A hot summer on the Wye, and what it meant for the river's residents



Photos by Becky Bryant

Why we monitor

When we monitor a river, we're asking how well it can support the wildlife that should live in it and along its banks. Our sensors measure the water itself: temperature, dissolved oxygen, pH, turbidity and conductivity. We then compare those readings with what fish and other river life need. This report focuses on salmon and trout because they are amongst the most sensitive species and many global environmental thresholds are based on them. They need cool, clean, well-oxygenated water, which also tends to suit many other animals and plants we would hope to see in that waterway.

The Wye

The Wye is one of the most important rivers in the UK for wildlife. It is a Special Area of Conservation, which gives it the highest level of protection in the UK for species including Atlantic salmon, otters, three kinds of lamprey, and twaite shad.

Shad swim more than 100 km upstream from the sea to spawn, as far as Builth Wells - so those heading for the upper spawning grounds pass right by the club. The Welsh stretch of the Wye holds the densest otter population in Wales.

The river is also under strain. In 2023 Natural England downgraded its condition to "unfavourable declining", citing reductions in salmon, native crayfish and water plants.

For freshwater water quality, the main concern is phosphorus from farming and sewage, which feeds algal growth in summer.

HAIGH ENVIRONMENTAL

AQUA WATCH

About this report

This is our first quarterly report. With support from Haigh Environmental, AquaWatch has monitored the river at the rowing club every 15 minutes since late June, more than 35,000 readings this quarter. Continuous readings catch what occasional sampling misses: the overnight dip in oxygen, the surge of turbid water after a storm, the hottest afternoon of the heatwave. Because this is the first report, we can describe this summer but can't yet say whether it was unusual. Each quarter will add to that picture.



Our sensors don't measure bacteria or algal toxins, so this report can't tell you whether the water is safe for swimming or a capsize.

The summer in brief

Of the conditions we measure, heat was the biggest pressure on the river's inhabitants this quarter. Oxygen and pH showed strong plant and algal growth through the hottest weeks. Oxygen stayed above the critical threshold that harms fish throughout. The first heavy rain of the summer arrived at the end of August, and from then the river cooled. A storm in mid-September showed clearly what rain does to the river.

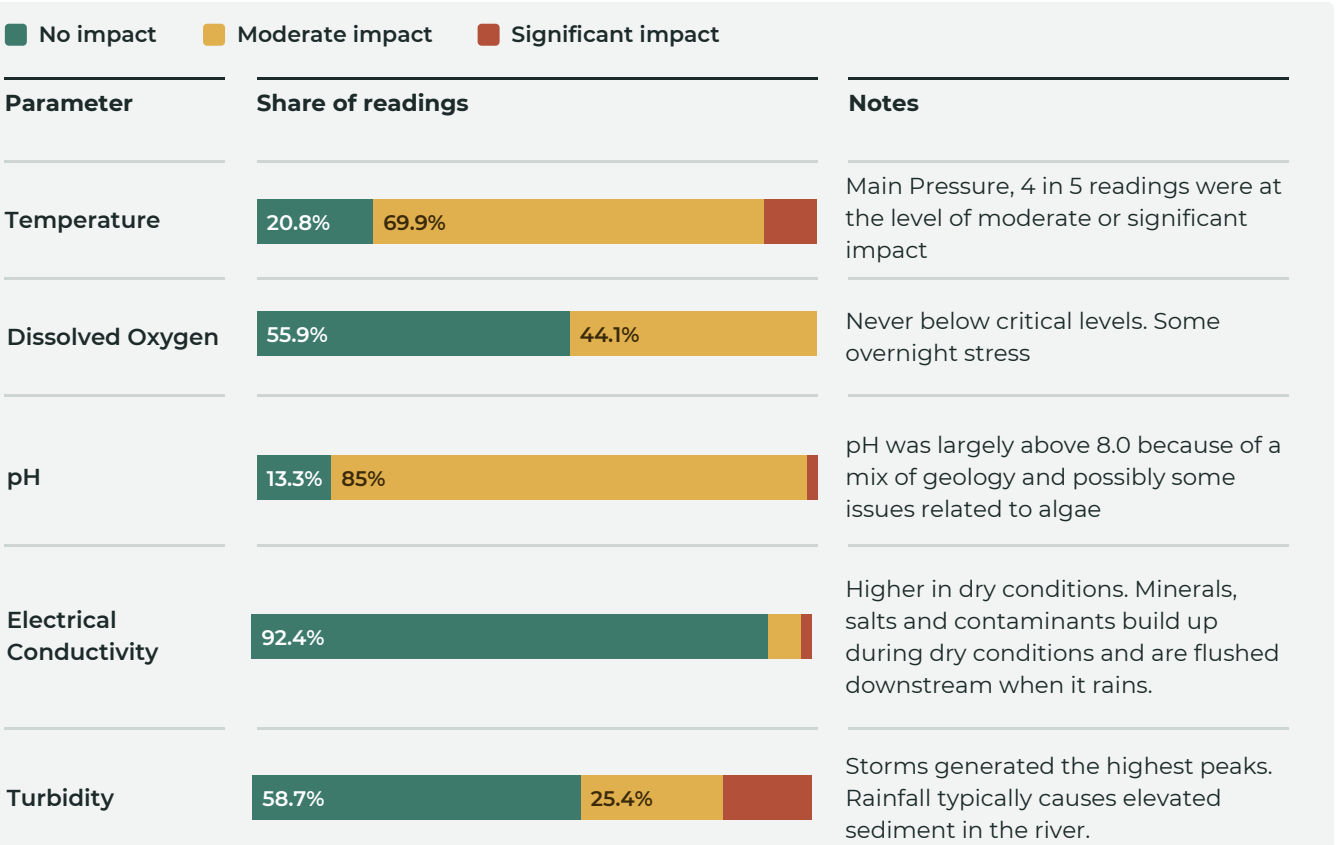


Fig 1 – Share of continuous monitoring readings falling into each impact band for temperature, dissolved oxygen, pH, turbidity and conductivity. Bands are defined as: temperature ≤18°C (No impact), 18–24°C (Moderate impact) or >24°C (Significant impact); dissolved oxygen >9 mg/L (No impact), 5–9 mg/L (Moderate impact) or <5 mg/L (Significant impact); pH 6.5–8.0 (No impact), 6.0–6.5 or 8.0–9.0 (Moderate impact) or <6.0 or >9.0 (Significant impact); turbidity <25 NTU (No impact), 25–80 NTU (Moderate impact) or >80 NTU (Significant impact); and conductivity thresholds set on a site-adaptive basis using a 14-day rolling median as baseline, baseline (No impact), baseline + 2*MAD (Moderate impact), above baseline + 3*MAD (Significant impact). Thresholds based on adult salmonids.

Water temperature

What it can indicate: Water temperature follows the weather, and is also affected by how much water is flowing and how much shade the river gets. It matters for more than comfort: warm water holds less oxygen, and causes fish to burn more energy. Salmon and trout start to struggle above 18°C and temperatures over 24°C can have significant adverse effects on populations.

What we saw: The warmest recorded reading was 27.9°C, at four in the afternoon on 26 June. There is a gap in the record during the hottest part of the summer. The water was at 27°C and still rising when it began, so the true peak may have been higher. When the record resumed on 23 July, nearly every reading for the rest of July was above 18°C. Across the whole quarter, 3 out of 4 of readings were above 18C, and approximately 1 in 10 readings were above 24°C. In water that warm, salmon and trout experience thermal stress, which means that growth rates decline, and there can be adverse effects on cellular function leading to mortality. As a consequence, fish tend to seek out cooler, deeper water and feed less. August brought some relief, with the river dipping below 18°C more often. From 22 August, after the first heavy rain of the summer, it was less than 18°C every night, and since the 8th September it has stayed in the ideal range.

Did you know?

Salmon eggs hatch in the gravel in spring, and the young fish spend one to three years in the river before heading to sea. The young salmon in the Wye today lived through this summer's heat.

Once back in fresh water, adult salmon stop feeding and live off their reserves until they spawn, sometimes for most of a year. Warm water makes them burn those reserves faster.

After a year or more at sea, salmon return to the river where they hatched, finding their way partly by smell.

Brown trout and sea trout are the same species. Sea trout are brown trout that go to sea and come back silver, similar to salmon.

The Wye's biggest recorded salmon weighed 59½ lb. Doreen Davey landed it at Winforton, upstream of Hereford, on 13 March 1923, and it is still Britain's record spring salmon.



Photos by Becky Bryant

Dissolved oxygen

What it can indicate: Fish draw water across their gills to absorb oxygen dissolved in the water. Levels rise when plants and algae photosynthesise in daylight, and fall when they, and everything else in the river, use oxygen at night. Oxygen also falls when organic material breaks down in the water, which is why very low levels (hypoxia) can point to sewage, farm waste, or a mass of algae dying off. Very low oxygen in rivers can be an indicator of compounding problems and is one of the main causes of fish kill events.

What we saw: Oxygen is lowest at dawn. Even then, it never fell to the 5 mg/L level where it becomes critical for fish survival. The lowest reading all quarter was 6.3 mg/L, at dawn on 19 August. There was still some stress; for a little under half of all readings, oxygen sat below the 9 mg/L that salmon and trout need to be comfortable, and about six in ten of those low readings came overnight. This added to the strain of warm water. Oxygen was also lower in September, after the first heavy rain captured at the EA rain gauges, flushed through the system, which is likely to have dislodged much of the algal growth that had been driving dissolved oxygen levels over the dry period. In addition, organic material washed into the system may have caused a reduction in oxygen levels as it began to break down.

pH

What it can indicate: pH measures how acidic or alkaline the water is. The rocks and soils of the catchment set the baseline. Plant life shifts pH through the day: as plants and algae photosynthesise, they draw carbon dioxide out of the water and pH rises, then it falls again overnight. A large daily swing, peaking in the afternoon, is a sign of strong plant or algal growth. At around a pH of 9 and above, ammonia in the water becomes more toxic to fish.

What we saw: pH sat above 8.0, the top of the ideal range for salmon and trout, for most of the quarter. That may be normal here. Around Ross the Wye flows over sandstone with occasional limestone, which tends to keep the water alkaline, and you can compare our readings with Environment Agency records for this stretch. On top of that baseline, pH rose and fell by about half a unit most days through the summer, peaking at 9.2 in early July and regularly approaching 9 on August afternoons. After the mid-September storm the daily swing roughly halved. At these levels pH is unlikely to harm fish directly.

What did you see?

We know that algae is an issue on the Wye, did you notice more as the weather got hotter?

Turbidity

What it can indicate: Turbidity is a measure of how suspended sediment and organic matter clouds the water; the same thing your eye picks up when the river turns brown or green. Our sensors measure it by shining light through the water, in units called NTU. Turbidity comes from anything suspended in the river: soil washed off fields and roads, discharges, algae, or the riverbed being stirred up by floods, animals or boats. It matters because fish hunt by sight and struggle to feed in turbid water and can impact food sources. Fine sediment can also settle into gravel beds and smother fish eggs.

What we saw: For the first three weeks of the summer the river was mostly clear, with around nine in ten readings below 25 NTU, the level at which fish can feed normally.

In late July you replaced the sensor unit. From then until late August, the turbidity readings changed character. Turbidity tended to build in the evenings, typically peaking between 5 and 10 pm, and dropped away by late morning, even though almost no rain fell. The earlier unit, at the same site, showed nothing on this scale. That suggests to us something close to the sensor changed, perhaps exactly where it sat, or how the water around it was being used.

This is where your knowledge of the river helps. Did anything change at the landing stage or riverbank in late July or August: new moorings, more boats launching, significantly lower water levels causing plants to come in contact with the sensors, extra evening sessions, bank or maintenance work?

Conductivity

What it can indicate: Conductivity measures how much material is dissolved in the water. Some comes naturally from the rocks the river flows over. Some comes from people: salts in treated wastewater, fertiliser and manure washed off farmland, and contaminants from roads. Conductivity can't tell us which. It rises when the river runs low, because whatever enters it become more concentrated, and falls when rainwater dilutes or flushes the river.

What we saw: Through July and August conductivity crept up, from about 290 µS/cm in late June to around 400 µS/cm. That is most likely because the river ran low in the dry weather: river levels upstream fell steadily over the same weeks. It then dropped sharply in the September storm and stayed lower for the rest of the quarter.

Did you know?

In 1782 William Gilpin published Observations on the River Wye, the first illustrated tour guide published in Britain. His verdict: "if you have never navigated the Wye, you have seen nothing."

The Wye Tour ran by boat from Ross to Chepstow and took two days. By 1808 there were eight boats making regular trips, most hired from inns in Ross and Monmouth.

The tour peaked during the Napoleonic Wars, when fashionable travellers couldn't take the Grand Tour of Europe and holidayed on the Wye instead.

Reading the signals together

Each measurement tells part of a story. Readings that move together at the same time tell much more. This summer gave us three clear examples.

The August afternoons

On August afternoons, oxygen reached more than one and a half times what the water would normally hold, and pH climbed towards 9. Both happen when large amounts of plants and algae are photosynthesising. Environment Agency monitoring at Ross in 2021 showed the same pattern. Much of the Wye's summer algae grows on the riverbed, but free-floating blooms are becoming more common. Either can make the water look green. People who live on and use the river know it best: what did you see over this period?

The weather breaks

After nine weeks with barely any rain reported from the nearest gauges, the weather broke on 27th August. Within a day the overnight water temperature dropped below 18°C. Oxygen and pH fell, and over the next few days turbidity rose as soil washed in from the land. The change also helped us read the dry weeks before it. Turbidity had climbed to between 50 and 190 NTU with almost no rain, then fell to about 2 NTU within an hour of the sensor being cleaned on the morning of 26 August. Sediment in the river doesn't vanish when a sensor is wiped, so much of that dry-weather reading was most likely algae growing on or around the sensor which is something to check at every visit.

The September storm

Environment Agency rain gauges at Holme Lacy, upstream of the club, and Llanwarne, just to the west, each recorded about 11 mm of rain overnight on 12 September. The river at Ross barely rose that night. The bigger change came from further away. Rain over mid-Wales sent a surge of water down the river: the Natural Resources Wales gauge at Erwood, near Builth Wells, rose sharply early on 13 September. That water took about a day to reach Ross. On the morning of 14 September, the Environment Agency gauge at Ross showed the river rising. Within hours, turbidity at our sensor rose from single figures to over 100 NTU, peaking near 700, and conductivity halved as rainwater diluted the river. Two readings from our sensor and an independent river gauge all changed at the same time, the signature we'd expect from a rain event. It is still an interpretation: we don't measure the rain in mid-Wales directly, and something else upstream could have added to the change as it passed.

What one sensor can and can't tell you

One sensor tells you a great deal about one spot. Turbidity can vary over a few metres. Water beside a landing stage can be more turbid than mid-channel, and a plume from a field drain or tributary can hug one bank for some distance. Our readings describe the river at the club precisely, but on their own they can't show whether turbid water came from upstream, from a nearby bank, or from right beside the sensor. Answering that takes several sensors along the river, showing when a plume passes each one. It's the same reason a single rain gauge can miss a storm that soaks the next village.

Next quarter

Salmon and trout spawn from November, laying eggs in gravel beds where they stay until spring. Fine sediment washed in by heavy rain can settle into those gravels and smother the eggs, so over the winter we'll be watching how turbid the river gets after rain. Autumn flows will also show how the river responds once the heat has gone. We'll report again in December.



Photos by Becky Bryant

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Rainfall: Environment Agency rain gauges at Holme Lacy and Llanwarne. River levels: Environment Agency gauge at Ross-on-Wye and Natural Resources Wales gauge at Erwood. This data is provisional and has not yet been quality-checked by the agencies. Contains Environment Agency information © Environment Agency and/or database right. Contains Natural Resources Wales information © Natural Resources Wales and database right.