	15
Tanytarsini	?	4
Orthocladiinae	?	2
Athripsodes	?	3
Leuctra fusca	?	10

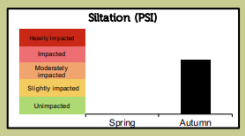
Species	Spring	Autumn

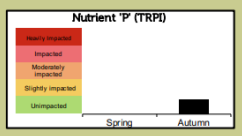
Surveyors' Notes

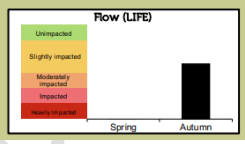
Year	2020
Catchment	Bristol Avon
River	Chew
Site	Dapps Bridge
NGR	ST 65700 68036
TRPI River Type	4
Spring Date	?
Autumn Date	02/09/2020

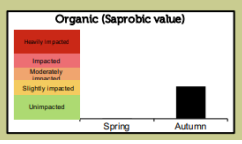
	Spring	Autumn
BMWP	-	62
ASPT	-	5.17
WHPT	-	64.1
WHPT ASPT	-	5.34
Number of Taxa	-	12
EPT species	-	9
EPT abundance	-	20
TOTAL abundance	-	314
CCI	-	4.13
LIFE	-	7.29
PSI	-	36.00
SPEAR	-	23.39
TRPI	-	83.33
Saprobic	-	2.09











Appendix 3 - Biological Monitoring Working Party (BMWP) Score System

The BMWP (Biological Monitoring Working Party) score is a nationally used pollution index derived from the tolerances of various families of aquatic animals to organic pollution. The system was devised by the Biological Monitoring Working Party for the 1980 Water Quality Survey of England and Wales. It is widely accepted as a means of assessing biological quality. Each family is allocated a score from 1 to 10 depending on its sensitivity with the most pollution sensitive family scoring 10.

For each sample, a family is scored only once regardless of the number of species found within that family. An overall score (BMWP score) is derived for a particular sample by the summation of all the family scores. Generally, the higher the score, the higher the biological quality of the sample and the cleaner the watercourse.

The ASPT (average score per taxon) is derived by dividing the BMWP score by the total number of scoring families. This gives an indication of the balance between pollution sensitive and pollution tolerant taxa. Usually, the higher the ASPT, the more sensitive the population is to pollution. Usually a low ASPT indicates that the site is suffering from pollution.