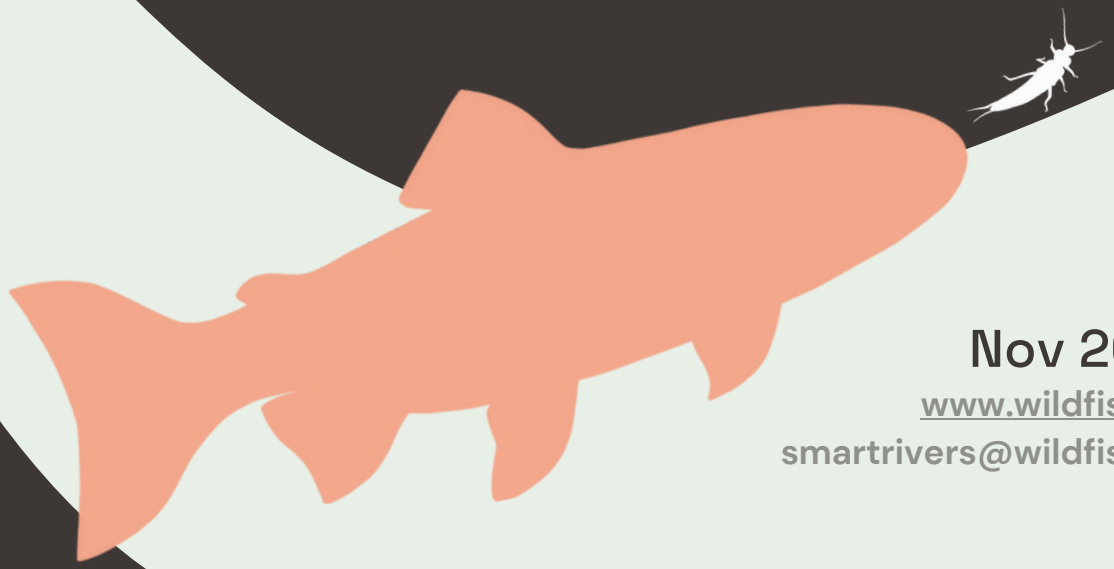
SmartRivers

What your data told us in 2023



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Data for change

At its core SmartRivers is a citizen science data collection project. The nationwide decline in monitoring by environmental regulators is well documented. Our SmartRivers hubs are helping to fill the gap and making sure their rivers don't drop off the environmental agenda. No river should be left unmonitored - that's why we believe every river should be a SmartRiver.

SmartRivers data is all online and open access, so it is available for anyone with an interest in protecting rivers. The data is both a voice for local communities and a tool for local stakeholders. The collection process has been carefully curated and reviewed to make it as comparable to professional monitoring as possible.

National integration of your data

We are working hard behind the scenes with regulators to explore how they can better use and integrate SmartRivers data.

The value and opportunities with your data are clear. We will keep you up to date with progress.

The 2023 breakdown

188 sites monitored in spring

163 sites monitored in autumn

61 rivers monitored

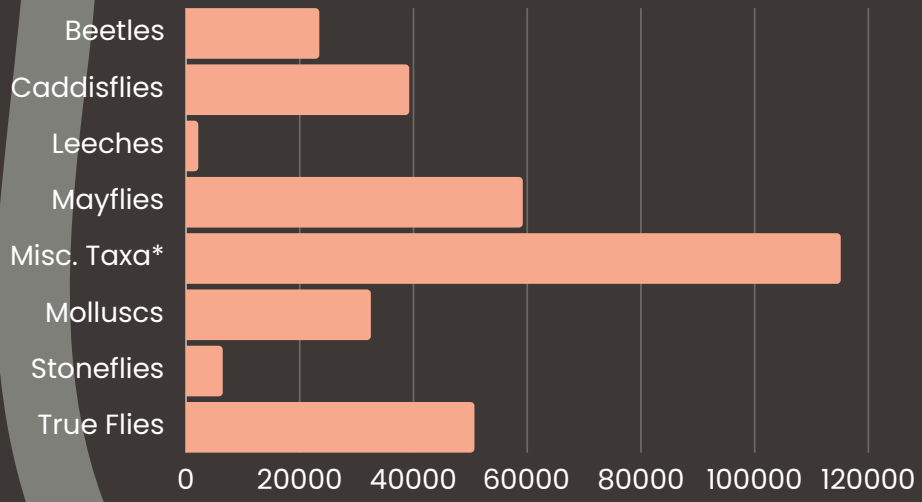

Fig. 1: Number of invertebrates counted in 2023
88% of Misc Taxa were the freshwater shrimp **Gammarus*

353

Different invertebrate species found

Rare species spotlight:

Scarce Purple Dun
Paraleptophlebia werneri

The scarce purple dun mayfly is a nationally scarce species that can be found in winterbourne chalk streams in the south of England.

These 'winterbournes' dry out in the summer months and the scarce purple may dun is well adapted to these conditions. The species has one generation a year, generally overwintering as aquatic nymphs with the adults emerging in spring before the water stops flowing.

This species was first found in the UK in 1939 in the rivers Allen and Till, Hampshire.

The Till is one of our monitored SmartRivers as part of the Wiltshire Fisheries Association hub. In our 2023 spring surveys **five** scarce purple dun nymphs were found at the upstream reference site.

Invasive species spotlight:

New Zealand mud snail
Potamopyrgus antipodarum

The New Zealand mud snail is an invasive species that is found on every continent but Antartica.

It is thought to have been introduced to the UK in the 1850's, likely through the shipping industry's freshwater supplies. One of the secrets to its 'success' is that the species has a fast reproduction rate with females being able to breed asexually, producing clones and rapidly expanding populations. Additionally, the snails are very tolerant, which makes them very easy to spread between rivers on equipment and can pass through the digestive system of fish unscathed.

Their impact as an invasive species is unclear. But when there are high population densities it is likely to be impacting ecosystem dynamics and nutrient cycling in an area. In 2023 this species was found in **43% of spring surveys** and **47% of autumn surveys.**

Your sites showed the most stress from.... sediment

Overall, the greatest impact indicated by the invertebrate communities at sites in 2023 was sediment pollution, with **35%** and **53%** of sites exhibiting concerning impact in spring and autumn respectively (Fig. 2). The heaviest impact in a single season was from chemicals, with **55%** of sites showing concerning impact in autumn.

This was more pronounced in England, with **66%** of the sites showing concerning sediment and chemical impact in autumn 2023. See Appendix 1 for the full breakdown of site percentage pressures exhibited by country.

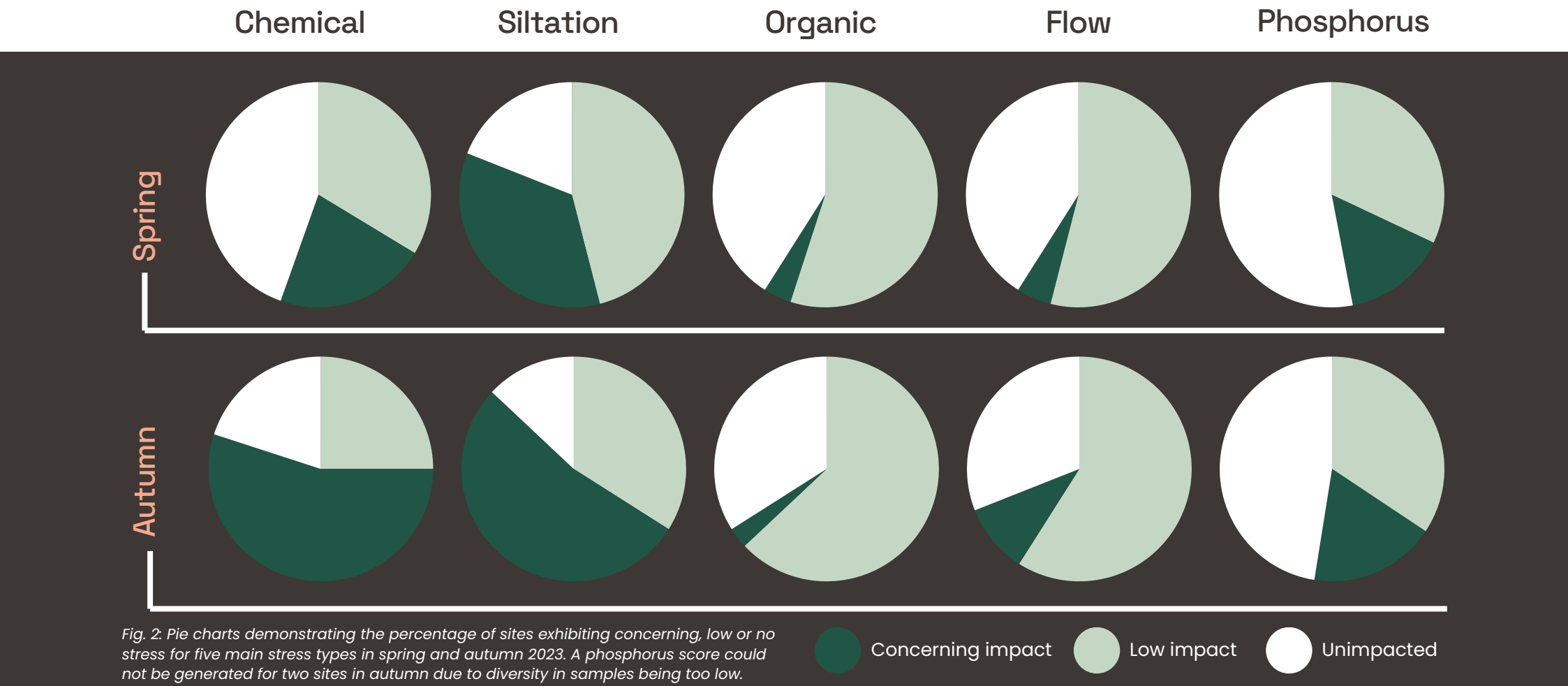

Fig. 2: Pie charts demonstrating the percentage of sites exhibiting concerning, low or no stress for five main stress types in spring and autumn 2023. A phosphorus score could not be generated for two sites in autumn due to diversity in samples being too low.

2023 river rankings: water quality

Our SmartRivers hub rivers ranked from least stressed to most stressed based on their combined water quality pressure scores for sediment, phosphorus, chemical, flow and organic enrichment. Some sites were only monitored one season, the averages of these may be skewed compared to a river with both seasons of data. Spring only sites are highlighted in **green** and autumn only in **pink**. Impacted sites on a river system will bring down the overall ranking of that river.

For a detailed rankings breakdown, including variation per river and separation by stress type and country see Appendix 2-3.

Least stressed → Most stressed

1. Cegidog
2. **Eassie Burn**
3. G. Langdale Beck
4. Halladale
5. Ceiriog
6. Brockton Brk.
7. **Isla**
8. Piall
9. Rottal Burn
10. **Vagastie**
11. South Esk (Angus)
12. Dyke (Halladale)
13. Minsterley Brk.
14. South Esk (Lothian)
15. Lyon
16. Pontesford Brk.
17. **Linacre Brk.**
18. **Dean Water**
19. Cain
20. Rothay
21. **Wick**
22. **Mudale**
23. **Yealm**
24. Candover Brk.
25. Bourne Rivulet
26. **Skelpick Burn**
27. Alyn
28. Cynon
29. Coddington Brk.
30. Pillhill Brook
31. Waycock
32. Chess
33. Wilfin Beck
34. Anton
35. Test
36. **Cheriton Str.**
37. Ford Wood Beck
38. Itchen
39. **Naver**
40. **Silverbridge Str.**
41. Tilston Brk.
42. **Congresbury Yeo**
43. Wylye
44. Arle
45. Avon
46. Aldford Brk.
47. Nadder
48. Thaw
49. Ems
50. Aln
51. Great Stour
52. Kenson
53. Nant Llancarfan
54. Rea Brk.
55. Cunsey Beck
56. Brathay
57. Chew
58. Mill Brk.
59. Beverley Brk.
60. Till
61. Golborne Brk.

Data application: Restoration

SmartRivers sample sites are selected by the volunteer group and can be placed to **assess the impact of restoration work.** Barnes Common are conducting various in-stream habitat works on the Beverley Brook. They have chosen to use SmartRivers monitoring to assess the state of the river now and how it responds to their interventions.

Below are the Beverley Brook water quality scores from 2023 compared to other English SmartRivers sites (Fig. 3). As you can see, the majority of sites are indicating **moderate** to **very high** impacts across most of the monitored stressors. This is reflective of the high pressures facing our urban waterways throughout the UK.

These results are prior to the restoration work - it will be interesting to compare trends as the work progresses.

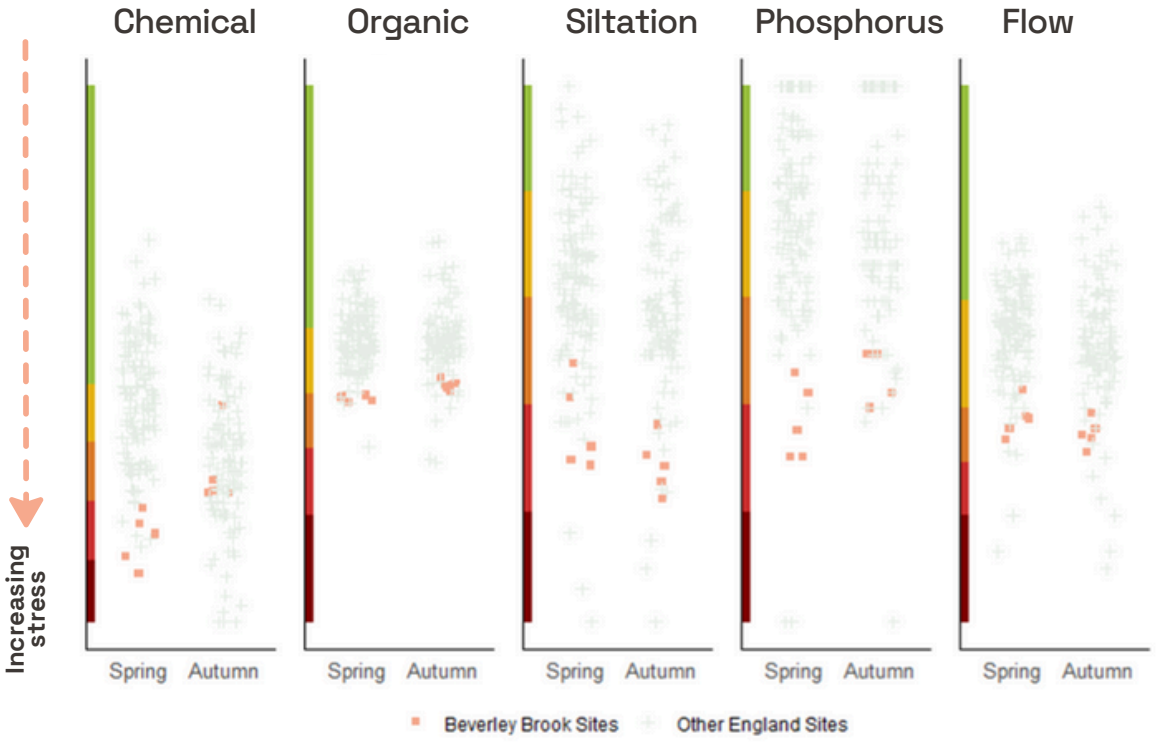

Fig. 3: Beverley Brook water quality scores for spring and autumn 2023 compared to other England SmartRivers sites.

"We're working hard to make the river more biodiverse and carefully monitoring changes through SmartRivers."
- Will Dartnell, Project Manager and hub lead

Barnes Common SmartRivers hub
Beverley Brook

Data application:
Catchment exploration

While many of our hubs focus on sites along a single river, others also include sites in tributaries to the main river. This allows for a catchment level view of water pressures. The Vale of Glamorgan Council hub follows this approach with two main river sites and three tributary sites (Fig. 4).

The key pressures facing the Thaw catchment are fine sediments (PSI) and, particularly in autumn, chemicals (SPEAR), as can be seen with scores in the **moderate** to **high** impact bandings (Fig. 5). As we continue to monitor these sites year after year we will look for sites that are repeatedly showing signs of the same pressures. This can help hubs to focus remedial work where it is most effective.

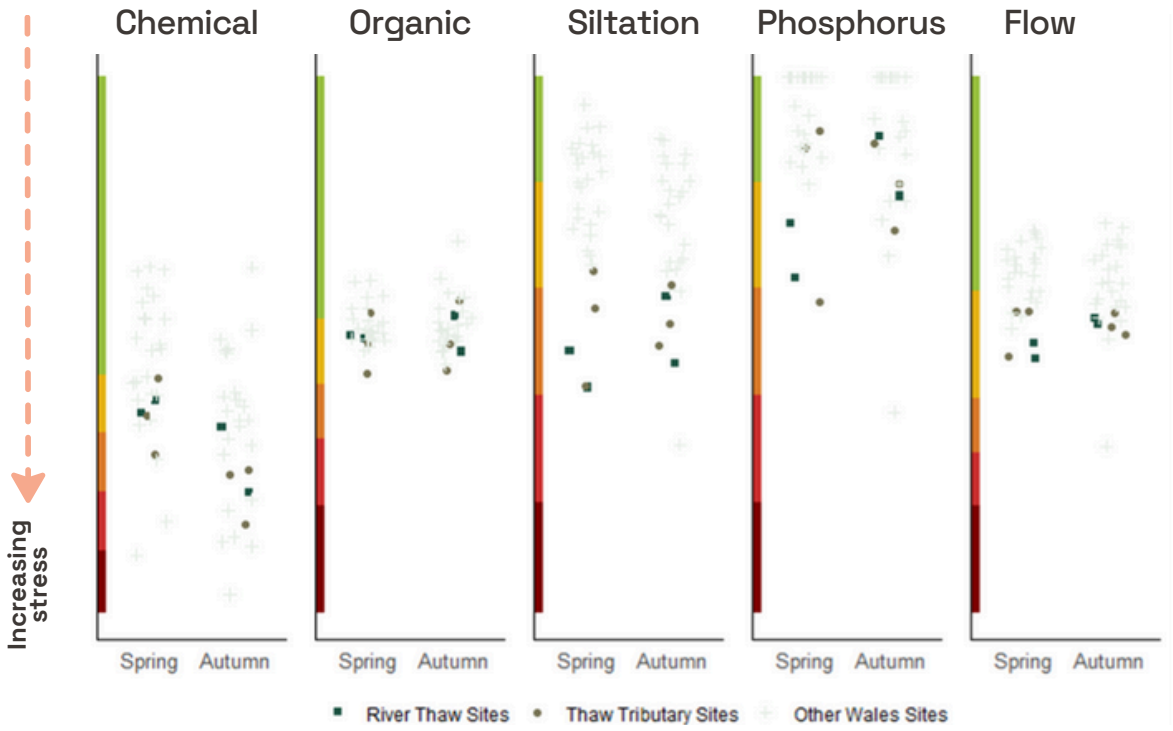

Fig. 5: Thaw and tributary water quality scores for spring and autumn 2023 compared to other Welsh SmartRivers sites.

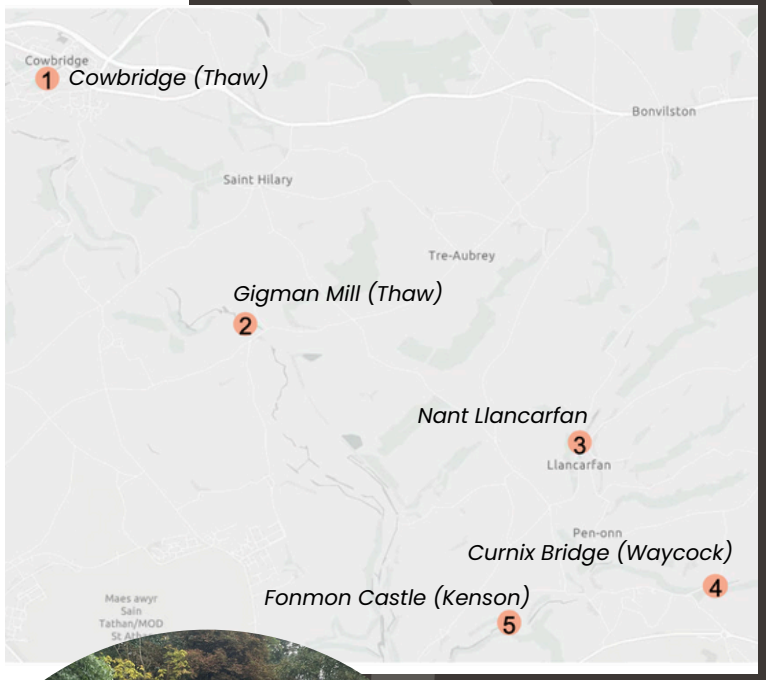

Fig. 4: Thaw hub monitoring site locations

Vale of Glamorgan Council SmartRivers hub
'Restore the Thaw'

2023 invertebrate community river rankings

Pages 8 and 9 show:

- The SmartRivers rivers ordered by diversity and abundance for riverflies in spring 2023.
- The SmartRivers rivers ordered by total invertebrate diversity for spring and autumn 2023.

Ecosystems with a higher diversity and abundance of species are more stable as they are more able to cope with disturbances like pollution and climate change. However, it is important to examine what is making up the majority of the community. If you have lots of sensitive species, such as riverflies (mayflies, stoneflies and caddisflies), that is an indicator of good water quality. If the composition is mostly tolerant species such as non-biting midges or water hoglouse, that can indicate an issue.

Considering river type and habitat is also essential in these kinds of assessments. Sites with better habitat are more resilient to poor water quality, so your invertebrate diversity might still be reasonable despite experiencing pressure from pollution.

The judgement for 'good' abundance and diversity varies depending on river type - rivers like chalk streams tend to have a much greater variety of species than small upland rivers for example.

2023 river rankings: riverflies (spring)

Below are the spring 2023 river rankings for riverfly diversity and abundance, from highest to lowest. The most riverfly diverse river was the Cegidog in Wales, although this only had one monitoring site. The chalk stream with the highest diversity of riverflies was the Candover Brook, a tributary of the Itchen. The Brathay (Windermere catchment) and Golborne Brook (Aldford Brook catchment) had the lowest spring riverfly diversity. The Brathay also had the lowest riverfly abundance along with Cunsey Beck, another Windermere river. Two chalk streams, the Pillhill Brook and Bourne Rivulet, had the highest riverfly abundances. For a full breakdown of riverfly diversity and abundance by country see Appendix 4-5.

Diversity

1. Cegidog
2. Candover Brk.
3. Rea Brk.
4. Eassie Burn
5. Skelpick Burn
6. Cain
7. Arle
8. Pillhill Brk.
9. Vagastie
10. Wick
11. Ceiriog
12. Isla

13. South Esk (Angus)
14. Test
15. Lyon
16. Naver
17. Pontesford Brk.
18. Itchen
19. South Esk (Lothian)
20. Brockton Brk.
21. Dyke (Halladale)
22. Halladale
23. Minsterley Brk.
24. Avon

25. Bourne Rivulet
26. Coddington Brk.
27. Dean Water
28. Wylye
29. Anton
30. Kenson
31. Cynon
32. Mudale
33. Tilston Brk.
34. Waycock
35. Great Stour
36. Alyn

37. Linacre Brook
38. Aln
39. Nant Llancarfan
40. Nadder
41. Chew
42. Great Langdale Beck
43. Thaw
44. Rothay
45. Congresbury Yeo

46. Ems
47. Chess
48. Wilfin Beck
49. Beverley Brk.
50. Aldford Brk.
51. Ford Wood Beck
52. Mill Brk.
53. Cunsey Beck
54. Till
55. Rottal Burn
56. Brathay
57. Golborne Brk.

Abundance

1. Pillhill Brook
2. Bourne Rivulet
3. Eassie Burn
4. Candover Brook
5. Arle
6. Coddington Brk.
7. Rea Brk.
8. Cegidog
9. South Esk (Angus)
10. Test
11. Ceiriog
12. Anton

13. Pontesford Brk.
14. Golborne Brk.
15. Cynon
16. South Esk (Lothian)
17. Avon
18. Great Stour
19. Mill Brk.
20. Wylye
21. Dean Water
22. Vagastie
23. Wick
24. Minsterley Brk.

25. Till
26. Cain
27. Naver
28. Ems
29. Thaw
30. Isla
31. Halladale
32. Alyn
33. Kenson
34. Lyon
35. Waycock
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37. Skelpick Burn
38. Aldford Brk.
39. Brockton Brk.
40. Itchen
41. Linacre Brk.
42. Dyke (Halladale)
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45. Nadder
46. Wilfin Beck
47. Chew
48. Nant Llancarfan

49. Great Langdale Beck
50. Rothay
51. Beverley Brk.
52. Mudale
53. Ford Wood Beck
54. Congresbury Yeo
55. Rottal Burn
56. Cunsey Beck
57. Brathay

2023 river rankings: All invertebrates

Below are the spring and autumn 2023 river rankings for total invertebrate diversity, from highest to lowest. In spring, the most diverse rivers were three chalk streams - the Candover Brook, Pillhill Brook and Arle. The same was seen in autumn with the Cheriton Stream, Candover Brook and Pillhill Brook having the greatest diversity. As described on page 7, rivers like chalk streams tend to have a much greater variety of species so the judgement for 'good' abundance and diversity must be adjusted to take this into consideration. Although it is worth noting that the River Chess (a chalk stream) ranked the second lowest for diversity in autumn. The least diverse rivers in spring and autumn 2023 were in the Windermere catchment (Cunsey Beck and Wilfin Beck respectively).

For a full breakdown of total invertebrate diversity and abundance see Appendix 6.

Most diverse → Least diverse

Spring

1. Candover Brook
2. Pillhill Brook
3. Arle
4. Rea Brook
5. Wick
6. Eassie Burn
7. Cegidog
8. Dean Water
9. Skelpick Burn
10. Test
11. Kenson
12. Avon
13. Isla

14. Lyon
15. Cain
16. South Esk (Angus)
17. Coddington Brook
18. Pontesford Brook
19. South Esk (Lothian)
20. Ceiriog
21. Bourne Rivulet
22. Naver
23. Vagastie
24. Dyke (Halladale)
25. Thaw
26. Beverley Brook

27. Halladale
28. Anton
29. Minsterley Brook
30. Wylye
31. Great Stour
32. Itchen
33. Waycock
34. Aln
35. Nadder
36. Cynon
37. Brockton Brook
38. Chew
39. Golborne Brook

40. Mill Brook
41. Mudale
42. Nant Llancarfan
43. Congresbury Yeo
44. Alyn
45. Ems
46. Aldford Brook
47. Tilston Brook
48. Linacre Brook
49. Rothay
50. Great Langdale Beck
51. Wilfin Beck

52. Chess
53. Rottal Burn
54. Ford Wood Beck
55. Till
56. Brathay
57. Cunsey Beck

Autumn

1. Cheriton Stream
2. Candover Brook
3. Pillhill Brook
4. Cegidog
5. Pontesford Brook
6. Bourne Rivulet
7. Arle
8. Great Stour
9. Rea Brook
10. Anton
11. Halladale
12. Test
13. Lyon

14. Ceiriog
15. Cynon
16. Thaw
17. Piall
18. Cain
19. South Esk (Lothian)
20. Avon
21. Minsterley Brook
22. Beverley Brook
23. Dyke (Halladale)
24. Nadder
25. Rothay
26. Waycock

27. South Esk (Angus)
28. Wylye
29. Alyn
30. Nant Llancarfan
31. Brathay
32. Great Langdale Beck
33. Mill Brook
34. Itchen
35. Aldford Brook
36. Rottal Burn
37. Aln
38. Silverbridge Str.

39. Tilston Brook
40. Yealm
41. Ford Wood Beck
42. Brockton Brook
43. Chew
44. Coddington Brook
45. Ems
46. Cunsey Beck
47. Kenson
48. Till
49. Golborne Brook
50. Chess
51. Wilfin Beck

Data application: Campaigning

Working alongside the Save Windermere campaign this SmartRivers hub covered five of the rivers and becks feeding into England's largest lake. Our first full year of data collection found numerous indications of impacts on biodiversity and water quality downstream of United Utilities wastewater infrastructure (see the full report here).

Wilfin Beck is an archetypal Lake District Beck, which remains mostly hidden from sight, but is nonetheless impacted by Windermere's seasonal tourist population. The Save Windermere campaign has documented an ongoing presence of sewage fungus downstream of the works, which had its permit issued over 30 years ago.

In our autumn 2023 sample downstream of the discharge we found only two leeches of the same species. When compared to the upstream sample containing 27 species and 228 individuals, this is a clear indication of the impact a sewage treatment works can have. When a sample contains so little biodiversity we are unable to accurately calculate water quality scores. However, the paucity of invertebrate life speaks for itself (Fig. 6).

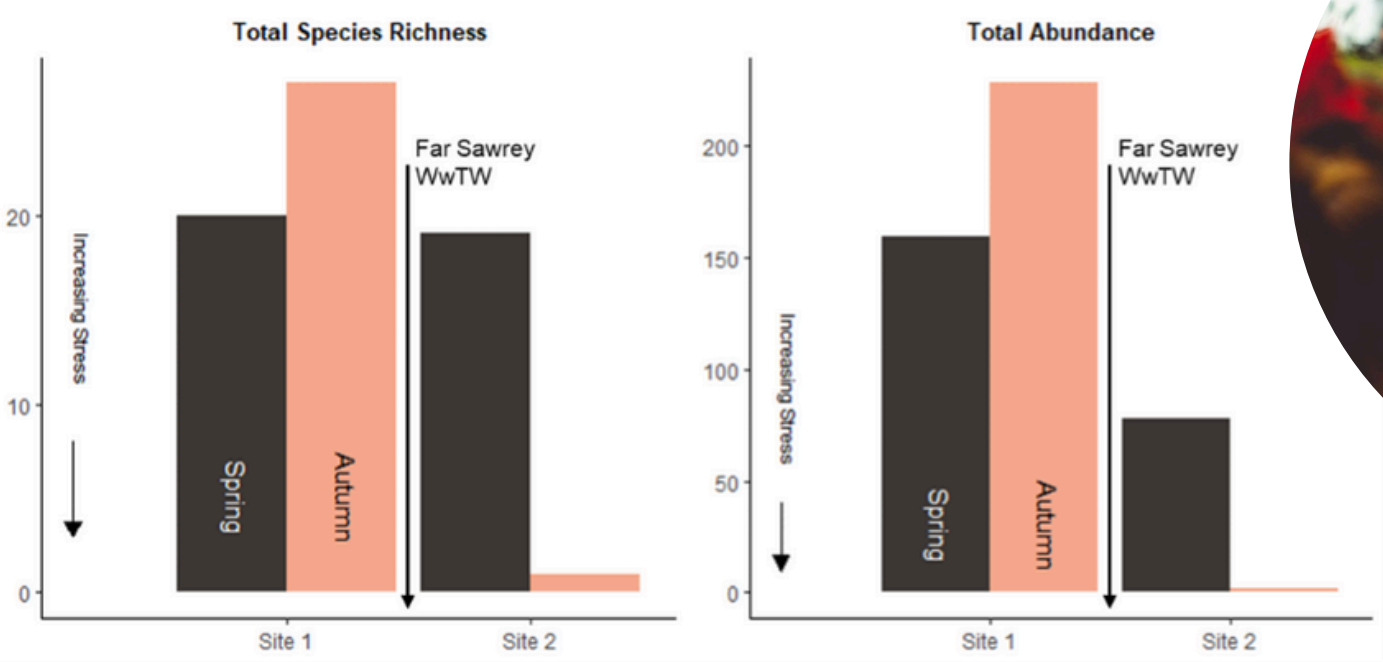

Fig. 6: Total invertebrate species diversity and abundance at the Wilfin Beck SmartRivers sites, upstream and downstream of Far Sawrey sewage works, in spring and autumn 2023.

Save Windermere SmartRivers hub

Wilfin Beck

From people to policy

Local groups ask us:

How much data is needed before we can get meaningful environmental monitoring results that regulators and other stakeholders will take notice of?

Unfortunately, there is no standard answer to this. All hubs are unique, and we can't preempt what the data will say, but as a science-led organisation we will guide you in the right direction. We will be looking for trends over time in the data to drive where problems exist and require action.

Every local regulatory authority is also different, with varying levels of resource and manpower. But if your hub wants it, you will have WildFish by your side to present the data and add weight to the conversation to drive action. There are few 'silver bullets' in environmental management, but we will support you in using your data in the most meaningful way.

If your hub wants to do more locally with your SmartRivers data, please do get in touch.

The WildFish policy team are here to support you.