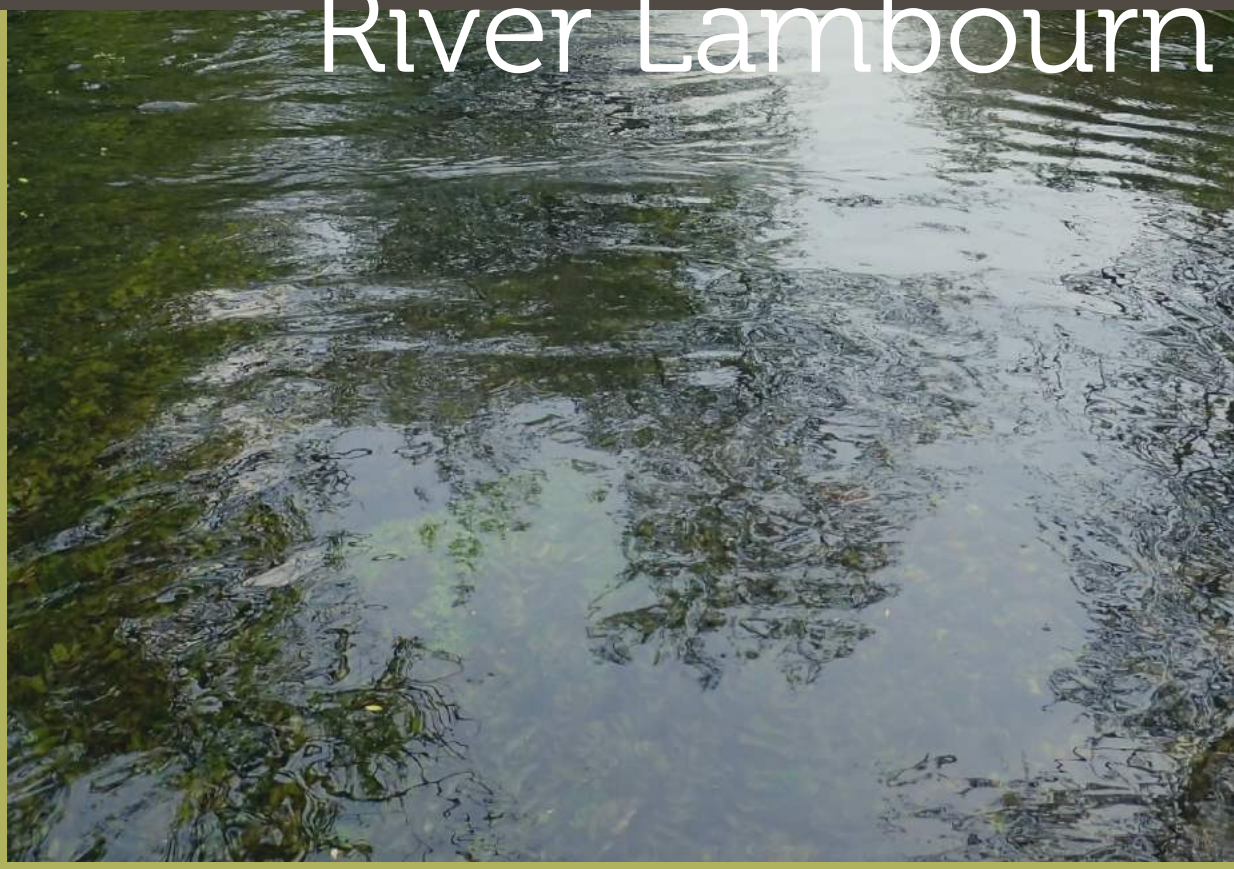
RIVERFLY CENSUS CONCLUSIONS

River Lambourn



Salmon & Trout Conservation

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REPORT OUTLINE

OUR KEY POINTS

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

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 Lambourn

OUR THOUGHTS

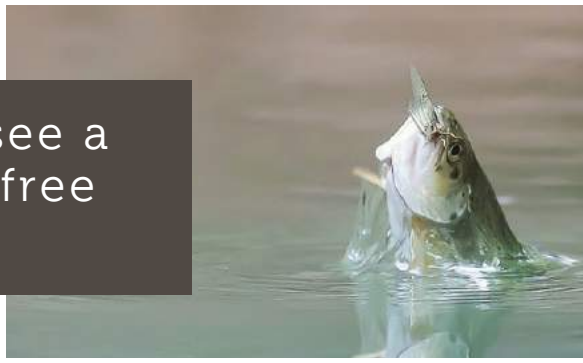
We use our findings to discuss potential key issues on the river

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 Lambourn has revealed that there is room for improvement regarding water quality. The invertebrate communities along the river indicated stress from excess fine sediment and chemicals throughout the river. Nutrient stress was also present, but this appeared to be more of an issue further downstream. To improve water quality in the River Lambourn and protect its wildlife here are our recommendations:

- Hydrological restoration work has improved water quality at Hunt's Green, however it has not entirely solved water quality issues, particularly sediment, nutrient and chemical loading from upstream.

- More detailed investigation should be made into sediment pathways. By identifying hotspots of high sediment risk to the River Lambourn, efforts for land management improvement will be more targeted and as a result more effective.

- It would be beneficial to quantify the contribution of septic tanks to nutrient loading in the river. Considerable effort has been made in improving infrastructure at the sewage treatment works, but nutrient stress is still marked, particularly downstream. This knowledge would indicate where effort needs to be made to tackle phosphorus inputs to the river.

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.

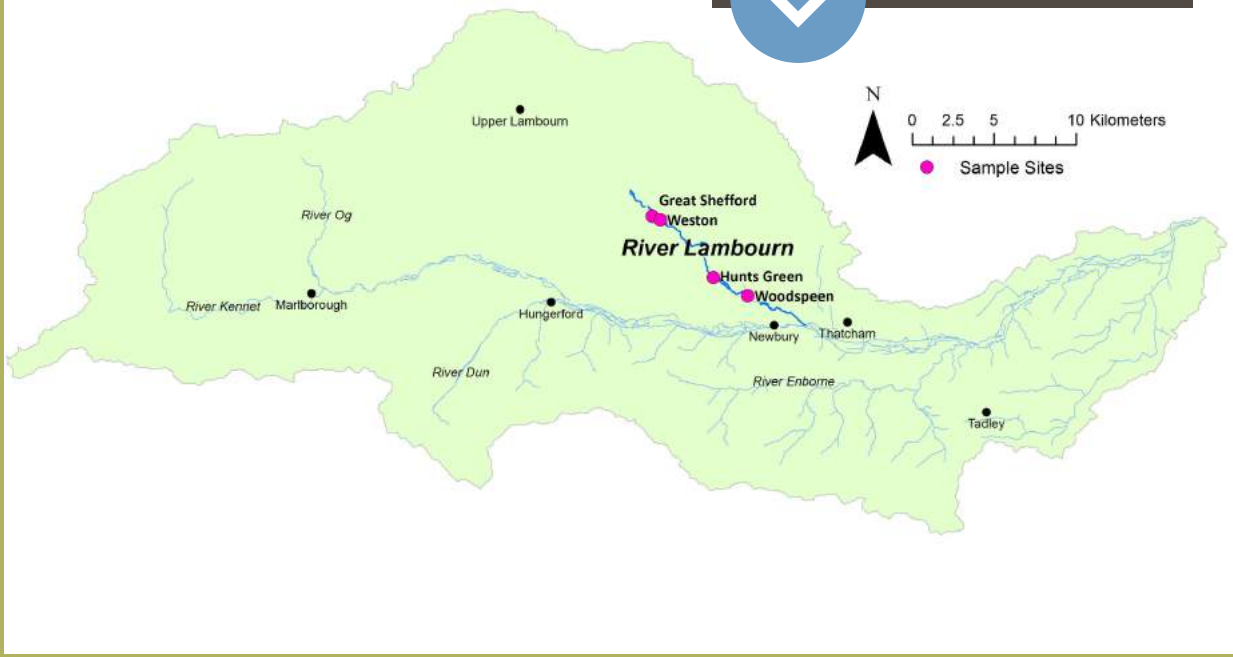
MAKE A STAND

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 Lambourn began in 2015 and continued for three years on four sites: Great Shefford, Weston, Hunt's Green and Woodspeen.

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

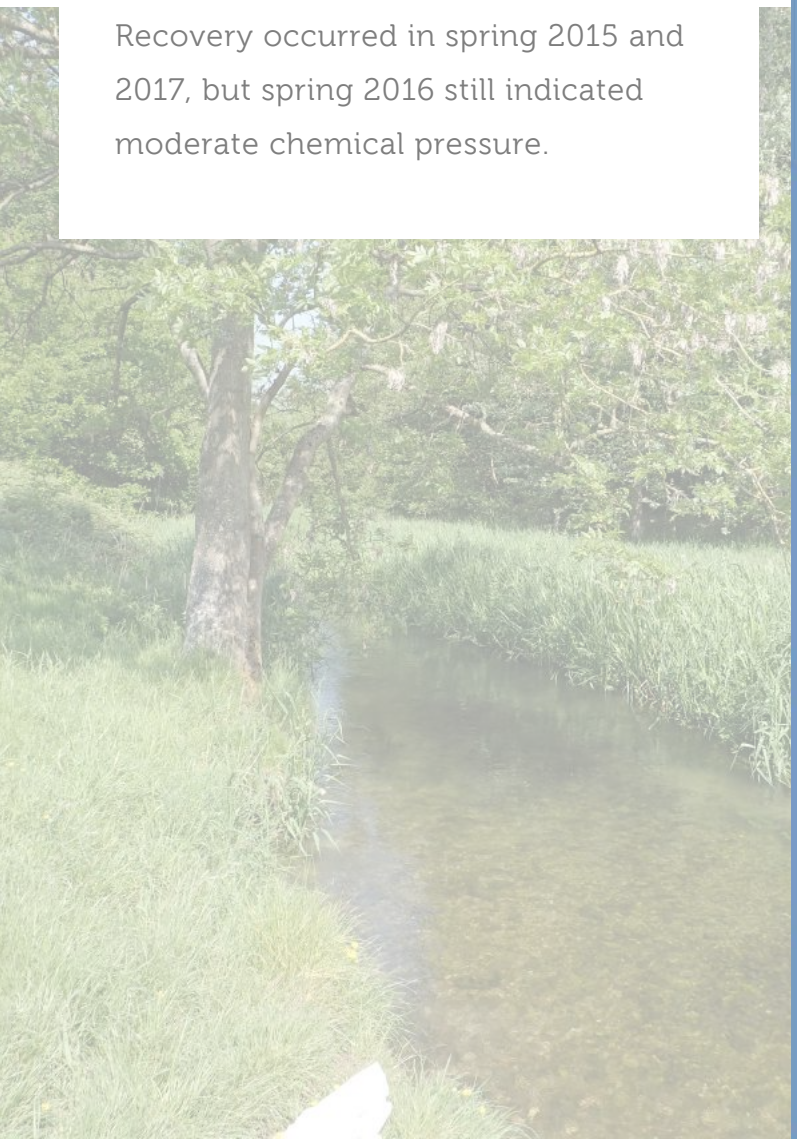


1 WHAT WE'VE FOUND
Great Shefford

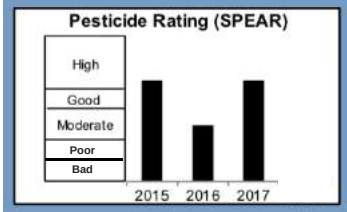
The invertebrate community at Great Shefford exhibited some stress from excess fine sediment. Slight impact signatures were present during the entire survey period, except for moderate stress signatures in autumn 2015 and spring 2017.

There was little invertebrate evidence of nutrient stress.

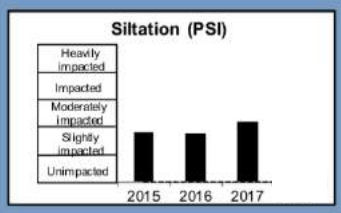
Chemical stress was concerning, signatures failed the proposed WFD standard for SPEAR throughout autumn (Beketov et al. 2009). Recovery occurred in spring 2015 and 2017, but spring 2016 still indicated moderate chemical pressure.

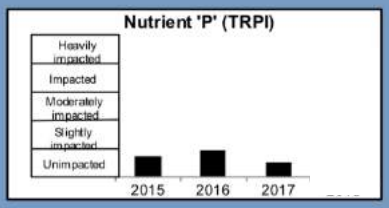


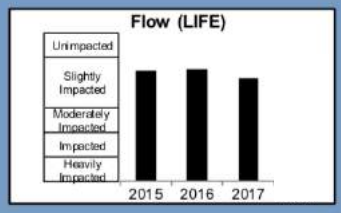
SPRING BIOMETRICS

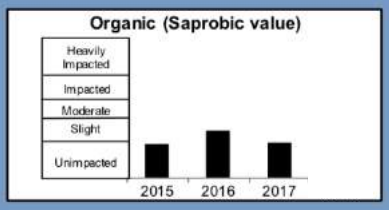


	2015	2016	2017
BMWP	139	69	82
ASPT	5.79	4.60	5.13
Annual Mayfly Sp. Richness	4	2	2
Total Abundance	900	1277	554
EPT	16	8	10
CCI	8.33	3.64	-
LIFE	7.74	7.76	7.58
PSI	63.46	64.71	55.56
SPEAR	48.88	27.25	48.52
TRPI	85.71	81.25	90.00
Saprobic	1.75	2.01	1.77

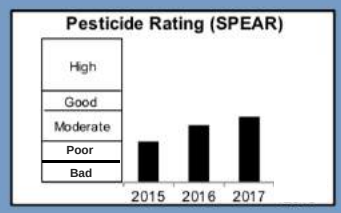




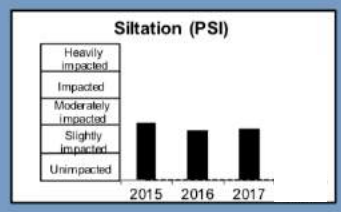


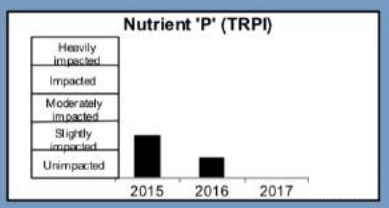


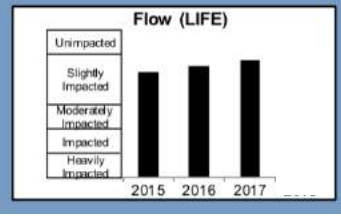
AUTUMN BIOMETRICS

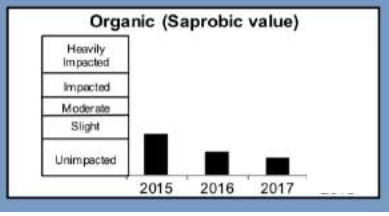


	2015	2016	2017
BMWP	98	80	98
ASPT	5.16	5.00	5.16
Annual Mayfly Sp. Richness	4	2	2
Total Abundance	507	1110	1510
EPT	8	7	8
CCI	7.94	12.50	9.17
LIFE	7.65	7.76	7.90
PSI	57.89	63.89	62.00
SPEAR	19.75	27.72	31.92
TRPI	70.00	85.71	100.00
Saprobic	1.90	1.52	1.39









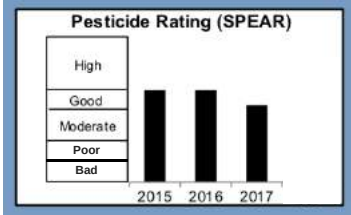
2 WHAT WE'VE FOUND
Weston

The LIFE biometric revealed a consistent slight impact from flow stress on the invertebrate community at Weston during 2015-2017, with the exception of an improved flow velocity signature in autumn 2017. Sediment stress impact scores were moderate in autumn 2015, autumn 2016 and spring 2017, all other signatures were slight.

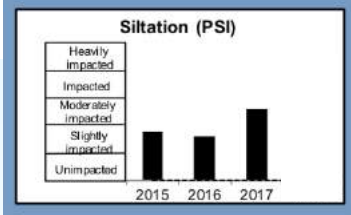
Nutrient stress was most pronounced in autumn 2015, where a moderate impact occurred. Slight impact was indicated for the rest of the survey period.

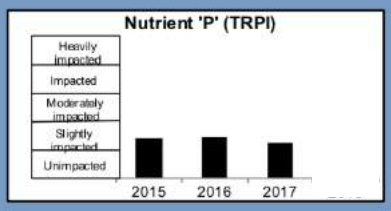
The complex chemical biometric, SPEAR, showed an impact from chemicals particularly in autumn. Slight recovery occurred in spring.

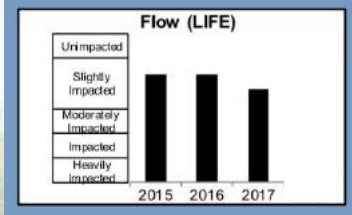
SPRING BIOMETRICS

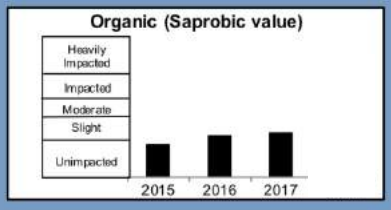


	2015	2016	2017
BMWP	125	91	81
ASPT	5.95	5.69	5.40
Annual Mayfly Sp. Richness	4	3	3
Total Abundance	1511	1186	1875
EPT	12	11	5
CCI	18.50	7.94	-
LIFE	7.68	7.68	7.38
PSI	64.44	67.57	48.15
SPEAR	44.78	44.22	37.14
TRPI	71.43	70.59	75.00
Saprobic	1.70	1.89	1.95

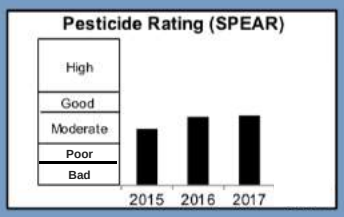




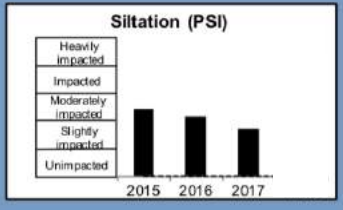


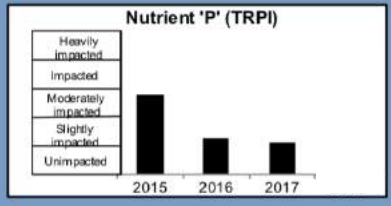


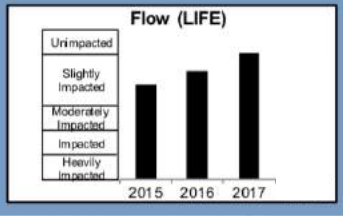
AUTUMN BIOMETRICS

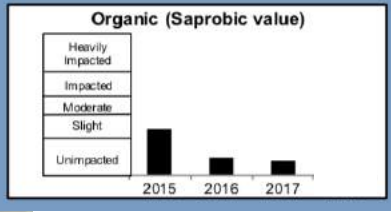


	2015	2016	2017
BMWP	93	91	108
ASPT	4.90	5.06	5.40
Annual Mayfly Sp. Richness	4	3	3
Total Abundance	676	860	2268
EPT	7	9	9
CCI	7.69	8.75	7.81
LIFE	7.39	7.67	8.05
PSI	51.52	56.82	66.00
SPEAR	27.09	32.98	33.57
TRPI	44.44	75.00	77.78
Saprobic	1.98	1.37	1.32









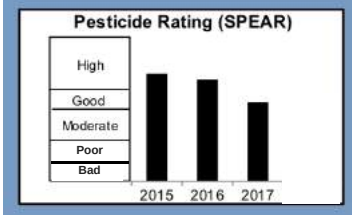
3 WHAT WE'VE FOUND
Hunt's Green

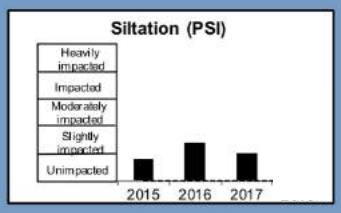
Nutrient stress at Hunt's Green was mostly slight, with unimpacted signatures in 2017. The invertebrate community did not indicate flow stress at this site. Stress from excess fine sediment was only slight during the entire survey period with an unimpacted score in spring 2015.

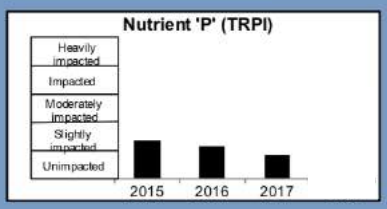
Chemical stress was indicated in autumn, with moderate impact scores (failing the proposed WFD standard in 2015 and 2017). Recovery in spring did occur, but was less in spring 2017.

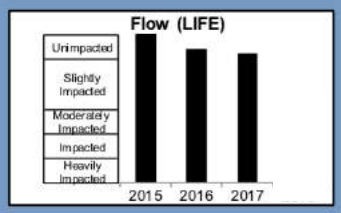
SPRING BIOMETRICS

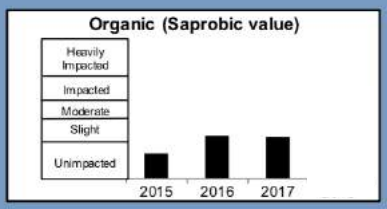
	2015	2016	2017
BMWP	153	161	89
ASPT	6.61	6.19	6.36
Annual Mayfly Sp. Richness	8	10	6
Total Abundance	2673	2689	690
EPT	20	21	8
CCI	19.78	16.50	-
LIFE	8.61	8.23	8.14
PSI	83.93	72.58	80.00
SPEAR	52.61	49.13	38.84
TRPI	72.73	76.47	83.33
Saprobic	1.53	1.92	1.90





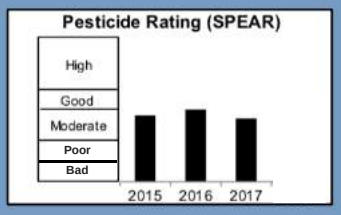


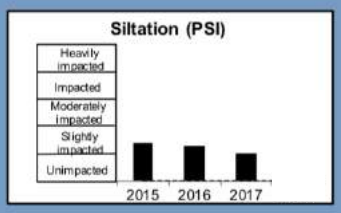


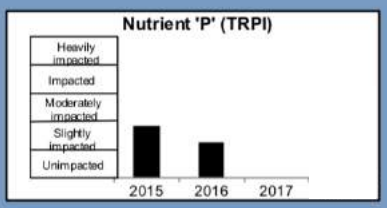


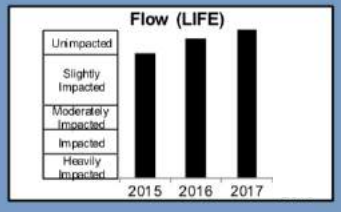
AUTUMN BIOMETRICS

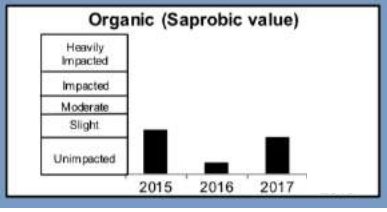
	2015	2016	2017
BMWP	140	101	80
ASPT	5.60	5.94	6.15
Annual Mayfly Sp. Richness	8	10	6
Total Abundance	527	813	427
EPT	14	10	7
CCI	9.09	10.42	9.50
LIFE	8.04	8.35	8.55
PSI	71.74	73.81	79.17
SPEAR	32.20	35.25	30.88
TRPI	63.34	75.00	100.00
Saprobic	1.97	1.26	1.80









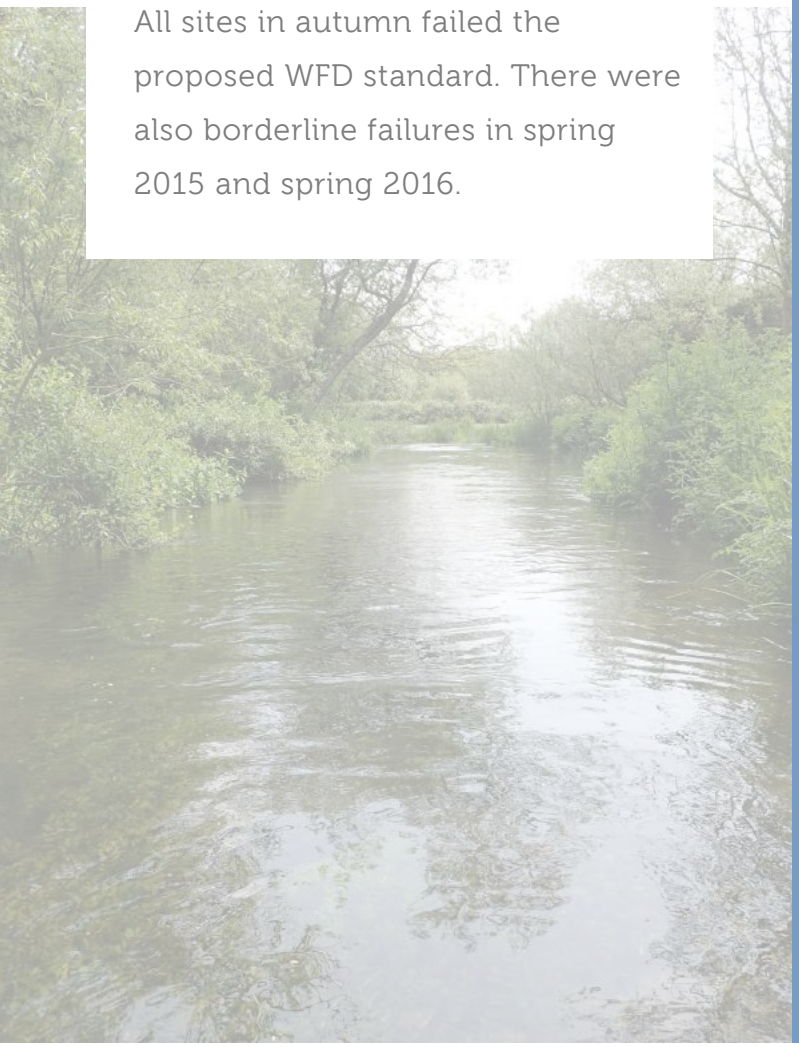


4 WHAT WE'VE FOUND
Woodspeen

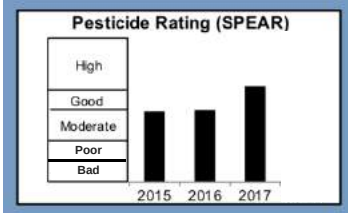
Sediment stress scores at Woodspeen were mostly moderate, apart from spring 2016 which was at the slight/moderate impact border and autumn 2017 which was slight impact.

In autumn the invertebrate community consistently exhibited slight stress from nutrients. In spring, moderate impact occurred in 2015 and 2016.

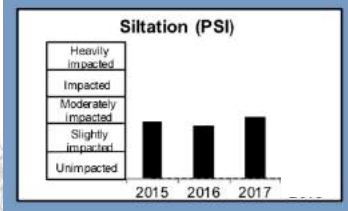
Chemical impact was especially concerning in autumn 2015, where a poor SPEAR signature occurred. All sites in autumn failed the proposed WFD standard. There were also borderline failures in spring 2015 and spring 2016.

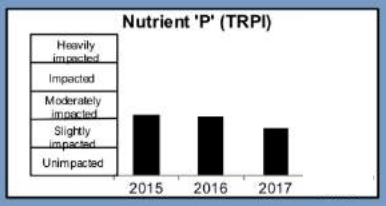


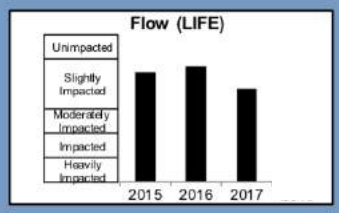
SPRING BIOMETRICS

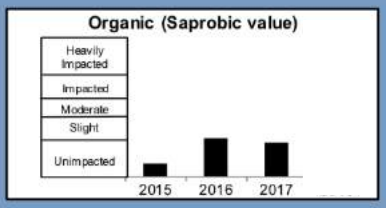


	2015	2016	2017
BMWP	123	133	86
ASPT	5.59	5.78	5.38
Annual Mayfly Sp. Richness	6	6	8
Total Abundance	358	766	172
EPT	10	12	8
CCI	11.33	10.31	-
LIFE	7.74	7.85	7.41
PSI	58.33	61.54	54.84
SPEAR	34.55	34.88	46.76
TRPI	57.33	58.33	66.67
Saprobic	1.28	1.83	1.75

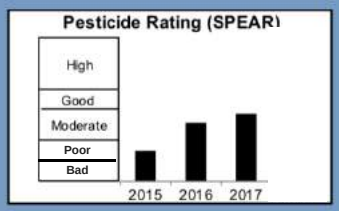




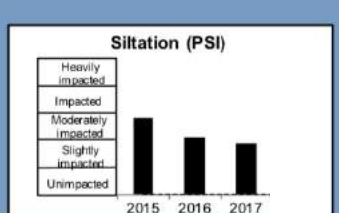


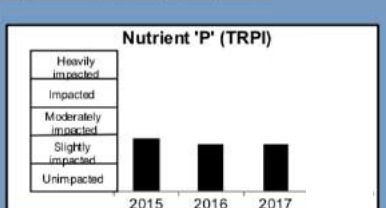


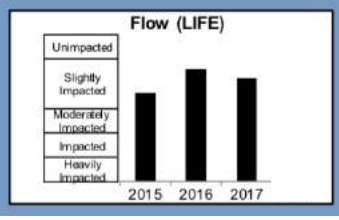
AUTUMN BIOMETRICS

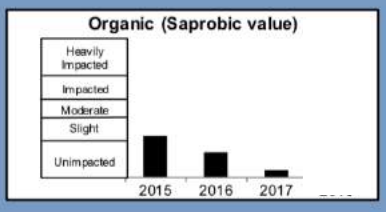


	2015	2016	2017
BMWP	86	117	95
ASPT	5.73	5.57	5.28
Annual Mayfly Sp. Richness	6	6	8
Total Abundance	311	697	523
EPT	5	7	9
CCI	4.64	8.00	9.29
LIFE	7.31	7.79	7.60
PSI	44.00	58.54	62.50
SPEAR	14.85	28.41	32.60
TRPI	62.50	66.67	66.67
Saprobic	1.91	1.54	1.16









Discussion

The River Lambourn, located within the Kennet catchment area, is a chalk river designated as a Site of Special Scientific Interest (SSSI) and a Special Area of Conservation (SAC) under the EU Habitats Directive. It has been recognised that the river is not meeting its current conservation targets. This failure has been mainly attributed to physical modification. The presence of historic structures and/or over engineering of the channel has resulted in loss of physical habitat and geomorphological function. A wide range of physical restoration projects have taken place in the river to address problematic modifications, in turn improving hydrology and water quality.

We found that Hunt's Green exhibited the best water quality out of the four sites sampled. This site is located on a previously restored stretch of river (Fig. 1). Despite stress scores being the least concerning here with minimal impact from flow stress, our findings still indicate slight nutrient and sediment issues, which may potentially be from loadings further upstream. Weston and Woodspeen are located on stretches on the river that have been identified as needing significant changes to structures and/or physical habitat restoration (Fig. 1). Stress on the invertebrate community from excess fine sediment is greatest at these two sites, with frequent moderate impact peaks in both seasons.

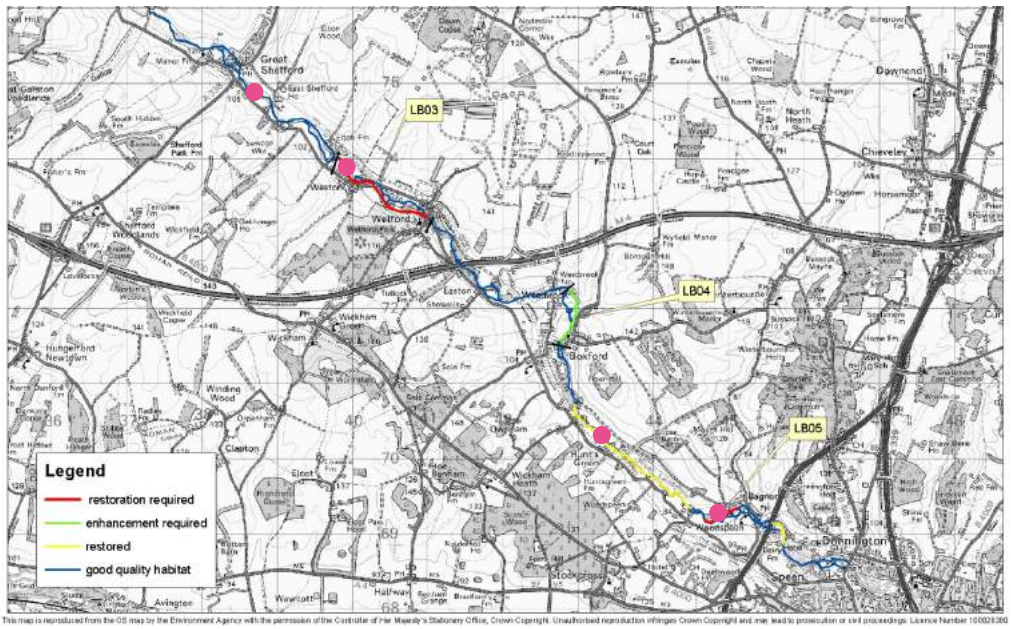


Fig. 1 - Whole river restoration plan for the River Lambourn SSSI. Approximate locations of Riverfly Census moniitoring sites shown by pink circles. (Environment Agency, 2011)

Great Shefford is located on a stretch of the river identified by the Environment Agency as good quality habitat (Fig. 1). However, the invertebrate community indicated stress from excess fine sediment and chemicals at this site. Mixed farming characterises the Lambourn sub-catchment, where cultivated land comprises 63.6%, pasture 21.4% and woodland 7.9% of the total area (Collins & Walling, 2007). Arable cultivation takes place on or adjacent to the floodplain, especially along the ephemeral section of the river between Lambourn village and Great Shefford (Grapes, 2004). Surface soil run-off from this land is likely to be a key source of sediment and chemical stress to the upper Lambourn. The seasonal nature of this part of the river also means less water is available to dilute run off, meaning the concentration of pollutants is not reduced upon entry into the water column.

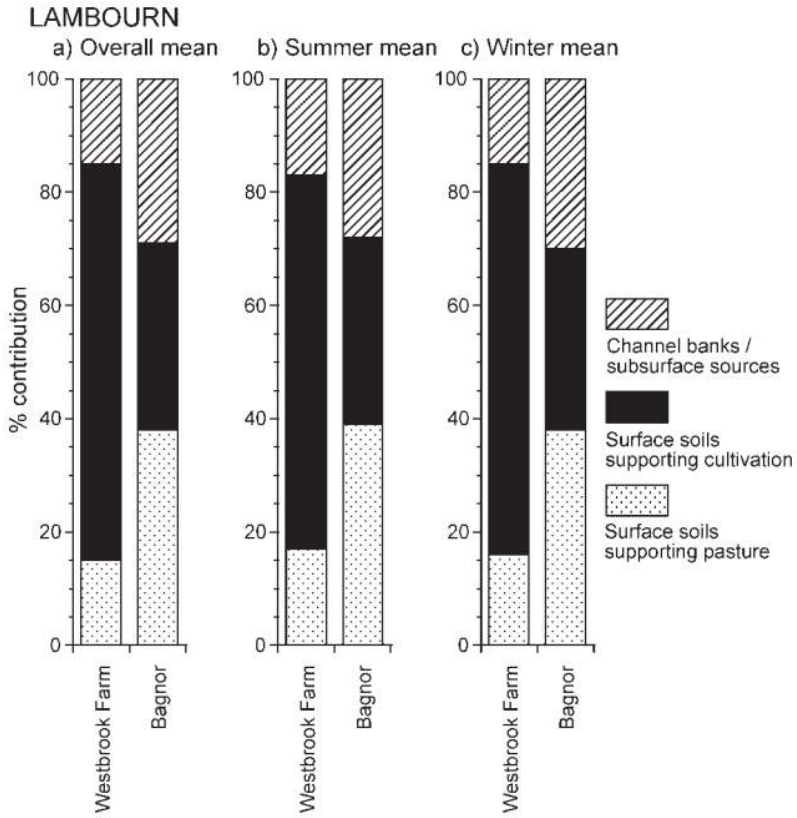


Fig. 2 - Mean estimates of the origin of fine sediment stored on the channel bed of the Lambourn sub-catchment (Collins & Walling, 2007)

Sediment fingerprinting by Collins & Walling (2007) confirmed that surface soils represent the greatest contribution of sediment to the Lambourn river bed, although they highlighted that mitigation measures should also be directed towards protection of channel banks, especially in the lower reaches of the river (Fig. 2).

Some stretches on the Lambourn are ephemeral, so it is normal that parts of the river dry up (Fig. 3). Because of this, at certain times of the year treated waste water makes up an important amount of the flow. Where there is less river water available to dilute effluent, in-river concentrations of phosphates and chemicals are higher. There are four sewage treatment works in area which make up approximately 2% of the Lambourn's mean flow (Grapes, 2004). Ten kilometers from the source, just downstream of Great Shefford, the river receives input from East Shefford sewage works. The works does have tertiary treatment facilities that remove between 80 and 90% of phosphorus from the sewage effluent (Lehmann et al. 2016). However, additional waste water input might be received from septic tanks which release into groundwater close to the river. which could explain some of the nutrient stress signatures at our sites.

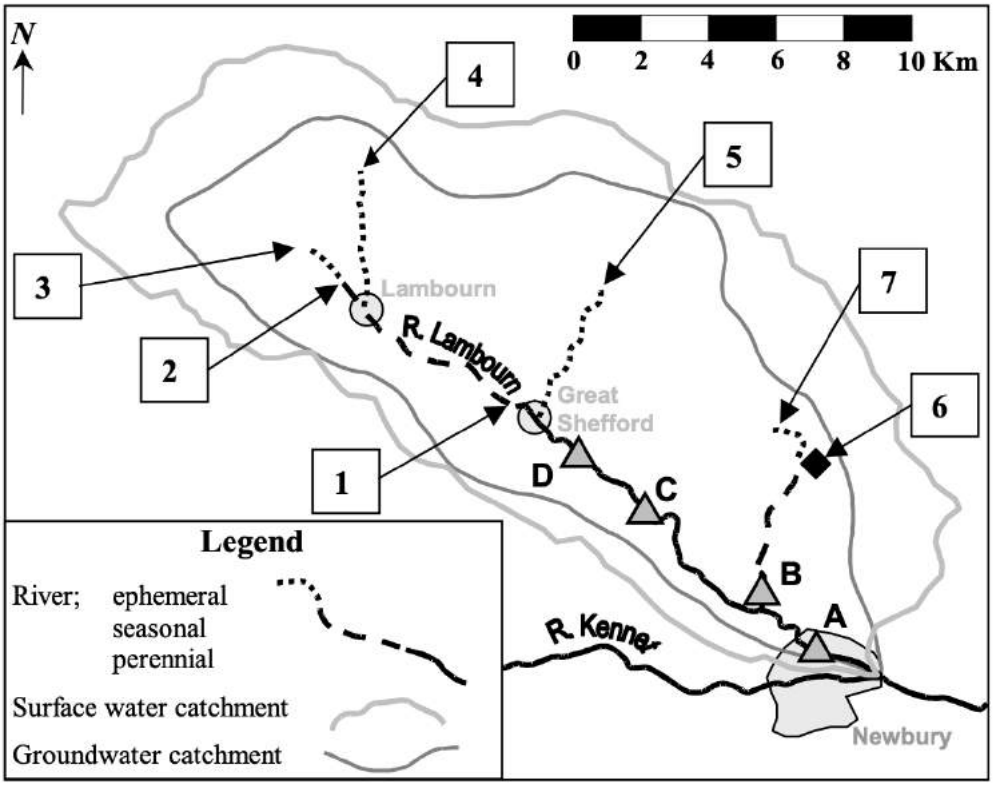


Fig. 3 - Hydrology of the River Lambourn sub-catchment (Grapes, 2004)

Invasive signal crayfish (Pacifasticus lenuiscus) were found throughout the survey catchment, although great efforts are being made to control numbers. These species are capable of exerting change in ecological condition to the river, so it is essential their impact is monitored. No other faunal invasive species were found during the 3 year study.

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.

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