RIVERFLY CENSUS CONCLUSIONS

River Ure

Salmon & Trout Conservation

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REPORT OUTLINE

OUR KEY POINTS

The 'take home' messages and recommendations from our survey on the River Ure

WHAT WE'VE DONE

A summary of the Riverfly Census process and objectives

WHAT WE'VE FOUND

A site-by-site presentation of the S&TC Riverfly Census results on the Ure

OUR THOUGHTS

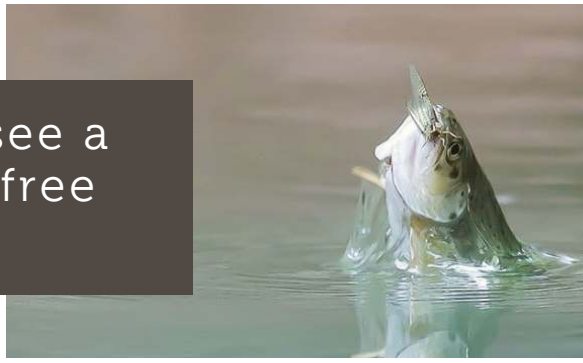
We use our findings to discuss potential key issues on the river

ACKNOWLEDGEMENTS & CONTACT

Work commissioned from Aquascience Consultancy Ltd. We thank them for their professionalism, rigour and assistance throughout the Riverfly Census.

Report composed by Lauren Mattingley. For Riverfly Census enquiries contact: lauren@salmon-trout.org

At Salmon & Trout Conservation, we see a world where wild fish have pollution-free places to live, with plenty to eat.



OUR KEY POINTS

The Salmon & Trout Conservation (S&TC) Riverfly Census on the Ure has revealed that overall the river is in a clean condition. However, there are signs of some nutrient and chemical issues. To maintain the health of the river we have made the following recommendations:

- Further investigation into septic tank prevalence in the catchment would be a useful first step in understanding their contribution to nutrient loading in the River Ure catchment.
- To protect the river from chemical pollution it would be worthwhile finding out what types of chemicals are present. Pinpointing their origin is essential to prevent them entering the Ure.
- Access to the the river by livestock is common in the upper Ure catchment. It would be interesting to fence off a section of river bank from animals and conduct species-level biological monitoring before and after to measure the impact this has on the ecology.

WHAT WE'VE DONE

The Riverfly Census was created to collect much needed high-resolution, scientifically robust data about the state of our rivers and the pressures facing them. We frequently talk about missing flylife and lack of fish compared to the 'good old days', but anecdotal evidence like this has little weight in environmental decision making.

> "Without data you're just another person with an opinion"
>
> W. Edwards Deming

River insects spend the majority of their lives in the water as nymphs, making them brilliant indicators of river health. Their continuous exposure to water makes examining them much more informative than spot chemical samples. Every invertebrate is unique, and each requires a specific set of conditions to thrive.

The Riverfly Census utilises the invertebrate assemblage: presence, absence and abundance of certain invertebrates, to indicate the types of stress our rivers are experiencing. The composition of the invertebrate community in the sample allows a biometric score to be calculated, which provides a surrogate, or direct scale, of physical chemical impact. Below are the biometrics used and the type of stress they indicate.

BIOMETRIC GLOSSARY

PSI

Proportion of Sediment-sensitive Invertebrates

A measure of stress caused by excess fine sediment on the invertebrate community

TRPI

Total Reactive Phosphorus Index

A relatively new metric developed to indicate pressure from phosphorus pollution

SPEAR

SPEcies At Risk

A measure to assess the impact of exposure to pesticides, herbicides and complex chemical toxicants on the invertebrate community

LIFE

Lotic-invertebrate Index for Flow Evaluation

A metric to assess the impact of flow related stress on invertebrate communities which live in flowing water

SI

Saprobic Index

A measure to indicate stress on the invertebrate community caused by organic pollution

CENSUS METHOD

SCOPE

The Riverfly Census has spanned three years. It began in 2015, with 12 rivers across England. Multiple sample sites were carefully selected on each river.

SAMPLE

Kick-sweep sampling was completed in spring and autumn to EA guidelines, at all sample sites. Sampling and species-level identification were carried out by professional external consultants, Aquascience Consultancy Ltd.

STUDY

Species presence/absence data was inputted into Aquascience's biometric calculator to obtain scores against key stress types. The data was then evaluated in a whole catchment context to pinpoint likely suspects contributing to river deterioration.

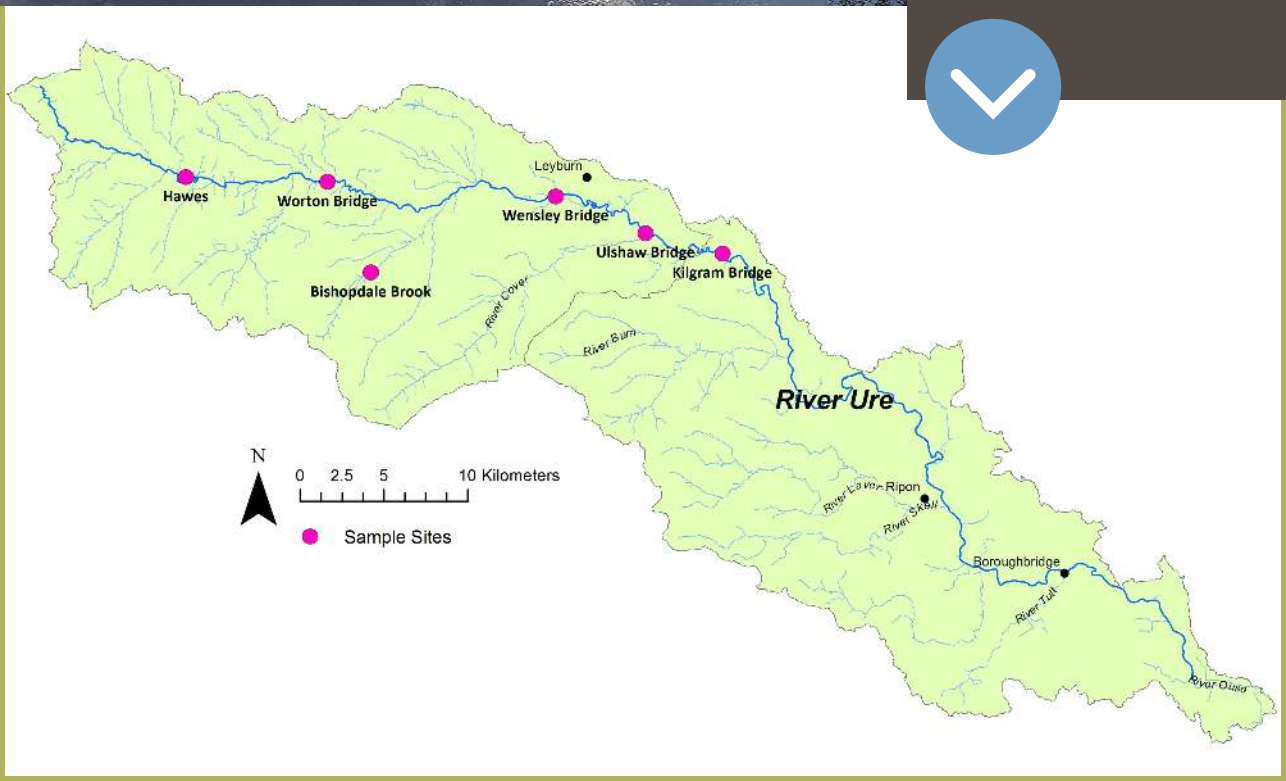
MAKE A STAND

The data was compiled, and is being reported to stakeholders and policy makers, to improve management and conservation of our rivers.

Results

Riverfly Census sampling on the Ure began in 2015 and continued for three years on five sites: Hawes, Worton Bridge, Wensley Bridge, Ulshaw Bridge and Kilgram Bridge.

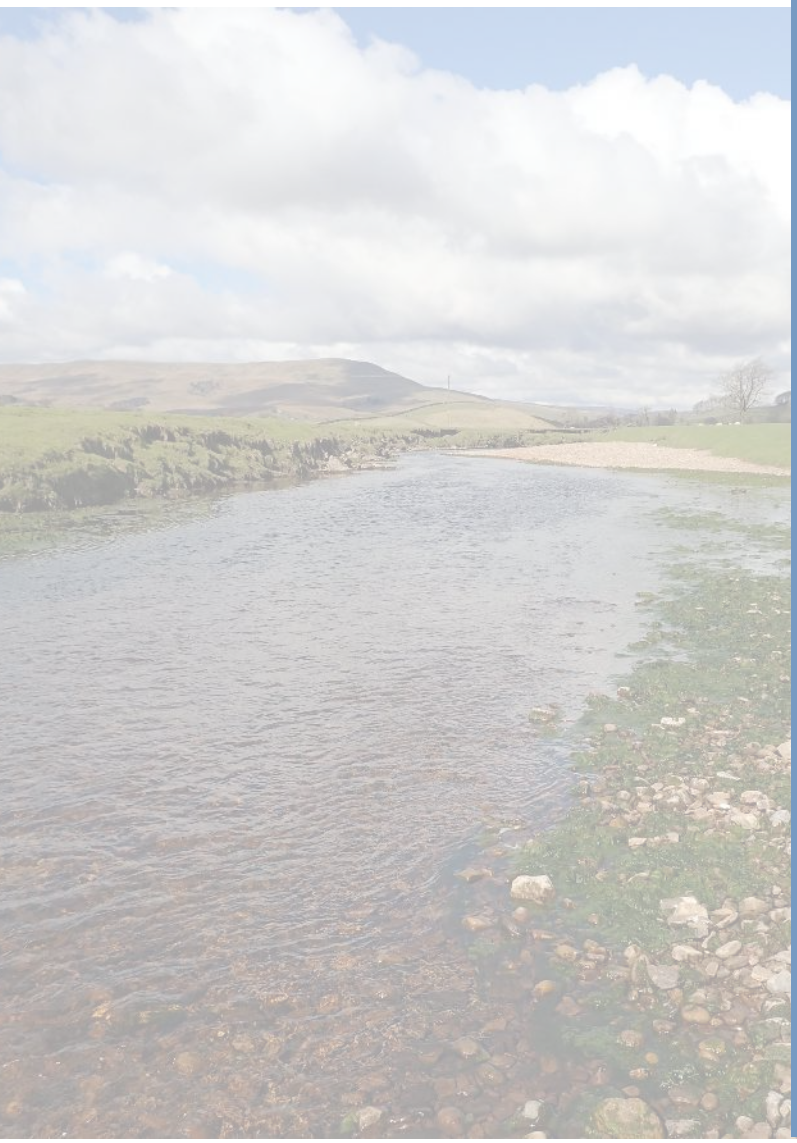
The locations of our sample sites are shown on the map, represented by pink circles.



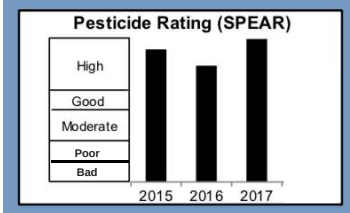
1 WHAT WE'VE FOUND
Hawes

The invertebrate community at Hawes exhibited considerable nutrient stress in spring 2016 and spring 2017. However, the site was completely free of nutrient stress in autumn for all three years surveyed.

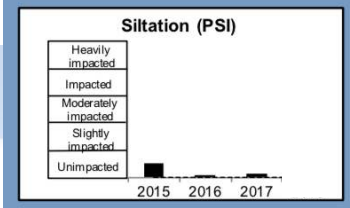
Stress from excess fine sediment and flow was not present at this site. There was an indication of chemical pressure in autumn 2016, but this was still above the proposed WFD threshold from Beketov et al. (2009).

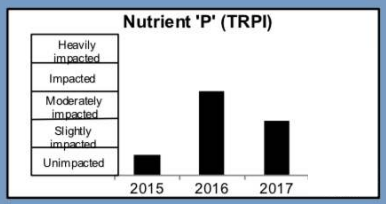


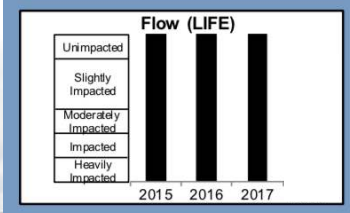
SPRING BIOMETRICS

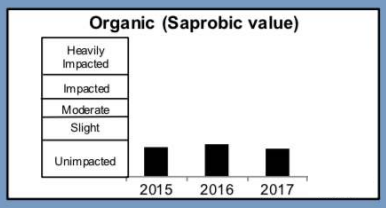


	2015	2016	2017
BMWP	-	-	-
ASPT	6.85	7.06	7.14
Annual Mayfly Sp. Richness	8	7	6
Total Abundance	686	859	695
EPT	19	15	13
CCI	11.32	10.88	-
LIFE	8.84	9.00	9.25
PSI	89.47	97.92	97.44
SPEAR	64.94	57.03	69.92
TRPI	85.71	40.00	61.18
Saprobic	1.63	1.69	1.60

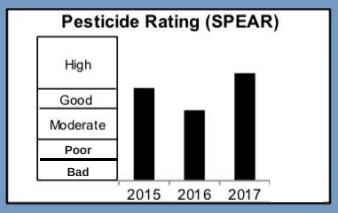




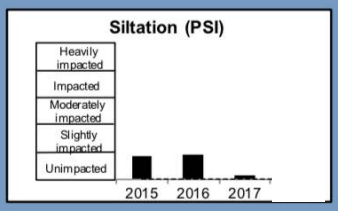


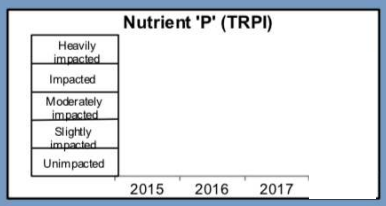


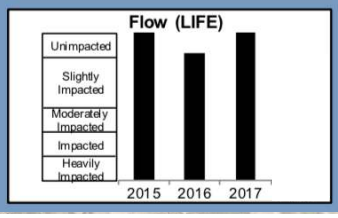
AUTUMN BIOMETRICS

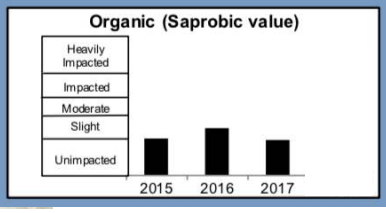


	2015	2016	2017
BMWP	-	-	-
ASPT	6.00	6.00	6.67
Annual Mayfly Sp. Richness	8	7	6
Total Abundance	472	250	394
EPT	10	9	12
CCI	5.50	10.38	17.77
LIFE	8.56	8.11	8.56
PSI	82.50	81.58	96.55
SPEAR	45.42	34.44	52.29
TRPI	100.00	100.00	100.00
Saprobic	1.80	2.01	1.77







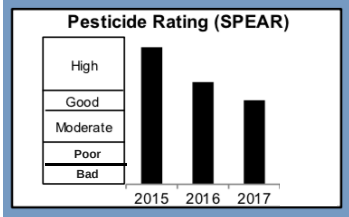


2 WHAT WE'VE FOUND
Worton Bridge

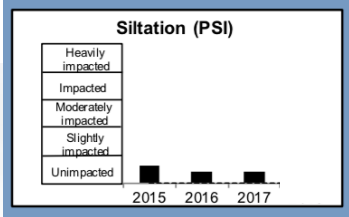
At Worton Bridge stress from nutrients was indicated by the invertebrate community in autumn 2015, but the site was unimpacted in autumn for the following two year. During spring, stress was only notable in 2017.

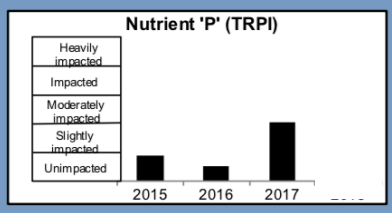
Slight stress from sediment was exhibited in autumn 2017. Chemical impact was present throughout autumn, with failure against the proposed WFD standard in 2017. Recovery in spring did occur, but was less pronounced in 2016 and 2017.

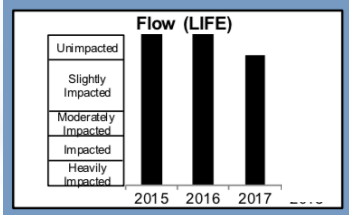
SPRING BIOMETRICS

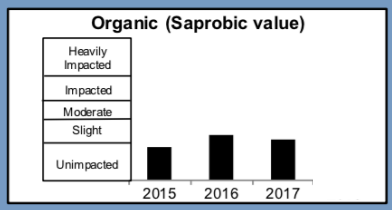


	2015	2016	2017
BMWP	-	-	-
ASPT	6.63	6.50	6.30
Annual Mayfly Sp. Richness	8	7	9
Total Abundance	476	787	204
EPT	20	12	11
CCI	11.32	9.58	-
LIFE	8.64	8.67	8.10
PSI	86.79	91.67	91.18
SPEAR	65.65	48.69	40.05
TRPI	81.82	89.47	58.60
Saprobic	1.71	1.96	1.88

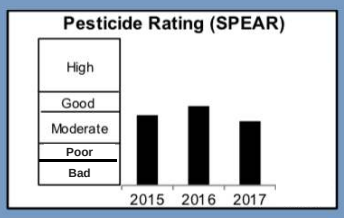




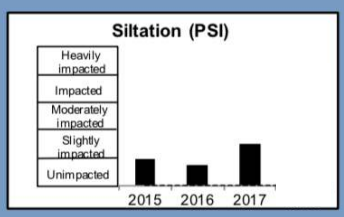


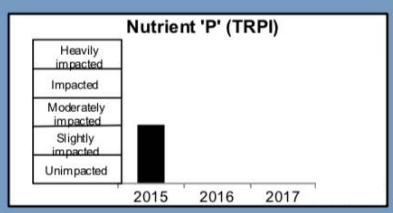


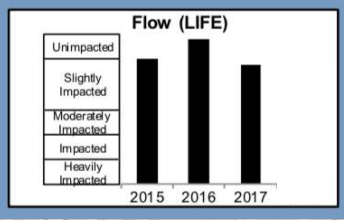
AUTUMN BIOMETRICS

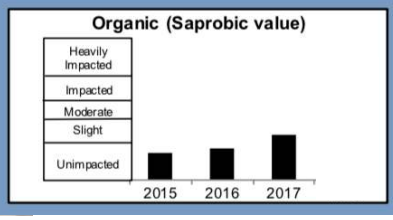


	2015	2016	2017
BMWP	-	-	-
ASPT	5.77	6.10	6.06
Annual Mayfly Sp. Richness	8	7	9
Total Abundance	552	582	244
EPT	9	13	10
CCI	4.93	8.95	15.75
LIFE	8.00	8.39	7.90
PSI	80.95	84.62	70.00
SPEAR	33.47	38.16	30.48
TRPI	58.46	100.00	100.00
Saprobic	1.56	1.67	1.97









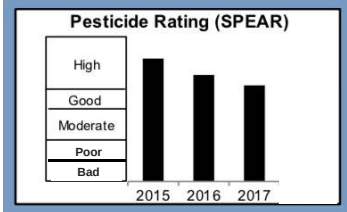
3 WHAT WE'VE FOUND
Wensley Bridge

There was a marked nutrient stress signature in autumn 2015, but no impact from nutrients was exhibited in 2016. In 2017 some nutrient stress was indicated during spring and autumn.

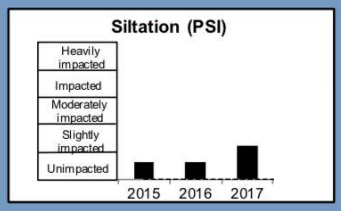
Slight stress from sediment was present in autumn 2015 and both seasons in 2017.

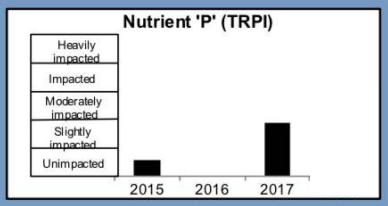
In autumn 2017 Wensley Bridge failed the proposed WFD threshold for SPEAR. Chemical stress was also present in autumn 2015.

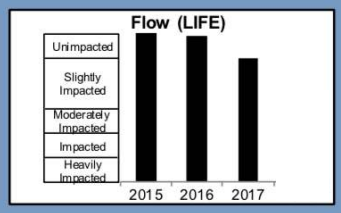
SPRING BIOMETRICS

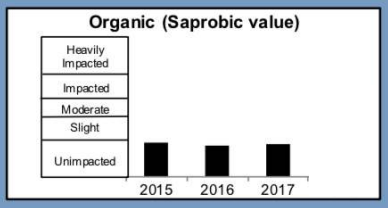


	2015	2016	2017
BMWP	-	-	-
ASPT	7.00	6.40	6.00
Annual Mayfly Sp. Richness	8	7	8
Total Abundance	747	495	439
EPT	22	20	21
CCI	17.14	17.50	-
LIFE	8.75	8.46	8.00
PSI	87.67	87.67	75.38
SPEAR	59.39	51.69	46.61
TRPI	88.89	100.00	62.43
Saprobic	1.73	1.66	1.71

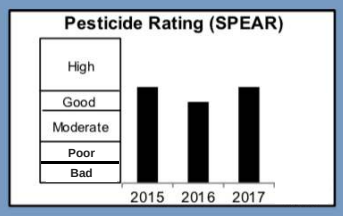




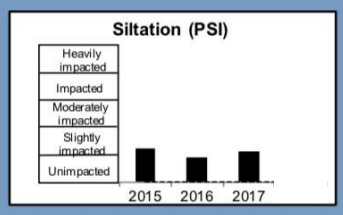


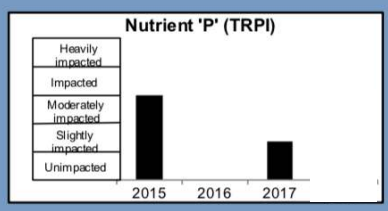


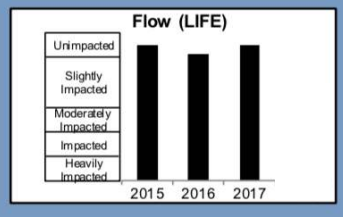
AUTUMN BIOMETRICS

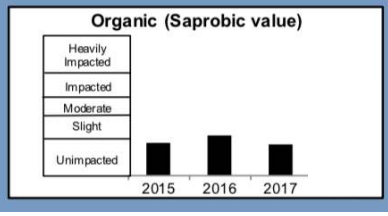


	2015	2016	2017
BMWP	-	-	-
ASPT	7.30	6.36	6.10
Annual Mayfly Sp. Richness	8	7	8
Total Abundance	461	601	290
EPT	12	15	15
CCI	8.61	14.00	11.00
LIFE	8.26	8.07	8.25
PSI	75.00	81.36	77.78
SPEAR	46.70	39.16	46.92
TRPI	40.00	100.00	72.73
Saprobic	1.71	1.86	1.68









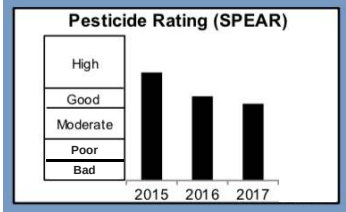
4 WHAT WE'VE FOUND
Ulshaw Bridge

Due to unfavourable sampling conditions Ulshaw Bridge could not be sampled in autumn 2017. Flow stress was exhibited in autumn during 2015 and 2016.

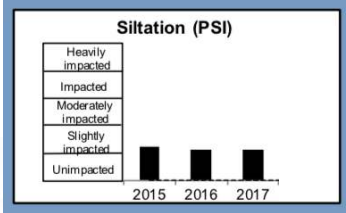
Sediment and nutrient stress were notable in autumn 2015, with moderate and impacted scores respectively. During 2016, some recovery occurred in spring but stress was exhibited again in autumn. Spring 2017 had a notable nutrient stress signature, but sediment stress was minimal.

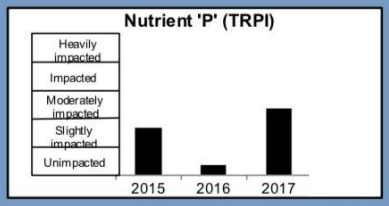
Autumn failed the proposed SPEAR WFD standard in both years sampled. Some recovery occurred in spring 2015 and 2017.

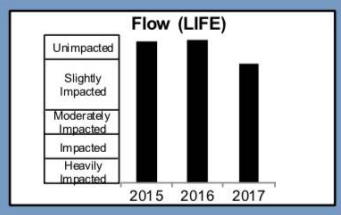
SPRING BIOMETRICS

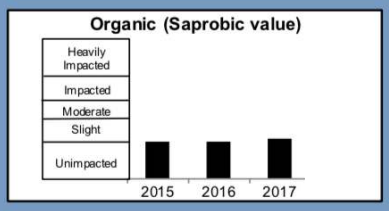


	2015	2016	2017
BMWP	-	-	-
ASPT	6.35	6.08	6.17
Annual Mayfly Sp. Richness	7	8	-
Total Abundance	810	426	345
EPT	23	17	22
CCI	16.55	9.79	-
LIFE	8.36	8.41	7.91
PSI	75.68	77.05	77.94
SPEAR	52.22	40.75	36.86
TRPI	66.67	92.31	52.22
Saprobic	1.79	1.79	1.85

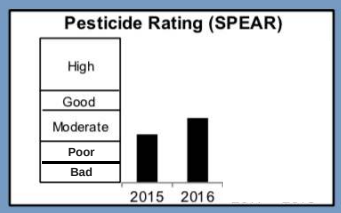




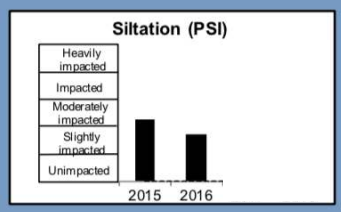


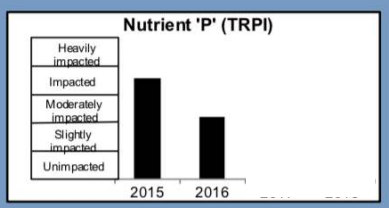


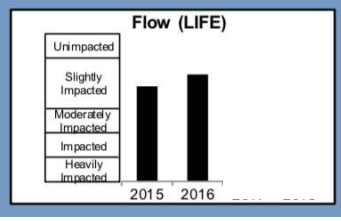
AUTUMN BIOMETRICS

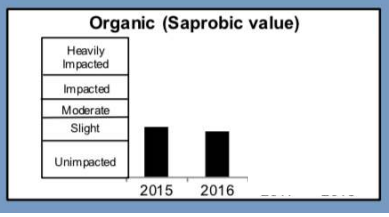


	2015	2016
BMWP	-	-
ASPT	5.30	5.93
Annual Mayfly Sp. Richness	7	8
Total Abundance	443	509
EPT	8	14
CCI	14.88	15.12
LIFE	7.42	7.69
PSI	54.29	66.10
SPEAR	23.81	31.36
TRPI	28.57	55.56
Saprobic	2.09	1.99







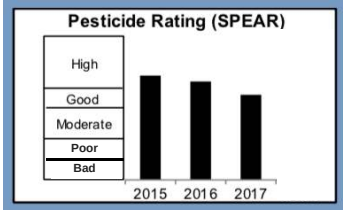


5 WHAT WE'VE FOUND
Kilgram Bridge

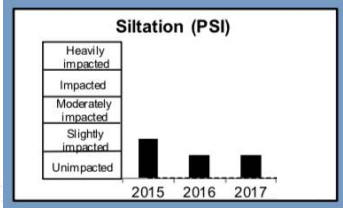
The signatures at Kilgram Bridge indicate that it is a relatively clean site. The invertebrate community exhibited minimal stress from nutrients, though impact was more pronounced in autumn 2016 and 2017.

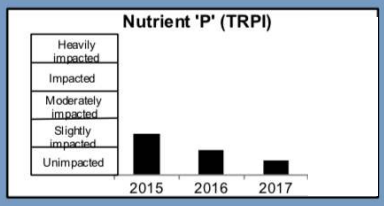
Stress from flow and sediment was also minimal. SPEAR scores were all above the proposed WFD target.

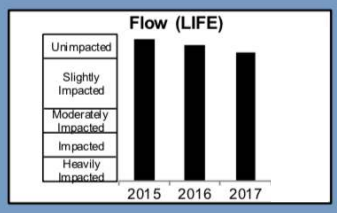
SPRING BIOMETRICS

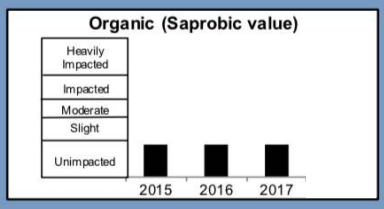


	2015	2016	2017
BMWP	-	-	-
ASPT	6.63	6.76	6.43
Annual Mayfly Sp. Richness	8	7	9
Total Abundance	902	326	413
EPT	21	15	23
CCI	19.00	11.84	-
LIFE	8.39	8.29	8.14
PSI	71.23	82.61	82.81
SPEAR	51.11	48.26	41.38
TRPI	70.83	81.82	89.47
Saprobic	1.72	1.69	1.69

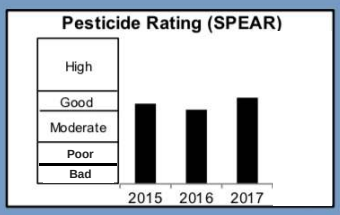




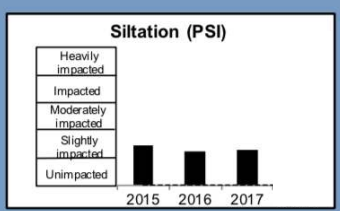


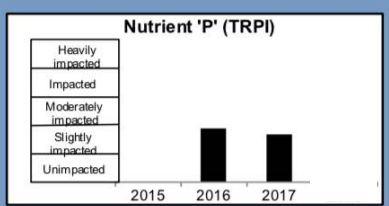


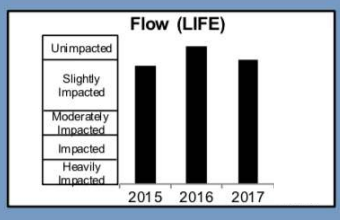
AUTUMN BIOMETRICS

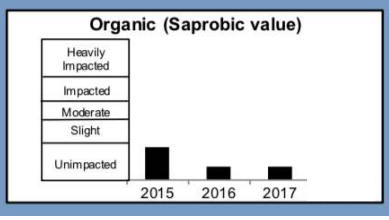


	2015	2016	2017
BMWP	-	-	-
ASPT	6.26	5.77	5.56
Annual Mayfly Sp. Richness	8	7	9
Total Abundance	456	1344	412
EPT	11	11	10
CCI	15.75	10.24	11.00
LIFE	7.88	8.28	8.00
PSI	71.15	75.81	74.47
SPEAR	38.48	35.92	41.37
TRPI	100.00	62.50	66.67
Saprobic	1.70	1.28	1.28









Discussion

Although we have no historical data for comparison, our results indicate that overall the upper Ure is in relatively clean condition. Statistical analysis of all our Riverfly Census rivers has also indicated the Ure is one of the cleanest systems we have surveyed.

Some signs of nutrient stress were present, but these were sporadic and did not follow a consistent pattern. This may be reflective of the high velocity 'flashy' nature of the river. Nutrient pollution enters rivers from land run-off and sewage effluent. There are six sewage treatment works in the catchment, the largest at Hawes. We found a considerable impact from nutrient stress at Hawes in spring 2016. This nutrient impact was evident in our riverbed photos; there is evidence of algal growth on the gravels at Hawes compared to Kilgram Bridge which exhibited no nutrient impact in 2016 (Fig. 1).

Fig. 1 - Left to right: Hawes river bed showing some signs of algal growth, an indication of nutrient enrichment and Kilgram Bridge with cleaner gravels (spring 2016).

A large proportion houses and villages in the Ure catchment are ‘off-grid’ and require septic tanks. These systems can be a source of additional phosphorus loading, mainly through poor maintenance. We do not know for certain the contribution septic tanks are making to nutrient pollution in the Ure, as data on the number in operation or their condition is lacking.

Signs of chemical stress were also evident, with some sites occasionally failing the proposed WFD SPEAR standard. Land use in the upper Ure is predominantly improved grassland and the river banks are commonly open to livestock. This means farm animals can enter the river and potentially deliver chemicals into the water through their waste and increased run-off from poaching of banks. However, chemicals may also be coming from treated sewage effluent as many pharmaceuticals are not removed in wastewater treatment processes.

FINAL WORD

Many of our rivers lack historical reference points, making it difficult to know exactly what optimal conditions in our rivers should look like. It is only with a reliable 'benchmark' of health that we can properly quantify deterioration or recovery, and only with robust long term monitoring can we truly understand the changes occurring in our freshwater systems.

We hope the Riverfly Census has gone some way towards helping to address these missing 'reference points' by providing the first species-level baseline for many of the rivers surveyed. But this is just the first step! We welcome working with local groups to better understand the possible pressures and moving towards a more sustainable future for our waterways.

REFERENCES

Beketov MA, Foit K, Schäfer, RB. (2009). SPEAR indicates pesticide effects in streams–comparative use of species-and family-level biomonitoring data. Environmental Pollution: 157(6) pp. 1841-1848.