SmartRivers

Your data sheet explained

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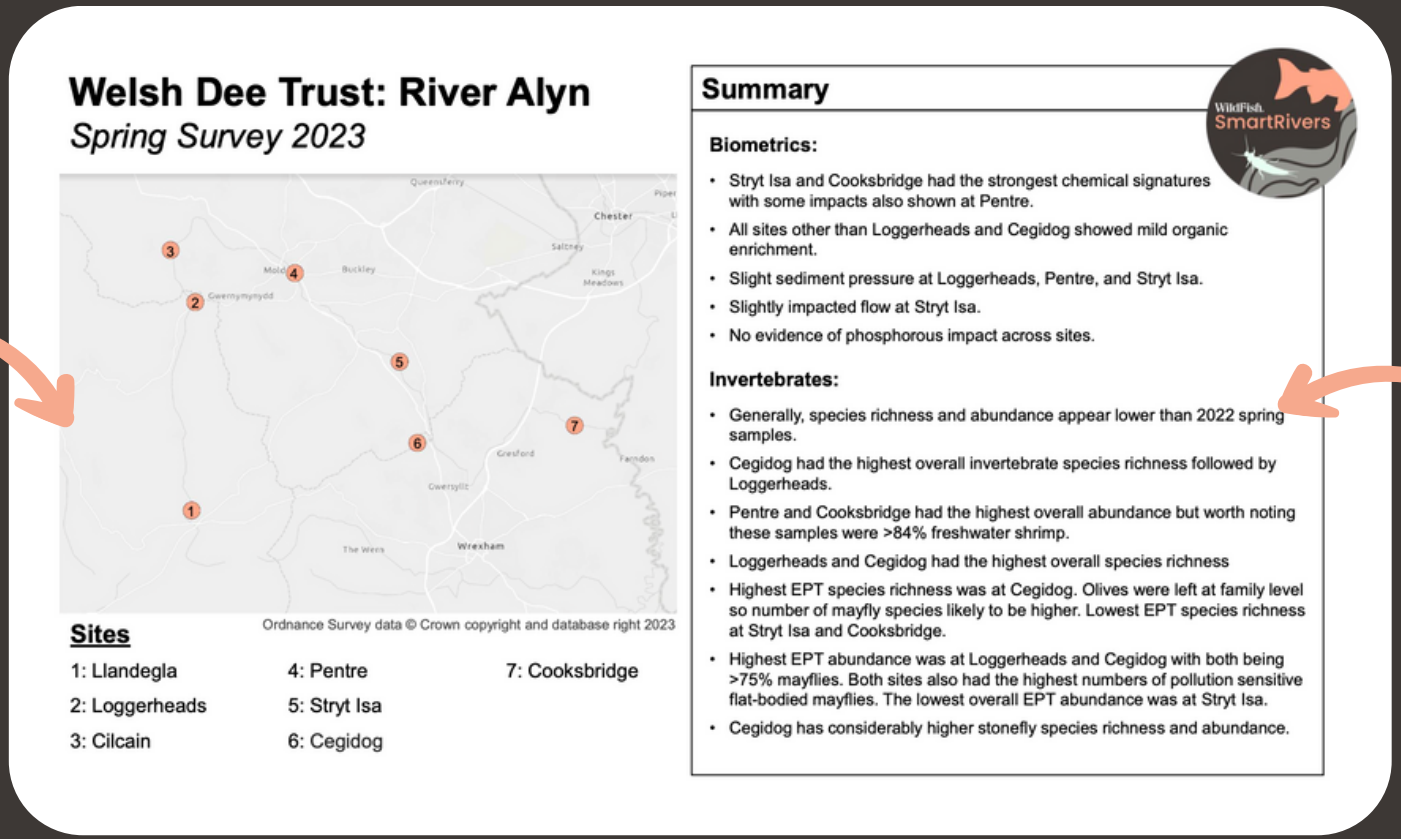
You will receive these data sheets twice a year – one with your spring results and one with your autumn results. The aim of this document is to help explain what you're looking at and what it means. If you have further questions or require additional resources, please contact us on smartrivers@wildfish.org.

Title page

This map shows **the sites your hub monitors.**

If a site appears to be in the wrong location on the map, please let us know!



Welsh Dee Trust: River Alyn

Spring Survey 2023

Ordnance Survey data © Crown copyright and database right 2023

Sites

1: Llandegla
2: Loggerheads
3: Cilcain
4: Pentre
5: Stryt Isa
6: Cegidog
7: Cooksbridge

Summary

Biometrics:

- Stryt Isa and Cooksbridge had the strongest chemical signatures with some impacts also shown at Pentre.
- All sites other than Loggerheads and Cegidog showed mild organic enrichment.
- Slight sediment pressure at Loggerheads, Pentre, and Stryt Isa.
- Slightly impacted flow at Stryt Isa.
- No evidence of phosphorous impact across sites.

Invertebrates:

- Generally, species richness and abundance appear lower than 2022 spring samples.
- Cegidog had the highest overall invertebrate species richness followed by Loggerheads.
- Pentre and Cooksbridge had the highest overall abundance but worth noting these samples were >84% freshwater shrimp.
- Loggerheads and Cegidog had the highest overall species richness
- Highest EPT species richness was at Cegidog. Olives were left at family level so number of mayfly species likely to be higher. Lowest EPT species richness at Stryt Isa and Cooksbridge.
- Highest EPT abundance was at Loggerheads and Cegidog with both being >75% mayflies. Both sites also had the highest numbers of pollution sensitive flat-bodied mayflies. The lowest overall EPT abundance was at Stryt Isa.
- Cegidog has considerably higher stonefly species richness and abundance.

A written summary with the **key points of interest** from your data that season.

Water quality scores: Page 1

These scores indicate the pressure(s) that a particular site on your river is facing.
Because SmartRivers monitoring entails identifying invertebrates to the lowest level in the taxonomic hierarchy possible (e.g., species) we can provide this detailed view of what is going on beneath the surface.

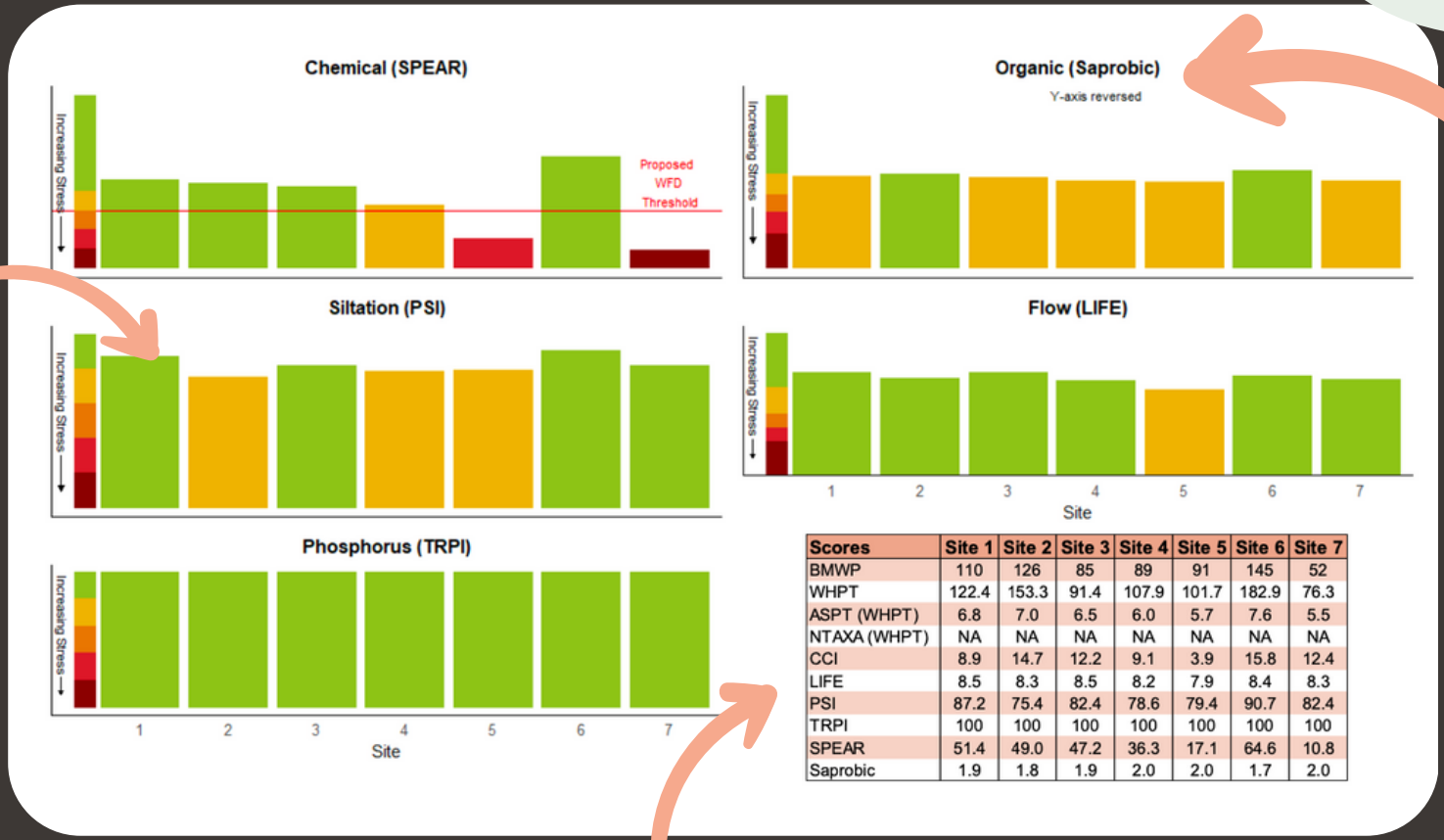
- Every invertebrate has specific pollution sensitivities, like a fingerprint, and water quality scores can be generated based on these.
- The more sensitive species you have, the less stress indicated at a site.

All scores calculated through SmartRivers have been acknowledged in the scientific community and **originate from peer-reviewed sources**.

For further detail on the individual metrics see the supplementary materials on pages 6/7.

The graphs have a **traffic light banding system to show the impact** indicated at each site- from **green** (unimpacted) to **red** (the most impacted).

Even a 'slight' impact could be meaningful for your sites. So, try to avoid just looking for red scores in your data.



The title of each graph describes **which water quality pressure is being scored** and the **technical name** of the metric used.

Scores	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
BMWP	110	126	85	89	91	145	52
WHPT	122.4	153.3	91.4	107.9	101.7	182.9	76.3
ASPT (WHPT)	6.8	7.0	6.5	6.0	5.7	7.6	5.5
NTAXA (WHPT)	NA	NA	NA	NA	NA	NA	NA
CCI	8.9	14.7	12.2	9.1	3.9	15.8	12.4
LIFE	8.5	8.3	8.5	8.2	7.9	8.4	8.3
PSI	87.2	75.4	82.4	78.6	79.4	90.7	82.4
TRPI	100	100	100	100	100	100	100
SPEAR	51.4	49.0	47.2	36.3	17.1	64.6	10.8
Saprobic	1.9	1.8	1.9	2.0	2.0	1.7	2.0

The table shows a **summary of all the water quality scores** across the sites including a number of other metrics.

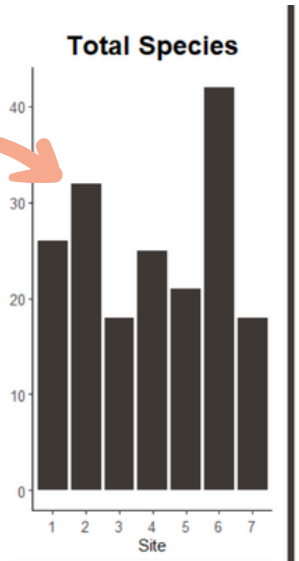
If your group would like graphs summarising these additional metrics to aid in discussions with local stakeholders/government bodies, please get in touch.

Biodiversity: Page 2

These graphs summarise all the invertebrates collected in your survey for the described season.

- Biodiversity is a good indicator of habitat quality.
- Loss of species and low or declining numbers of individuals are a sign of ecosystem distress in any environment.
- Generally, what we want to be seeing is a healthy invertebrate community appropriate to the river system, comprising a variety of different species with plenty of individuals.

A graph showing the **number of species found** per site.

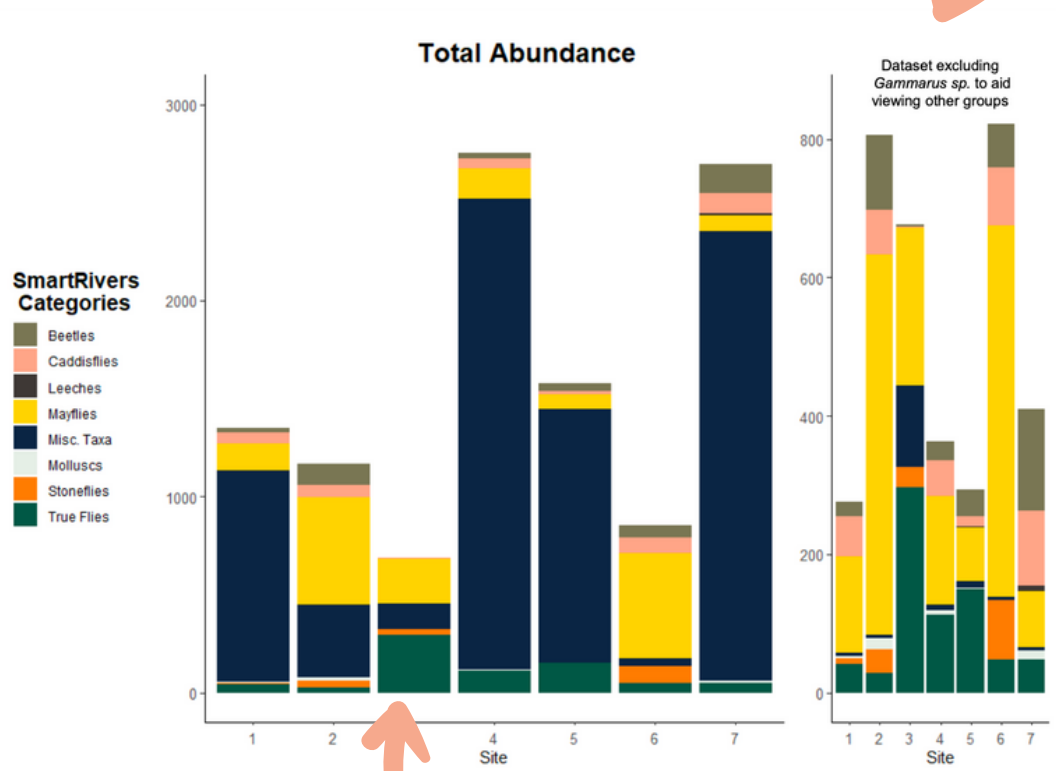


A table summarising **species richness and abundance** across your sites.

The numbers in brackets in this table show the **difference between this sample and the matching season the previous year**.

Site	Total Species	Total Abundance
1	26 (+5)	1351 (-917)
2	32 (-10)	1169 (-2790)
3	18 (-20)	687 (-620)
4	26 (-1)	2753 (-2153)
5	21 (-2)	1576 (-2629)
6	42 (+2)	855 (-744)
7	18 (-16)	2679 (-319)

(+/- shows change from previous year)



This graph shows **total invertebrate abundance per site grouped into the SmartRivers categories** by colour.

This gives a quick visual overview of the numbers and proportions of different invertebrates across the sites.

This is a graph **excluding any groups of particularly high abundance** so that the others can be seen in greater detail.

Some invertebrate species/groups such as *Gammarus* sp. (freshwater shrimp – miscellaneous taxa) or True Flies may be found in numbers that dwarf those of the other invertebrate groups, which can make viewing the fine detail hard on a single graph.

Biodiversity: Page 3

These graphs summarise your riverfly data.

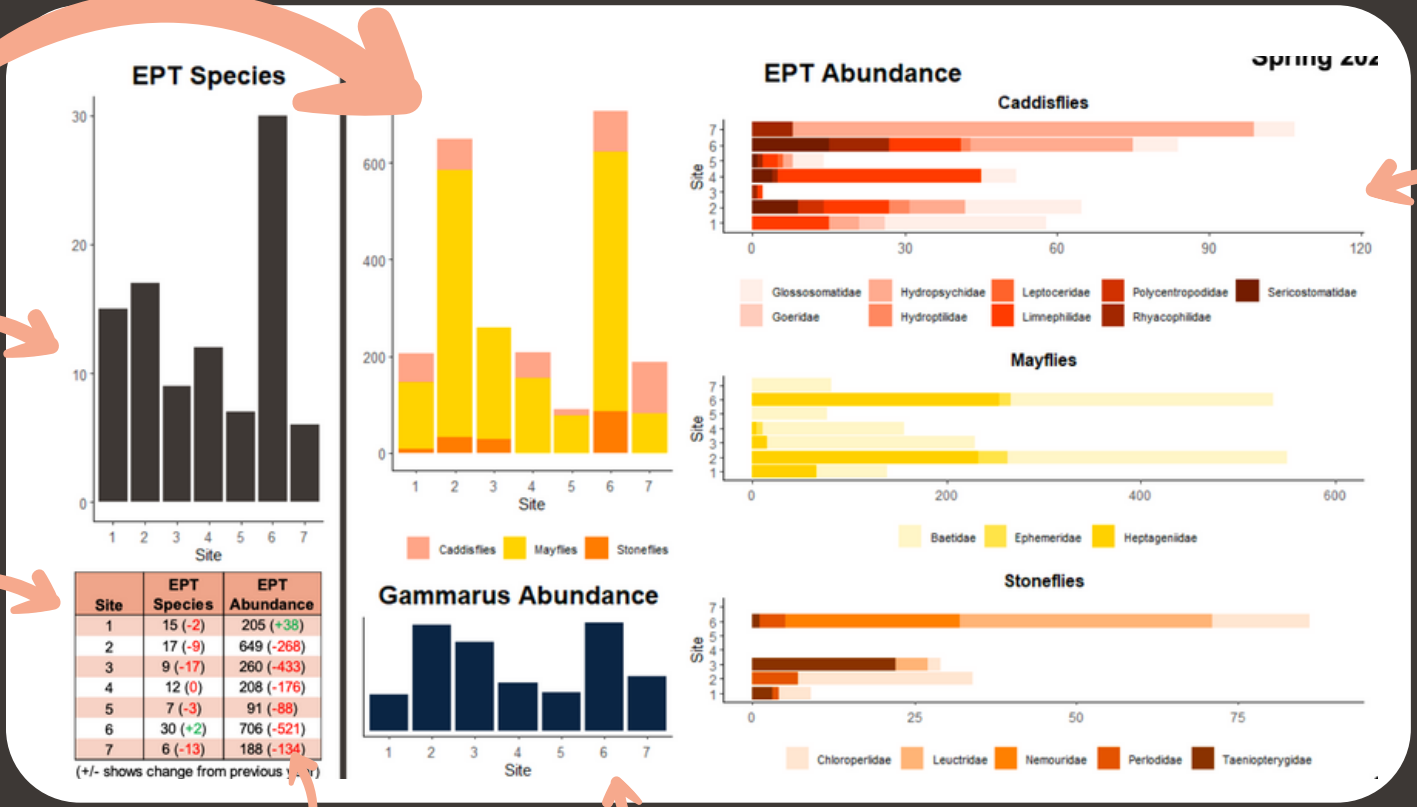
- The EPT riverflies – Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) – are a key group with regards to invertebrate monitoring. They are generally considered to be highly sensitive to pollution and thus can act as 'canaries in the coal mine', giving an early indication of changes in water quality.
- While riverflies are generally thought of as 'pollution-sensitive' there is still considerable variation between the species, so it is important to also examine what species are present at each site (see main summary and page 4).
- While not an EPT species *Gammarus* (freshwater shrimp) are a key component of the invertebrate community, often forming the bulk of the biomass found in a kick sample. These high relative numbers make them an important food source for other aquatic species. Additionally, their feeding strategy plays a key role in the breaking down of organic matter like fallen leaves".

A graph showing the **abundance of riverflies per site broken down into the EPT orders** by colour.

A graph showing the **number of EPT species** per site.

A table summarising **EPT species richness and abundance** across your sites.

The numbers in brackets in this table show the **difference between this sample and the matching season the previous year**.



Site	EPT Species	EPT Abundance
1	15 (-2)	205 (+38)
2	17 (-9)	649 (-268)
3	9 (-17)	260 (-433)
4	12 (0)	208 (-176)
5	7 (-3)	91 (-88)
6	30 (+2)	706 (-521)
7	6 (-13)	188 (-134)

(+/- shows change from previous

A graph showing the **number of *Gammarus* shrimp** per site.

These graphs show **individual families within the EPT orders** to give a broad overview of diversity within/ between sites. See page 9 for more detail on EPT families.

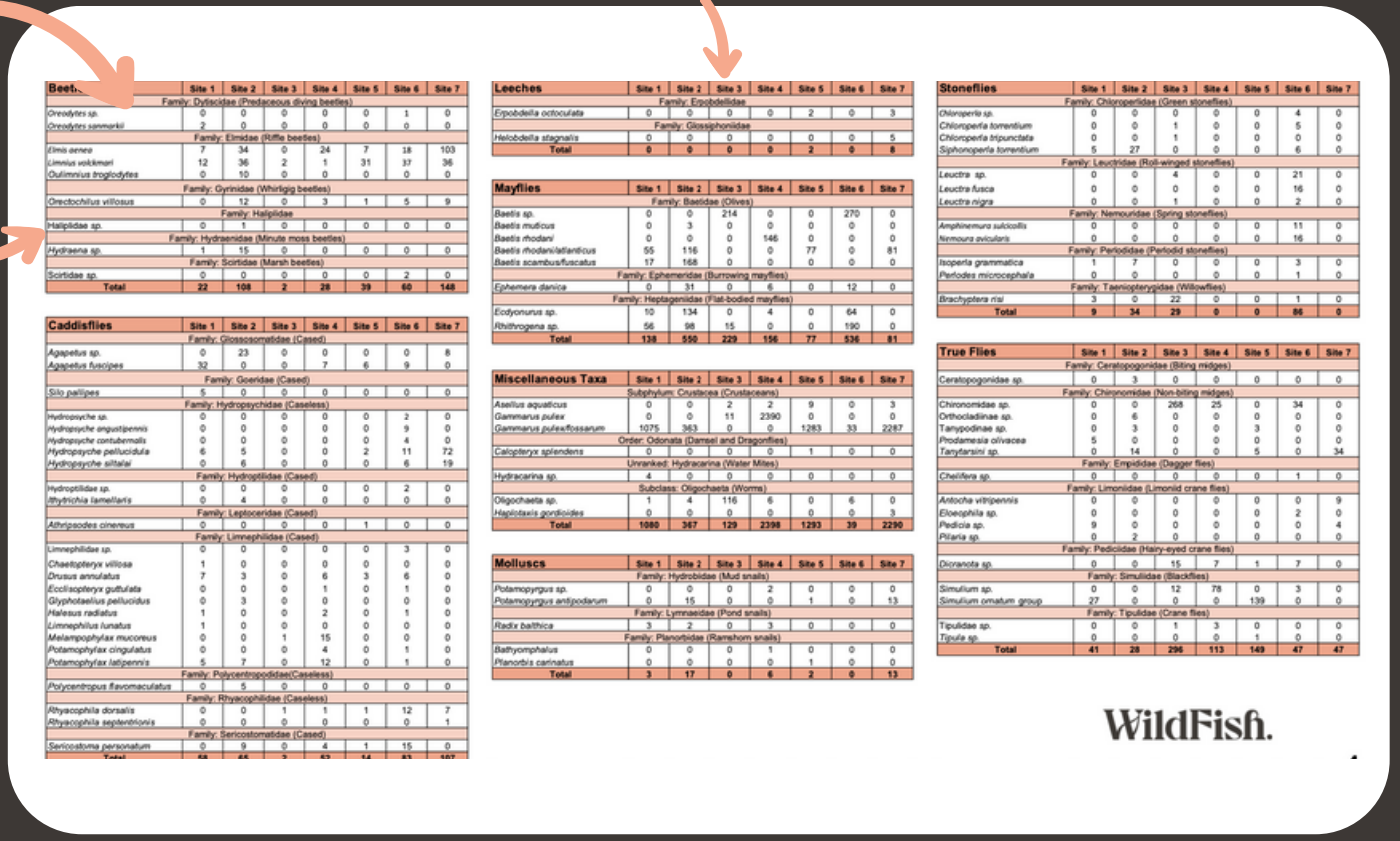
Full invertebrate breakdown: Page 4

This is the full taxonomic breakdown of what invertebrates, and how many, were found in your samples this season.

Sites monitored

SmartRivers group name

List of species found and their quantities



Beet...	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
Family: Dytiscidae (Predaceous diving beetles)							
Oreodytes sp.	0	0	0	0	0	1	0
Oreodytes sanmarkii	2	0	0	0	0	0	0
Family: Elmidae (Riffle beetles)							
Elmis aenea	7	34	0	24	7	18	103
Limnius volckmari	12	36	2	1	31	37	36
Oulimnius troglodytes	0	10	0	0	0	0	0
Family: Gyrinidae (Whirligig beetles)							
Orectochilus villosus	0	12	0	3	1	5	9
Family: Haliplidae							
Haliplidae sp.	0	1	0	0	0	0	0
Family: Hydraenidae (Minute moss beetles)							
Hydraena sp.	1	15	0	0	0	0	0
Family: Scirtidae (Marsh beetles)							
Scirtidae sp.	0	0	0	0	0	2	0
Total	**22**	**108**	**2**	**28**	**39**	**60**	**148**

Caddisflies	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
Family: Glossosomatidae (Cased)							
Agapetus sp.	0	23	0	0	0	0	8
Agapetus fuscipes	32	0	0	7	6	9	0
Family: Goeridae (Cased)							
Silo pallipes	5	0	0	0	0	0	0
Family: Hydropsychidae (Caseless)							
Hydropsyche sp.	0	0	0	0	0	2	0
Hydropsyche angustipennis	0	0	0	0	0	9	0
Hydropsyche contubernalis	0	0	0	0	0	4	0
Hydropsyche pellucidula	6	5	0	0	2	11	72
Hydropsyche siltalai	0	6	0	0	0	6	19
Family: Hydroptilidae (Cased)							
Hydroptilidae sp.	0	0	0	0	0	2	0
Ithytrichia lamellaris	0	4	0	0	0	0	0
Family: Leptoceridae (Cased)							
Athripsodes cinereus	0	0	0	0	1	0	0
Family: Limnephilidae (Cased)							
Limnephilidae sp.	0	0	0	0	0	3	0
Chaetopteryx villosa	1	0	0	0	0	0	0
Drusus annulatus	7	3	0	6	3	6	0
Ecclisopteryx guttulata	0	0	0	1	0	1	0
Glyphotaelius pellucidus	0	3	0	0	0	0	0
Halesus radiatus	1	0	0	2	0	1	0
Limnephilus lunatus	1	0	0	0	0	0	0
Melampophylax mucoreus	0	0	1	15	0	0	0
Potamophylax cingulatus	0	0	0	4	0	1	0
Potamophylax latipennis	5	7	0	12	0	1	0
Family: Polycentropodidae(Caseless)							
Polycentropus flavomaculatus	0	5	0	0	0	0	0
Family: Rhyacophilidae (Caseless)							
Rhyacophila dorsalis	0	0	1	1	1	12	7
Rhyacophila septentrionis	0	0	0	0	0	0	1
Family: Sericostomatidae (Cased)							
Sericostoma personatum	0	9	0	4	1	15	0
Total	**58**	**65**	**2**	**52**	**14**	**83**	**107**

Leeches	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
Family: Erpobdellidae							
Erpobdella octoculata	0	0	0	0	2	0	3
Family: Glossiphoniidae							
Helobdella stagnalis	0	0	0	0	0	0	5
Total	**0**	**0**	**0**	**0**	**2**	**0**	**8**

Mayflies	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
Family: Baetidae (Olives)							
Baetis sp.	0	0	214	0	0	270	0
Baetis muticus	0	3	0	0	0	0	0
Baetis rhodani	0	0	0	146	0	0	0
Baetis rhodani/atlanticus	55	116	0	0	77	0	81
Baetis scambus/fuscatus	17	168	0	0	0	0	0
Family: Ephemeridae (Burrowing mayflies)							
Ephemera danica	0	31	0	6	0	12	0
Family: Heptageniidae (Flat-bodied mayflies)							
Ecdyonurus sp.	10	134	0	4	0	64	0
Rhithrogena sp.	56	98	15	0	0	190	0
Total	**138**	**550**	**229**	**156**	**77**	**536**	**81**

Miscellaneous Taxa	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
Subphylum: Crustacea (Crustaceans)							
Asellus aquaticus	0	0	2	2	9	0	3
Gammarus pulex	0	0	11	2390	0	0	0
Gammarus pulex/fossarum	1075	363	0	0	1283	33	2287
Order: Odonata (Damsel and Dragonflies)							
Calopteryx splendens	0	0	0	0	1	0	0
Unranked: Hydracarina (Water Mites)							
Hydracarina sp.	4	0	0	0	0	0	0
Subclass: Oligochaeta (Worms)							
Oligochaeta sp.	1	4	116	6	0	6	0
Haplotaxis gordioides	0	0	0	0	0	0	3
Total	**1080**	**367**	**129**	**2398**	**1293**	**39**	**2290**

Molluscs	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
Family: Hydrobiidae (Mud snails)							
Potamopyrgus sp.	0	0	0	2	0	0	0
Potamopyrgus antipodarum	0	15	0	0	1	0	13
Family: Lymnaeidae (Pond snails)							
Radix balthica	3	2	0	3	0	0	0
Family: Planorbidae (Ramshorn snails)							
Bathyomphalus	0	0	0	1	0	0	0
Planorbis carinatus	0	0	0	0	1	0	0
Total	**3**	**17**	**0**	**6**	**2**	**0**	**13**

Stoneflies	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
Family: Chloroperlidae (Green stoneflies)							
Chloroperla sp.	0	0	0	0	0	4	0
Chloroperla tornentium	0	0	1	0	0	5	0
Chloroperla tripunctata	0	0	1	0	0	0	0
Siphonoperla torrentium	5	27	0	0	0	6	0
Family: Leuctridae (Roll-winged stoneflies)							
Leuctra sp.	0	0	4	0	0	21	0
Leuctra fusca	0	0	0	0	0	16	0
Leuctra nigra	0	0	1	0	0	2	0
Family: Nemouridae (Spring stoneflies)							
Amphinemura sulcicollis	0	0	0	0	0	11	0
Nemoura avicularis	0	0	0	0	0	16	0
Family: Perlodidae (Perlodid stoneflies)							
Isoperla grammatica	1	7	0	0	0	3	0
Perlodes microcephala	0	0	0	0	0	1	0
Family: Taeniopterygidae (Willowflies)							
Brachyptera risi	3	0	22	0	0	1	0
Total	**9**	**34**	**29**	**0**	**0**	**86**	**0**

True Flies	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
Family: Ceratopogonidae (Biting midges)							
Ceratopogonidae sp.	0	3	0	0	0	0	0
Family: Chironomidae (Non-biting midges)							
Chironomidae sp.	0	0	268	25	0	34	0
Orthocladiinae sp.	0	6	0	0	0	0	0
Tanypodinae sp.	0	3	0	0	3	0	0
Prodamesia olivacea	5	0	0	0	0	0	0
Tanytarsini sp.	0	14	0	0	5	0	34
Family: Empididae (Dagger flies)							
Chelifera sp.	0	0	0	0	0	1	0
Family: Limoniidae (Limonid crane flies)							
Antocha vitripennis	0	0	0	0	0	0	9
Eloeophila sp.	0	0	0	0	0	2	0
Pedicia sp.	9	0	0	0	0	0	4
Pilaria sp.	0	2	0	0	0	0	0
Family: Pediciidae (Hairy-eyed crane flies)							
Dicranota sp.	0	0	15	7	1	7	0
Family: Simuliidae (Blackflies)							
Simulium sp.	0	0	12	78	0	3	0
Simulium ornatum group	27	0	0	0	139	0	0
Family: Tipulidae (Crane flies)							
Tipulidae sp.	0	0	1	3	0	0	0
Tipula sp.	0	0	0	0	1	0	0
Total	**41**	**28**	**296**	**113**	**149**	**47**	**47**

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For any additional support or requests for interpretation, please do not hesitate to get in touch:
smartrivers@wildfish.org.

Supplementary material:

Water quality scores - Individual metrics

This is a brief summary of what the metrics featured are monitoring. A wide variety of information is available online regarding these and we would encourage our volunteers to access these resources to learn more.

Chemical Pressure – SPEAR (SPecies At Risk)

Chemicals are widely used in our society with numerous benefits. Unfortunately, once released into the environment they can have unintentional detrimental impacts on wildlife and freshwater ecosystems as a whole.

These chemicals can enter the environment through a variety of pathways for example, point pollution sources such as sewage treatment works or diffuse sources such as agricultural run-off.

SPEAR scores indicate the chemical pressure a particular site is experiencing, but not what specific chemicals are causing the problem.

Organic Pressure – Saprobic Index

The build-up of organic enrichment in rivers can lead to changes in microbial communities and their growth. Excessive microbial growth also leads to oxygen depletion in the surrounding habitat and can disrupt the entire ecosystem.

Wastewater from human population centres and intensive livestock farming are the key culprits with regards to organic pollution in rivers.

The impacts of organic enrichment in a river are highly dependent on the volume of flowing water (dilution) and the microbial communities ability to naturally break down this input.

The y-axis has been reversed on our saprobic graph so that 0 is at the top and 4 at the bottom. This is to match the other water quality score graphs, so that reductions on the y-axis equate to a decline in water quality.

Sediment Pressure – PSI (the Proportion of Sediment-sensitive Invertebrates index)

The movement of sediment from the land into our rivers is a natural process. The problems arise when excessive fine sediments enter the water.

Unnaturally high levels of sediment entering a river can suffocate resident flora and fauna, as well as altering habitats by reducing light levels and increasing turbidity (opaqueness of water column).
Additionally, toxic compounds can bind with the sediments, and this will increase concentrations of harmful substances in particular areas.

Erosion is the main source of sediments in rivers which can be accelerated to unnatural levels through inappropriate agricultural land use and management. Fine sediments may also come from urban run-off and discharges from wastewater treatment works or industrial processes.

Flow Pressure – LIFE (Lotic Invertebrate Flow Evaluation)

The water flowing through a river ultimately dictates the water quality. When flow is reduced pollutants are less diluted, sediments can more easily settle, and oxygen levels may be lower. Therefore, the negative impacts discussed in the other metric summaries are amplified when flow is low.

Flow rates can be impacted by a variety of causes. Natural changes in flow do occur through drought and flooding, however due to climate change the frequency and scale of these events are increasing. In terms of direct anthropogenic drivers: water abstraction, structures such as dams or weirs, and the alteration of natural river channels all hugely impact the volume and rate of flowing water.

Please note the y-axis range on the LIFE graph is from 5-10.

Phosphorus Pressure – TRPI (Total Reactive Phosphorus Index)

Phosphorus is an essential element for healthy plant life, but when too much phosphorus enters a river system it can be highly detrimental.

Elevated phosphorus levels can cause increases in plant and algae growth which subsequently decreases the amount of dissolved oxygen in the water column that wildlife needs to breathe. In addition, increased phosphorus can cause algal blooms that produce toxins and can reduce the survival of both invertebrate and fish eggs.

Point sources of phosphorus pollution include discharges from wastewater treatment and industry, while diffuse sources include fertiliser run-off from agricultural land.

BWMP (Biological Monitoring Working Party)

This is a family-level scoring system whereby the quality of water is measured using the invertebrate community. Each invertebrate family in a sample is given a score of 1-10 depending on their tolerance to pollution (10 = sensitive and 1 = tolerant). These values are summed to give a total score.

The BMWP system does not account for the abundance of invertebrates at a site simply their presence/absence. Partly due to this the BMWP has broadly been replaced by the WHPT system (below) which does incorporate abundance categories. In addition to the total score, the average score per taxa (ASPT) and the number of scoring taxa (NTAXA) are calculated (discussed with WHPT below) but we do not report these data in this summary.

WHPT (Walley Hawkes Paisley Trigg Index)

This family-level classification method is used by the Environment Agency in accordance with the Water Framework Directive (WFD) and enables the assessment of freshwater invertebrate communities in relation to general degradation of rivers from organic enrichment and subsequent impacts. This metric replaces the BMWP.

Invertebrate families are given a score in relation to their abundance category, giving a total score. Alongside this are two additional metrics used as indicators of river degradation: 1. The number of scoring taxa (NTAXA) – i.e., the number of invertebrate families contributing to the score and 2. The Average Score Per Taxon ASPT) which is calculated by the total score divided by NTAXA. Across all of these measures a lower value equals a lower quality site. Currently there is no available banding system.

CCI (Community Conservation Index)

This is a method used to quantify the conservation value of a particular site based on the invertebrate community. It accounts for the richness of the invertebrate community as well as the rarity of species that make up the community.

Each species is assigned a conservation score from 1-10 based on predetermined parameters. The sum of all conservation scores is then divided by the number of contributing species to get an average score. This value is then multiplied by a community score to get the final CCI value.

A higher score equals a greater conservation value of a particular site.

Water quality scores - Individual metric score bandings

SPEAR Bandings

- 45 - 100 = High (Unimpacted)
- 34 - 44 = Good
- 23 - 33 = Moderate
- 12 - 22 = Poor
- 0 - 11 = Bad (Heavily impacted)

Saprobic Bandings

- 0 - 1.8 = Minimal loading
- 1.81 - 2.29 = Mild loading
- 2.3 - 2.69 = Moderate loading
- 2.7 - 3.19 = Strong loading
- 3.2 - 4 = Extreme loading

CCI Bandings

- >20 = Very high conservation value
- 15 - 20 = High conservation value
- 10 - 15 = Good conservation value
- 5 - 10 = Moderate conservation value
- 0 - 5 = Low conservation value

PSI Bandings

- 81 -100 = Naturally sedimented
- 61 - 80 = Slightly sedimented
- 41 - 60 = Moderately sedimented
- 21 - 40 = Sedimented
- 0 - 20 = Heavily sedimented

LIFE Bandings

- >8 = Unimpacted
- 7 - 7.99 = Slightly impacted
- 6.5 - 6.99 = Moderately impacted
- 6 - 6.49 = Impacted
- <6 = Heavily impacted

TRPI Bandings

- 81 - 100 = Very low impact
- 61 - 80 = Low impact
- 41 - 60 = Moderate impact
- 21 - 40 = High impact
- 0 - 20 = Very high impact

BMWP Bandings

- >71 = Unimpacted
- 51 - 70 = Slightly impacted
- 36 - 50 = Moderately impacted
- 13 - 35 = Impacted
- 0 - 12 = Heavily impacted

About EPT families

Mayflies:

Mayflies are some of the best-known inhabitants of our rivers. As a whole this order is considered pollution sensitive but there is still considerable variation. For example, the family Heptageniidae (flat-bodied mayflies) are extremely sensitive to pollution whereas the Caenidae are generally far more tolerant.

Stoneflies:

Generally much more pollution sensitive than the other orders. However, they are evolved for colder faster flowing streams so don't panic if they aren't plentiful in lowland rivers (focus more on your mayflies).

Caddisflies:

Caddis are a hugely diverse order with numerous families. Variability of species is much higher than that of families so better to focus on this.

As the EPT riverflies are such an important group for monitoring water quality, we are working on additional material to give greater information regarding the relative importance of these families (and the species they contain) with regards to pollution sensitivities.

Watch this space!