WildFish.

SmartRivers

What your data told us in 2022

Nov 2023

www.wildfish.org
smartrivers@wildfish.org

All our hubs have local objectives, but their hard work also contributes towards the national picture.

This report is a breakdown of the 2022 SmartRivers dataset - looking at national water quality and biodiversity trends across our SmartRivers sites.

SmartRivers data is all free and open access.

If you would like access to the database to check out the raw data, drop us an email at: *smartrivers@wildfish.org*

Thank you

Our volunteers are our lifeblood. It's your passion and dedication that keeps this precious data coming in.

So, for every microcaddis larvae you've painstakingly picked out, every minute your eyes have gone square from the microscope lights and every pair of wet socks you've encountered from leaky waders - **thank you.**

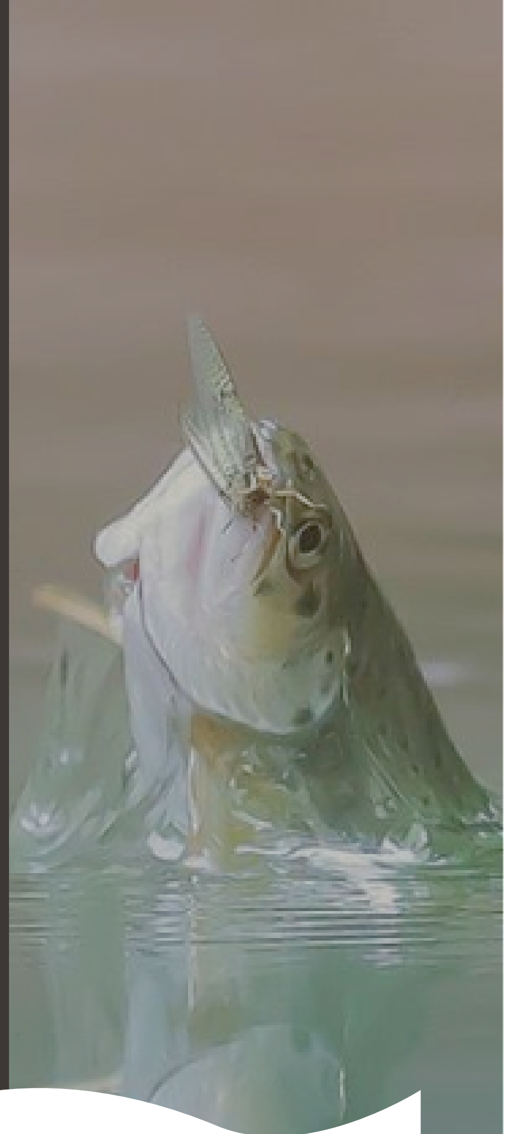
Foundation of life

Macroinvertebrates underpin the aquatic food web and are an essential part of ecosystem functioning. They are small animals without a backbone, which can be seen with the naked eye.

Freshwater invertebrates in rivers spend part or the entirety of their lives underwater. They range from insects (riverflies and beetles) to molluscs, leeches, worms and crustaceans.

Riverflies leave water when they reach maturity. Their adult life on land is typically short, ranging from hours to a few days, whereas their immature stage underwater can last several years.

As well as being an **important food source** for wild fish, birds and mammals, these tiny creatures also break down organic matter, **cycling nutrients** back into rivers.



SmartRivers uses freshwater invertebrates to make inferences about river water quality

Photo: Alan Ward

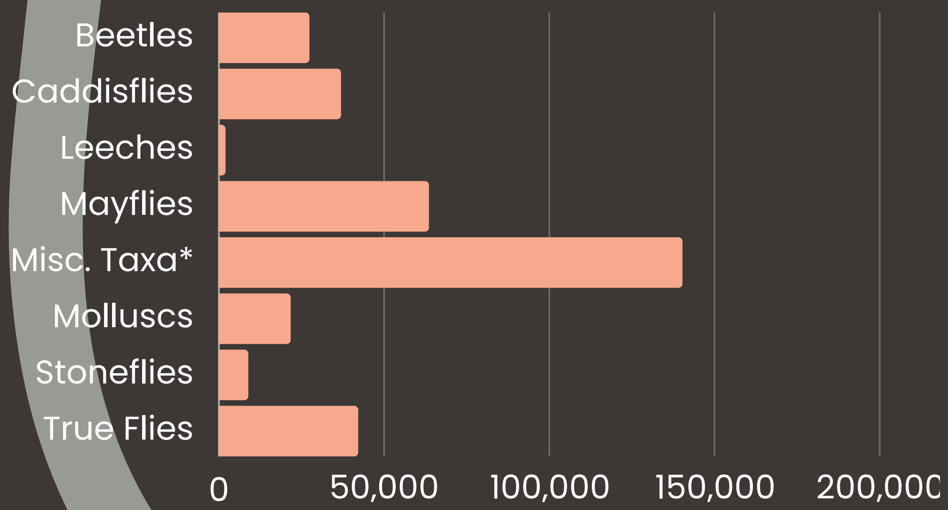
The 2022 breakdown

153
sites monitored in spring

149
sites monitored in autumn

55
rivers monitored

Number of invertebrates counted in 2022



268
Different invertebrate species found

343,077
Total invertebrate specimens counted

94% of Misc Taxa were the freshwater shrimp **Gammarus*

Spring

Greatest stress from:

Sediment

88%
of English sites were **impacted** by excess fine sediment

Sediment loss from the land to rivers is a natural process. However, excess fine sediments can have severe impacts.

Why is it a problem?

Too much sediment can choke wildlife, change habitats (by reducing light and increasing turbidity) and exacerbate concentrations of toxic compounds which become bound to it.

Where does it come from?
Accelerated erosion, caused by inappropriate land use or land management close to watercourses:

Run off from roads and urban development.

Point sources such as discharges from industry, sewage treatment plants and stormwater from municipal and industrial facilities.

Autumn

Greatest stress from:

Chemicals

Over **50%**
of English sites were showing concerning stress from chemical pollution

We use chemicals everyday - from healing illnesses to maximising food production. These leak into the environment, entering our air, soil and water.

Why are they a problem?
Once released into the environment, chemicals mix. These mixtures can be more toxic to wildlife than exposure to each chemical singularly.

Effects on river wildlife can be physical or behavioural, and such alterations can have a knock on effect on ecosystem structure.

Where do they come from?
Wastewater discharges - from septic tanks, sewage treatment works and industrial processes.

Run-off of pesticides, herbicides and fungicides applied to agricultural land. Veterinary medicines excreted from livestock.

Stormwater from urban land.

A river blood test

Invertebrates as indicators

Invertebrate species are quite particular about the water quality conditions they need to thrive. Because of this, they all have different tolerances to pollution.

Looking at which invertebrate species are present, along with their numbers, allows us to indicate what water quality stressors are present at a site, and the level of impact this stress is having on the system.

For example, stoneflies and most species of mayflies and caddisflies are very sensitive to organic pollution whereas shrimps, worms, blackfly and chironomid larvae are more tolerant of excess organic matter and low oxygen levels.

Where invertebrates live in the water and are subjected to pollution over time, they give a more representative picture of long-term water quality impacts. This is in contrast to spot water samples taken for chemical testing, which only represent river conditions at a single moment in time.

SmartRivers is the gold standard of invertebrate citizen science schemes.

The monitoring is designed to detect the chronic pollution pressures plaguing our rivers, not just gross pollution events.

Invertebrate samples are preserved and a microscope is used to complete analysis to species-level where possible.

From sample to score...

- Collect invertebrate sample
- Pick out species and quantities from sample
- Look up species and abundances against tolerance tables
- Calculate water quality stress score

Species tolerance

Some examples of invertebrate species and their tolerances:

More pollution tolerant

True fly: ***Simulium ornatum***
This blackfly is an opportunistic species, numbers can explode to fill a void when areas are polluted.

Mollusc: ***Ampullaceana balthica***
The wandering snail is tolerant to sediment pollution/reduced flow and is mildly sensitive to organic enrichment.

Less pollution tolerant

Stonefly: ***Dinocras cephalotes***
This stonefly species has a merovoltine life history, taking an estimated three years to complete its life cycle, making its presence an indicator of very good water quality.

Mayfly: ***Ecdyonurus dispar***
The Autumn Dun mayfly is highly sensitive to excess fine sediment, organic pollution and reduced flows.

Monitoring this way is a powerful tool.

The data is best used over a multi-year period to focus additional investigations.

Photo: Jack Perks

River rankings

Water quality stress

By combining the chemical, sediment and phosphorus stress scores for the rivers that were monitored we can rank them based on water quality stress. The least stressed is at the top and the most stressed is at the bottom (Fig. 1).

For a detailed breakdown by pressure see Appendix 1-4.

Please note, these gradings are based on the sites covered by our hubs on each river, so is just a guideline and may not be fully representative of the entire river system.

Some of the most stressed English rivers were the Hogsmill (London), Rea Brook (Shropshire), Great Stour (Kent) and several in the Bristol Avon catchment.

Our river coverage in Wales and Scotland was slightly less than England.

From our Welsh hubs, the most stressed rivers were the Golborne Brook, Mill Brook and Tilston Brook

In Scotland, water quality stress was less than the other two countries. The most stressed was the Naver.

The rivers highlighted in pink are explored in greater detail on the next page.

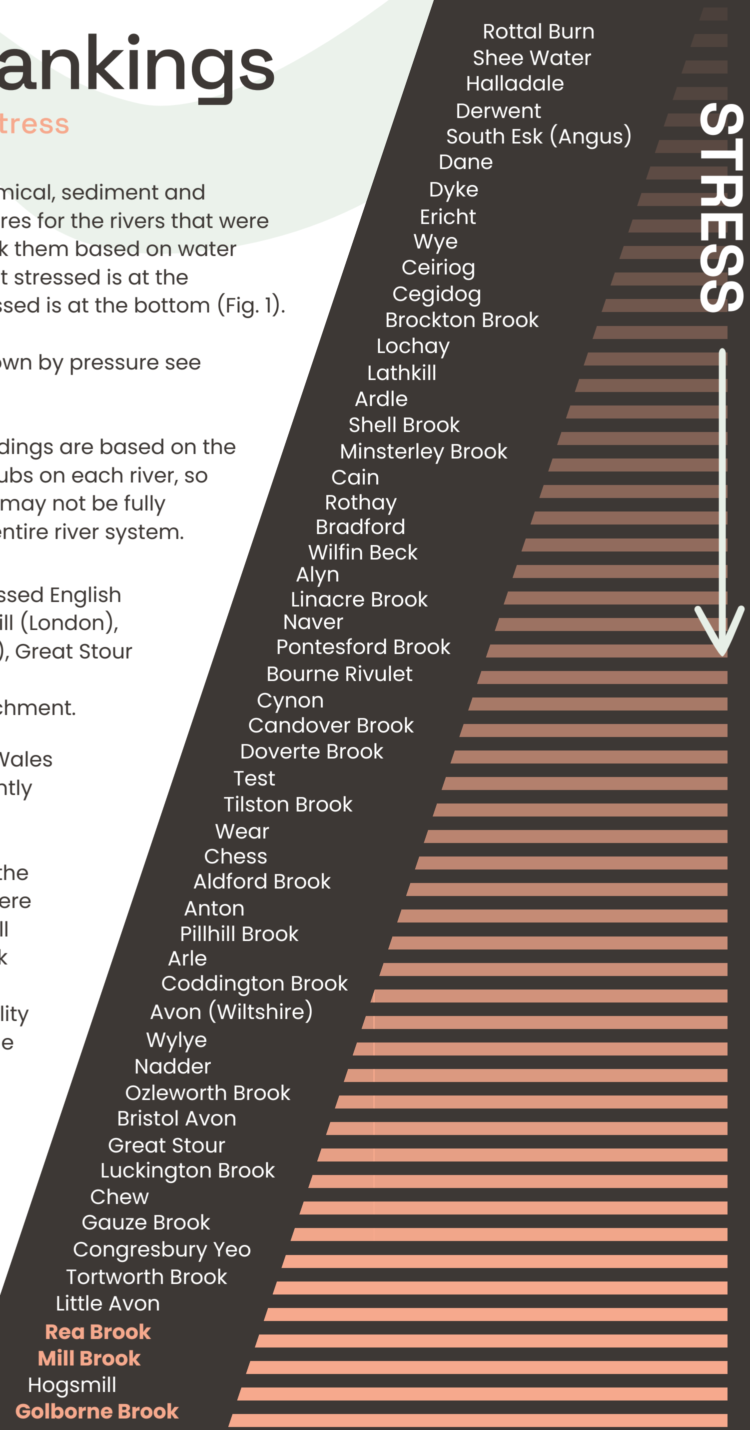


Fig. 1: Ranking of 54 SmartRivers rivers based on combined sediment, phosphorus and chemical water quality stress.

Monitored by Welsh Dee Trust hub

Golborne Brook (Chester)
This site is about 200m downstream of the sewage works serving Tattenhall village. The surrounding land is agricultural, with intensive dairy as well as cereals and maize. The river has been historically straightened and suffers from bank erosion as a result.

Mill Brook (Chester)
Land use upstream is largely intensive dairy, as well as some arable, although the land directly on the river is a combination of linear local nature reserve, permanent sheep pasture and horse paddocks for several hundred meters.

The upper part of the catchment is quite heavily impacted by groundwater abstraction.

The invertebrate community at these two sites indicated considerably greater stress from chemical, sediment and nutrient pollution than the other Welsh rivers we currently cover (Appendix 5).

Chemical impact was the most concerning. Our chemical stress metric doesn't tell you the type of chemical pollution at play. Given the catchment land use, it may be a combination of agricultural and wastewater inputs.

Monitored by Severn Rivers Trust hub

Rea Brook (Shrewsbury)
Rea Bridge (the worst performing site of the five monitored on the Rea Brook) gets dredged periodically by the Internal Drainage Board and its banks are about 10ft high. The river is very sluggish at this site and has been reported to back up during flood flows.

Land use around the site is agricultural, a combination of arable and sheep.

In autumn the invertebrate community exhibited notable stress from excess fine sediment, organic enrichment and flow in comparison to other English sites (Appendix 6).

Given the description of the habitat, these outputs are not surprising. Without natural flow rivers are less able to move sediments or dilute polluting inputs.

River rankings

Invertebrates

Table 1 and 2: SmartRivers rivers ranked by invertebrate diversity (right) and abundance (left). For a full breakdown see Appendix 7.

diversity

Spring	Autumn
Pillhill Brook	Pillhill Brook
Candover Brook	Anton
Arle	Candover Brook
Luckington Brook	Ardle
Dyke	Ericht
Test	Bourne Rivulet
Lochay	Arle
Halladale	Halladale
Cegidog	Dyke
Ericht	Lochay
Anton	Test
South Esk (Angus)	Pontesford Brook
Ardle	South Esk (Angus)
Wylye	Tortworth Brook
Rottal Burn	Cain
Avon (Wiltshire)	Ozleworth Brook
Bourne Rivulet	Cegidog
Little Avon	Little Avon
Shee Water	Luckington Brook
Bradford	Wear
Alyn	Rothay
Chess	Alyn
Chew	Avon (Wiltshire)
Derwent	Wylye
Pontesford Brook	Naver
Rea Brook	Great Stour
Cynon	Nadder
Coddington Brook	Rea Brook
Congresbury Yeo	Cynon
Ceiriog	Shee Water
Cain	Rottal Burn
Ozleworth Brook	Brockton Brook
Tortworth Brook	Minsterley Brook
Nadder	Wilfin Beck
Gauze Brook	Chew
Minsterley Brook	Ceiriog
Bristol Avon	Linacre Brook
Alford Brook	Tilston Brook
Naver	Gauze Brook
Wye	Chess
Wear	Congresbury Yeo
Mill Brook	Coddington Brook
Dane	Hogsmill
Great Stour	Alford Brook
Brockton Brook	Golborne Brook
Lathkill	Bristol Avon
Golborne Brook	Mill Brook
Hogsmill	Doverte Brook
Shell Brook	
Tilston Brook	
Doverte Brook	

abundance

Spring	Autumn
Pillhill Brook	Pillhill Brook
Arle	Alyn
Bourne Rivulet	Test
Candover Brook	Bourne Rivulet
Alyn	Candover Brook
Test	Chess
Chess	Arle
Anton	Anton
Rottal Burn	Avon
Cegidog	Cegidog
South Esk (Angus)	Rea Brook
Ericht	Cain
Avon	Brockton Brook
Wylye	Cynon
Nadder	Doverte Brook
Wear	Wylye
Alford Brook	Nadder
Hogsmill	Minsterley Brook
Dyke	Gauze Brook
Tilston Brook	Ericht
Cain	Wear
Bradford	Ardle
Coddington Brook	Tortworth Brook
Golborne Brook	Wilfin Beck
Cynon	Halladale
Halladale	South Esk (Angus)
Derwent	Coddington Brook
Ceiriog	Ozleworth Brook
Lochay	Golborne Brook
Rea Brook	Bristol Avon
Minsterley Brook	Dyke
Pontesford Brook	Great Stour
Mill Brook	Tilston Brook
Ardle	Pontesford Brook
Bristol Avon	Rothay
Congresbury Yeo	Little Avon
Shee Water	Chew
Luckington Brook	Mill Brook
Ozleworth Brook	Luckington Brook
Chew	Lochay
Little Avon	Ceiriog
Brockton Brook	Naver
Wye	Hogsmill
Great Stour	Linacre Brook
Dane	Congresbury Yeo
Gauze Brook	Alford Brook
Naver	Rottal Burn
Doverte Brook	Shee Water
Tortworth Brook	
Lathkill	
Shell Brook	

Ecosystems with a higher biodiversity of species are more stable as they are more likely to cope with disturbances like pollution and climate change.

When looking at species richness and abundance it is important to examine what is making up the majority of the community. If you have lots of mayflies, stoneflies and caddisflies, that is an indicator of good water quality. However, if your composition is mainly true flies, that can indicate an issue. See Appendix 7-10 for riverfly (EPT) specific diversity and abundance rankings.

One size doesn't fit all

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.

Rivers like chalk streams tend to have a much greater variety of species than rain-fed rivers in Scotland for example. As seen in the tables, the top scoring rivers are mostly chalk streams (table 1 and 2). However, in the water quality rankings, Scottish rivers like the Halladale and South Esk are much less impacted than the chalk streams.

The judgement for 'good' abundance and diversity must be adjusted to take this into consideration and rivers have their own bespoke targets.

Wilfin Beck (Ambleside)

Sewage works in the Lake District are not built to cope with the influx of tourists that frequent the area. As a result, rivers that drain into the lake, such as Wilfin Beck, are suffering from sewage inputs that contain cocktails of organic pollutants, chemicals and nutrients.

SmartRivers data shows a decline in water quality downstream of the sewage works. These sites also show lower species richness and drastic drops in abundance (Appendix 11).

We've also seen declines in pollution sensitive invertebrates like stoneflies and increases in pollution tolerant invertebrates like true flies at the downstream sites.

Monitored by Save Windermere hub

All rivers should be SmartRivers

Our rivers should have the best healthcare.

Every river deserves monitoring with scientific credibility that empowers local people to fight for better protection.

To find out more visit our website or get in touch:

www.wildfish.org

smartrivers@wildfish.org

WildFish.