FreshWater Watch
By earthwatch EUROPE

Great UK WaterBlitz Spring 2025 Report

Tywyn Bach

Contents

Thank you to our generous funders:
Barnsbury Charitable Trust
Big Give
CaSTCo
Funding Circle
Oakdale Trust
The Tomoro Foundation
The WFH Foundation

This report should be cited as: Bannatyne, L., Loiselle, S., Simmonds, K., & Woods, S. (2025). The Great UK WaterBlitz Spring 2025. Earthwatch Europe

Thank you to all the participants of the **Great UK WaterBlitz** who made this report possible.

Executive summary

Water sustains all life on our planet. Our whole world depends on an adequate supply of fresh, clean water. Despite this, the UK's freshwater ecosystems are in a terrible state.

The seriousness of the situation has been unclear due to incomplete or missing data. This is where citizen science comes in. Back in 2024, 7,000 citizen scientists gathered information across 3,600 rivers, lakes, streams and ponds during the eight days of our Summer and Autumn WaterBlitz weekends.

This year, between 25-28 April, **7,978** citizen scientists surveyed **4,017** freshwater sites; creating the UK's most comprehensive citizen-led snapshot of water quality to date.

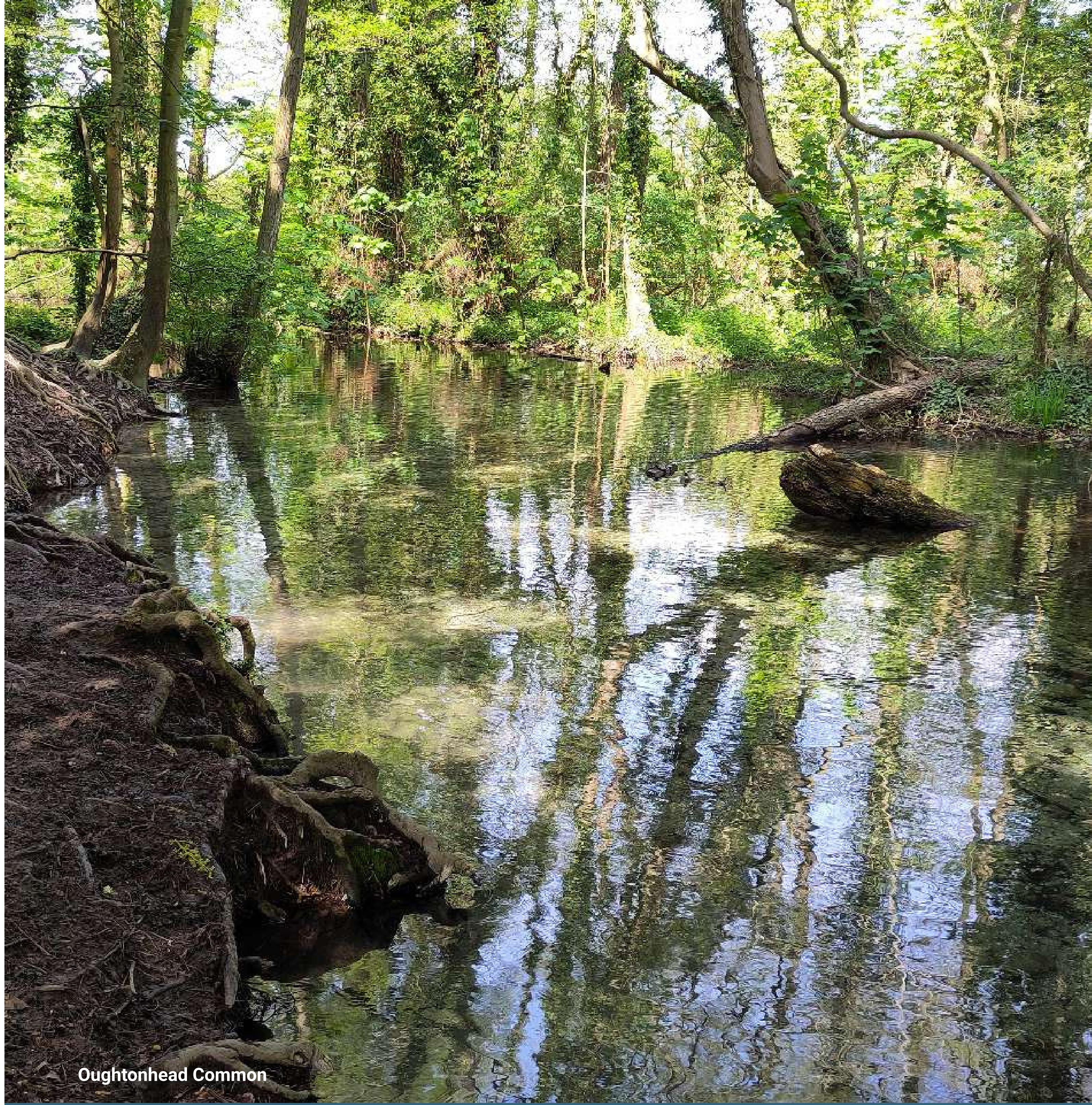
Of the 4,017 sites investigated, **66% showed poor water quality**. This compares well to previous WaterBlitzes – in the Summer and Autumn of 2024, 75% and 61% of sites, respectively, had unacceptable levels of pollution – indicating that we are **not seeing any improvement** in the consistently poor water quality across the UK.

The challenges to many waterbodies in the UK are due to a complex and interconnected range of pollution sources: sewage discharge, agriculture and urban run-off. Our rivers have been historically stressed by farming and are being pushed to the brink by outdated and inadequate sewage treatment works. There is, therefore, a pressing need for both **improvements to wastewater treatment processes** and **more sustainable agricultural practices** to reduce threats to vulnerable freshwater systems and species.

Through the FreshWater Watch programme, we enable communities to gather real-time water quality data. Nitrates and phosphates are present in both agricultural run-off and urban wastewater and are indicative of other pollutants – chemical and biological – being present. By working together with community groups and our friends at **The Rivers Trust, Water Rangers** and **Surfers Against Sewage**, we also investigated the presence of bacteria in our waterways.

Escherichia coli (E. coli) bacteria levels were measured in **301** locations across the UK and **24%** of them indicated that the water was too poor to swim in. Interestingly, we found a positive correlation between E. coli levels and phosphate levels, but not between E. coli levels and nitrate levels, indicating links between wastewater management and degraded river conditions.

Earthwatch Europe champions citizen science. We know that our dedicated citizen scientists gather accurate and timely information on water conditions, providing valuable insights that complement and can help prioritise official monitoring efforts, and ensure transparency and accountability from all types of polluters. We strongly call on authorities to formally integrate citizen science into national freshwater monitoring frameworks, recognising its vital role in data collection and community engagement. At the same time, we encourage citizen scientists to continue their essential work in monitoring and championing the health of their local rivers, lakes, ponds, and streams.



Oughtonhead Common

We want to see data-driven change to ensure that our future rivers are healthy from source to sea.

I work for an environmental monitoring publication and get to write about all manner of ways in which our environment is being affected by human impact. I thought it would be nice to become a citizen scientist for the day and take my younger sister to learn about water testing and why protecting our rivers is so important. It was great to be able to contribute something, to be a part of the change.

Ana Martins, River Wey, Weymouth

Key Findings

- **66%** of datapoints across the UK show poor water quality, with unacceptable levels of nutrient pollution
- Over three WaterBlitzes, England consistently has the worst water quality in the UK; this April, **74%** of sites tested had unacceptable levels of nutrient pollution
- Once again, our data suggest the **Thames** and **Anglian** river basin districts have the worst water quality in the UK, with **86%** of measurements showing unacceptable levels of nutrient pollution
- The **Neagh Bann** river basin district in Northern Ireland has the best water quality in the UK
- The Scottish counties of **Roxburgh, Ettrick and Lauderdale, Ross and Cromarty, Kirkcudbrightshire** and **Inverness** have the best water quality in the UK
- The English counties of **East Riding of Yorkshire** and **Rutland** have the worst water quality in the UK, closely followed by **Oxfordshire** and **Hertfordshire**
- **24%** of datapoints across the UK show E. coli levels that would classify as Poor (were the site to be given bathing water status) with significant regional variation
- Our data show a **positive correlation between E. coli levels and phosphate levels,** but not between E. coli levels and nitrate levels, demonstrating the importance of regular monitoring by FreshWater Watch citizen scientists and the impact of poor wastewater management

An introduction to pollution

River Leadon

Why are nitrates and phosphates so important?

Nitrates and phosphates occur naturally in the environment and are essential for plant growth; but high concentrations trigger a process called **eutrophication**, whereby excessive plant and algal growth leads to high levels of organic matter and bacterial activity, which in turn decrease oxygen concentrations, negatively impacting aquatic plants and animals.

The excess nitrate present in our water bodies and groundwater has been driven by agricultural intensification and increases in fertiliser use. Nitrate can infiltrate groundwater – water found underground in the cracks and spaces in soil, sand and rock – and can also be washed into ditches and rivers during rainfall. This makes agricultural areas a legacy source of *diffuse* nitrate pollution (in contrast to pollutants that enter water courses from a particular point, such as a pipe or outflow).

Although the proportions vary from catchment to catchment depending on the surrounding land use, the Environment Agency[1] estimates that **agriculture** accounts for **50-60% of nitrate** pollution in the water environment, whilst **sewage effluent** contributes about **25-30%** of nitrates nationally. Conversely, for phosphates, **urban wastewater contributes 73% of total phosphorous** to watercourses, while **agriculture contributes only 20%**[2].

In terms of nutrient pollution, our rivers have been historically stressed by farming, and are presently worsened by sewage, with high nitrate concentrations driving the poor ecological state of freshwater bodies across the UK, and elevated phosphate loads adding additional pressures.

How are nitrates and phosphates officially monitored?

Different government agencies are responsible for monitoring water across the UK. In Northern Ireland, the **Northern Ireland Environment Agency** is responsible for monitoring nutrients and water quality; in Scotland, the **Scottish Environment Protection Agency** ensures water meets environmental standards; in Wales, **Natural Resources Wales** manages water resources; and in England, the **Environment Agency** is responsible for the quality of water.

The Environment Agency monitors many elements of a waterbody – biological elements (for example, fish, invertebrates and plants), chemical elements (for example, heavy metals, pesticides and nutrients) water flows and levels – as well as the characteristics of the surrounding catchment. A waterbody is assigned one of five classes – high, good, moderate, poor, or bad – with the overall assessment based on a minimum of eight samples taken over three years. The Environment Agency applies **different standards** for nutrients to different types of rivers based on their varying levels of **ecological tolerance** to nutrient concentration, which is linked to wider factors such as altitude, and how hard or soft the water is.

In the Great UK WaterBlitz, we combine measurements of nitrate (N) and phosphate (P) taken by citizen scientists within a river sub-basin, based on at least five samples per sub-basin. Waterbodies with **acceptable** water quality show evidence of **low** nutrient pollution (<1.0 ppm N and <0.1 ppm P).

Waterbodies with **unacceptable** water quality show **moderate to high** levels of nutrient pollution (>1.0 ppm N or >0.1 ppm P) (Figure 1). We apply the same criteria **nationally**, without taking into account site-specific standards.

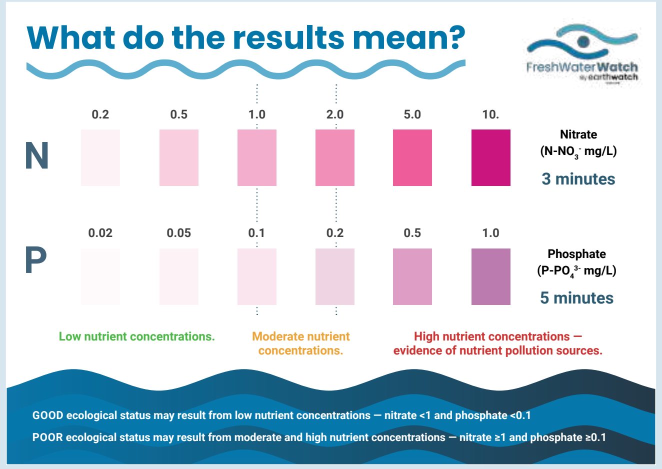


Figure 1. A nitrate and phosphate test card.

Why is E. coli of interest?

As well as nutrient pollution, our waterways are affected by a wide range of chemicals and bacteria, such as Escherichia coli (E. coli) bacteria. Bacteria are single-celled organisms found everywhere including in lakes, rivers, and streams. Most of these bacteria are harmless. However, certain bacteria have the potential to cause sickness and disease in humans and wildlife.

Coliforms are bacteria that live in the intestines of warm-blooded animals (such as humans, farm animals, pets and wildlife). Faecal coliform bacteria, including E. coli, are a kind of coliform found in human or other animal waste. E. coli forms a large group of bacteria. Most of them are harmless and are part of a healthy gut.

Both coliforms and disease-causing bacteria live in water. But unlike coliforms, disease-causing bacteria usually don't survive long outside the body of animals; which makes testing for disease-causing bacteria difficult. Instead, scientists and public health officials test for E. coli and total coliforms as an **indicator** of disease-causing bacteria.

However, because E. coli is inside all warm-blooded animals it is difficult to learn where it comes from. **High levels of E. coli could come from any warm-blooded animals**, ranging from pets, wildlife and livestock to human sewage and septic tanks. In order to determine the source of E. coli, scientists use more complicated techniques such as microbial source tracking and environmental DNA (eDNA) metabarcoding; both of which look at the genetic profiles of the bacteria, allowing them to be traced back to their species of origin.

How is E. coli officially monitored?

The Environment Agency monitors and tests **designated bathing waters** between May and September. Designated bathing waters can be coastal or inland waters; have at least 100 bathers a day during the bathing season (15 May to 30 September); and have toilet facilities bathers can use during the bathing season within a short distance of up to about 500m from the site.

During the bathing season, roughly 7,500 water samples are tested at Environment Agency labs for E. coli and intestinal Enterococci. At the end of the year the results of the samples are used to give a bathing water a classification of **Excellent, Good, Sufficient or Poor**. The Environment Agency does not routinely monitor other freshwater sites for bacteria.

Bathing water classifications are based on bacterial counts which are described in Colony Forming Units, or CFU, in 100 millilitres of river or lake water, which refers to the number of living cells that can grow and form a visible colony on a culture plate.

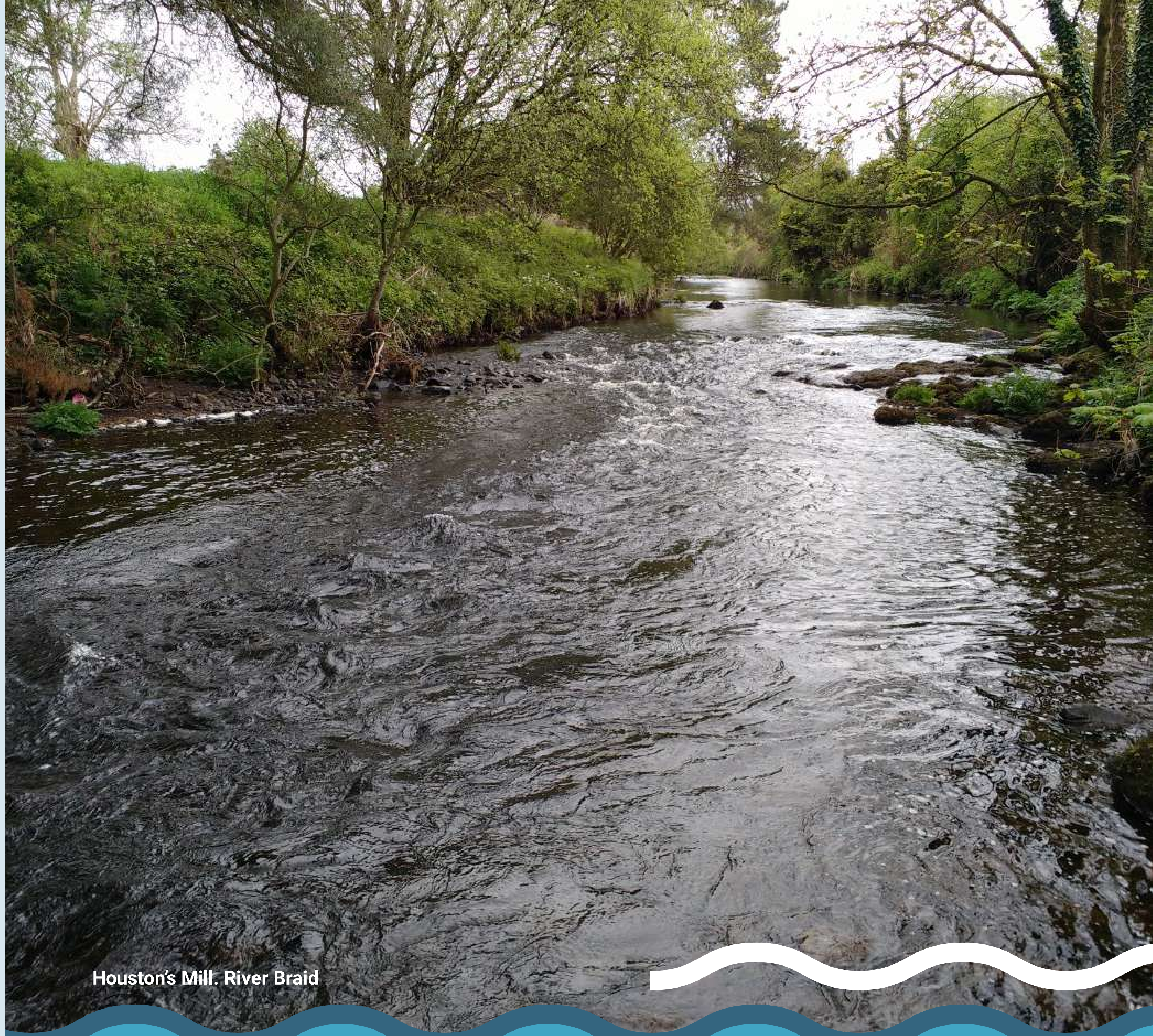
Inland waters are considered **Sufficient** if they contain less than **900cfu/100ml** of E. coli and less than **330cfu/100ml of intestinal enterococci**. Above this threshold, bathing waters are considered Poor and a sign showing **advice against bathing** must be displayed in the following year.

In the Great UK WaterBlitz, we have followed Environment Agency classification, and expressed all freshwater sites tested for E. coli as Poor or Sufficient, regardless of whether or not they are designated bathing waters.

How is wastewater treated?

Urban wastewater, commonly referred to as sewage, is a mix of domestic wastewater from toilets, baths, sinks and washing machines, wastewater from industry, and rainwater run-off from roads and other surfaced areas. Every day in the UK, 347,000 kilometres of sewers collect over 11 billion litres of wastewater which is treated at about 9,000 sewage treatment works before being discharged to inland waters, estuaries and the sea[3]. The purpose of wastewater treatment is to remove organic substances to protect the environment. This is done by settling out the solid matter (primary treatment), using bacteria that 'digest' and break down the organic substances (secondary treatment), and – at some, but not all treatment works – removing **nitrates and phosphates** (tertiary treatment) through, for example, sand filtration, activated carbon filtration, and chemical oxidation.

During heavy rainfall the capacity of sewers can be exceeded, which means the possible overload of sewage works and the potential to back up and flood roads, open spaces, and peoples' homes. Combined sewer overflows which bypass the treatment works and discharge untreated sewage directly into the receiving waterbody were developed as overflow valves to reduce the risk of sewage backing up during heavy rainfall.



Houston's Mill, River Braid

Many creatures that cannot live out of water now cannot live within the water either – because of human mismanagement. Being part of the WaterBlitz is one way to show that we cannot let this go on. I yearn for the day when I can hold up these little tests and show our local spot is ecologically sound!

Kirsten Johnson, River Mole, Stepping Stones, Dorking

Results

The picture of freshwater quality across the UK

Citizen scientists uploaded 4,017 datasets of nitrate and phosphate concentrations as well as observational data over a four-day period (25-28 April).

Participants were asked to select the type of freshwater body they were investigating from a pre-determined list: pond, stream, lake, river, wetland, canal, ditch or other.

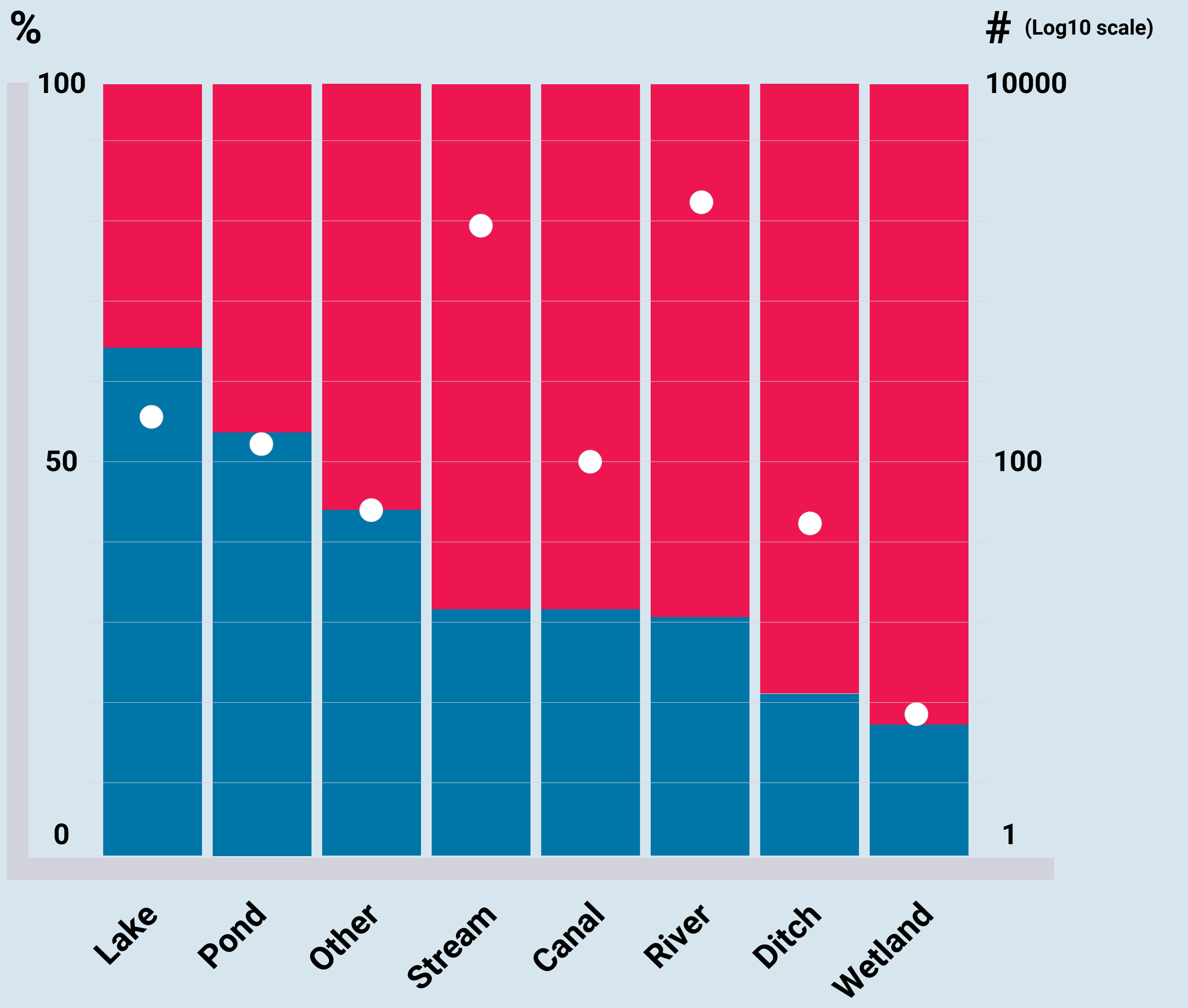


Figure 2. Water quality across the UK's freshwater bodies

Our data show that across the UK, most participants tested rivers and streams. Our data also suggest that rivers, ditches and wetlands were more polluted than other freshwater bodies. Interestingly, in Autumn 2024's WaterBlitz, wetlands were the least polluted water body type. The difference might be due to the drier weather over Spring 2025 compared to Autumn 2024.

How does water quality differ between countries?

Of the 4,017 surveys, 3,279 were collected in England; 278 were collected in Scotland; 253 measurements were taken in Wales; and 207 datapoints were gathered in Northern Ireland.

The data indicate that **England has the worst water quality in the UK** (Figure 3).

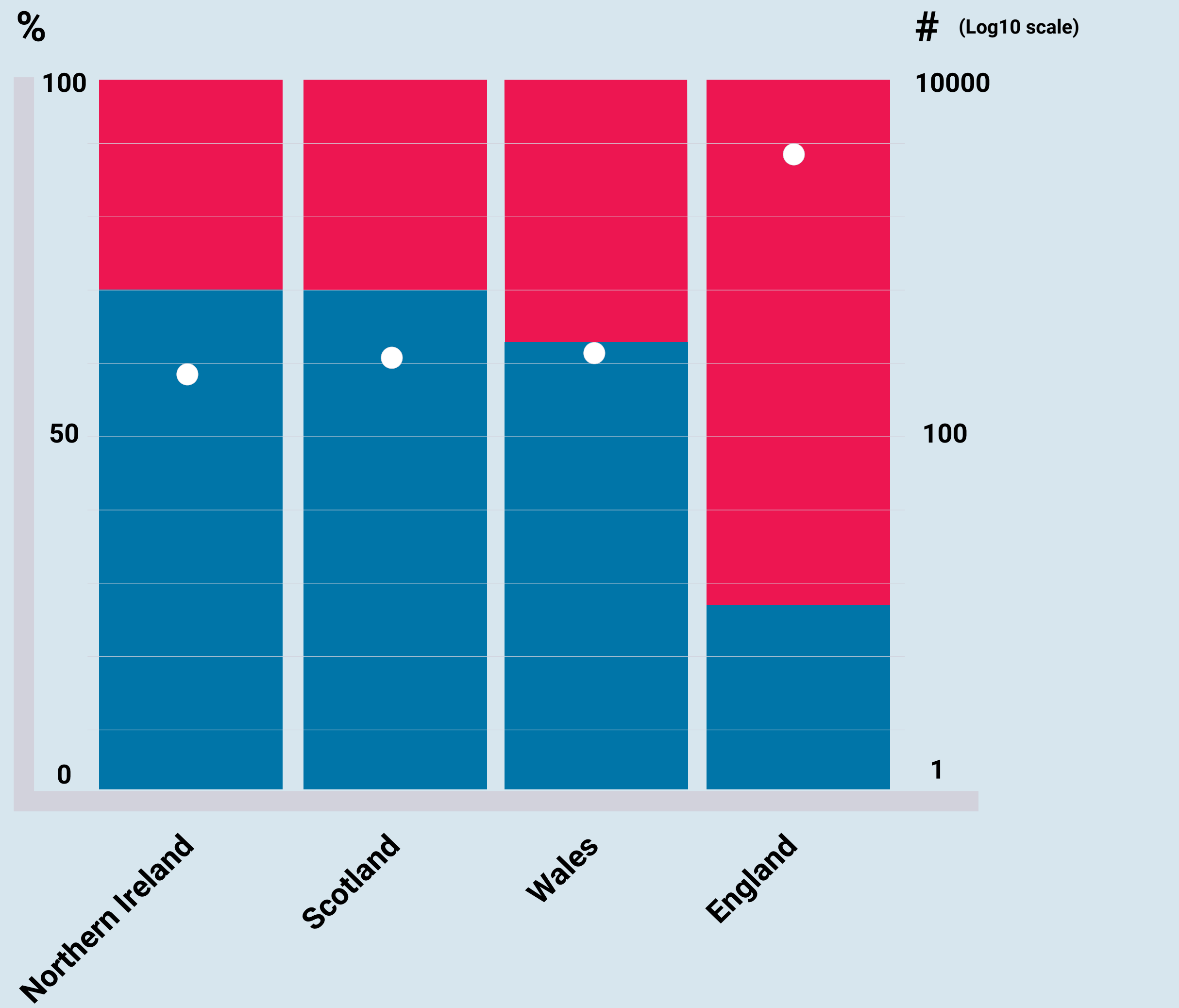


Figure 3. National overview of water quality

River Colne

> This is the second year I'm taking part in the WaterBlitz together with my daughter and our friends. It is important for me to ensure my daughter learns about the environment and the impact we have on it from an early age. We really enjoyed it, and we'll compare the results with last year to see if there were any changes. We will continue doing so!

Darya Berger, River Red, Redbourn, Hertfordshire

How does water quality differ over time?

As we continue to collect more data over repeated WaterBlitzes, the findings of the first WaterBlitz are confirmed as a trend. On average, 63% of measurements taken across Northern Ireland, Scotland and Wales indicate good water quality. In comparison, on average, 26% of measurements in England indicate good water quality. It is important that we continue to grow our biannual WaterBlitzes to further improve national coverage and allow robust, longer-term analysis of the UK's water quality.

June 2024

September 2024

April 2025

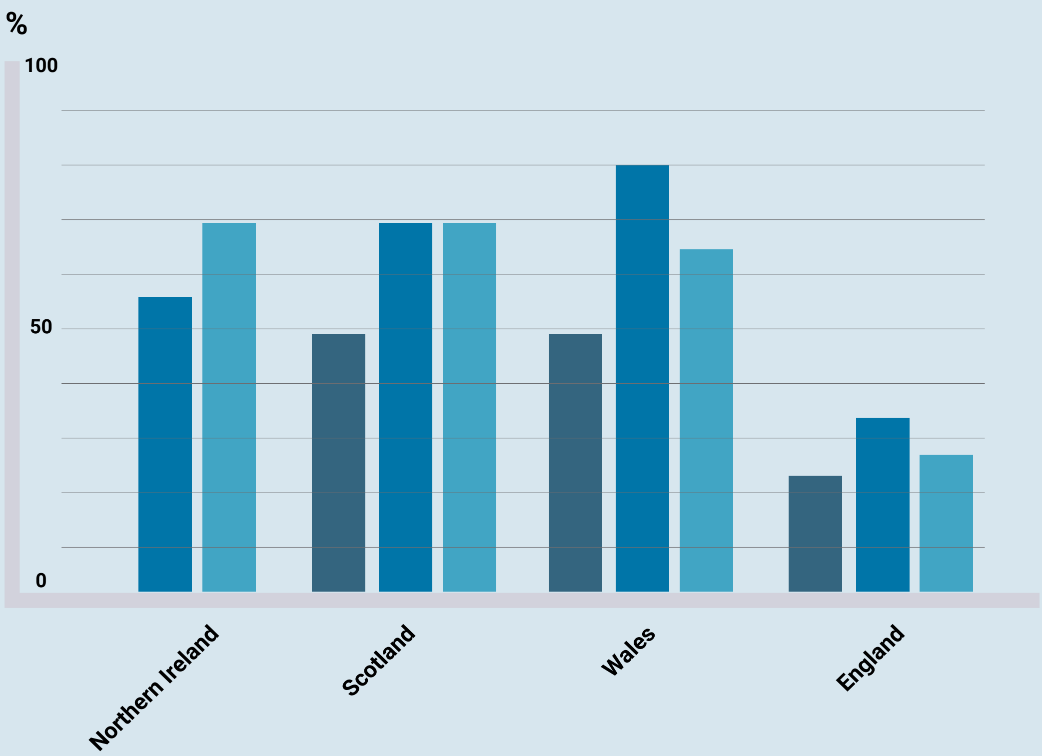
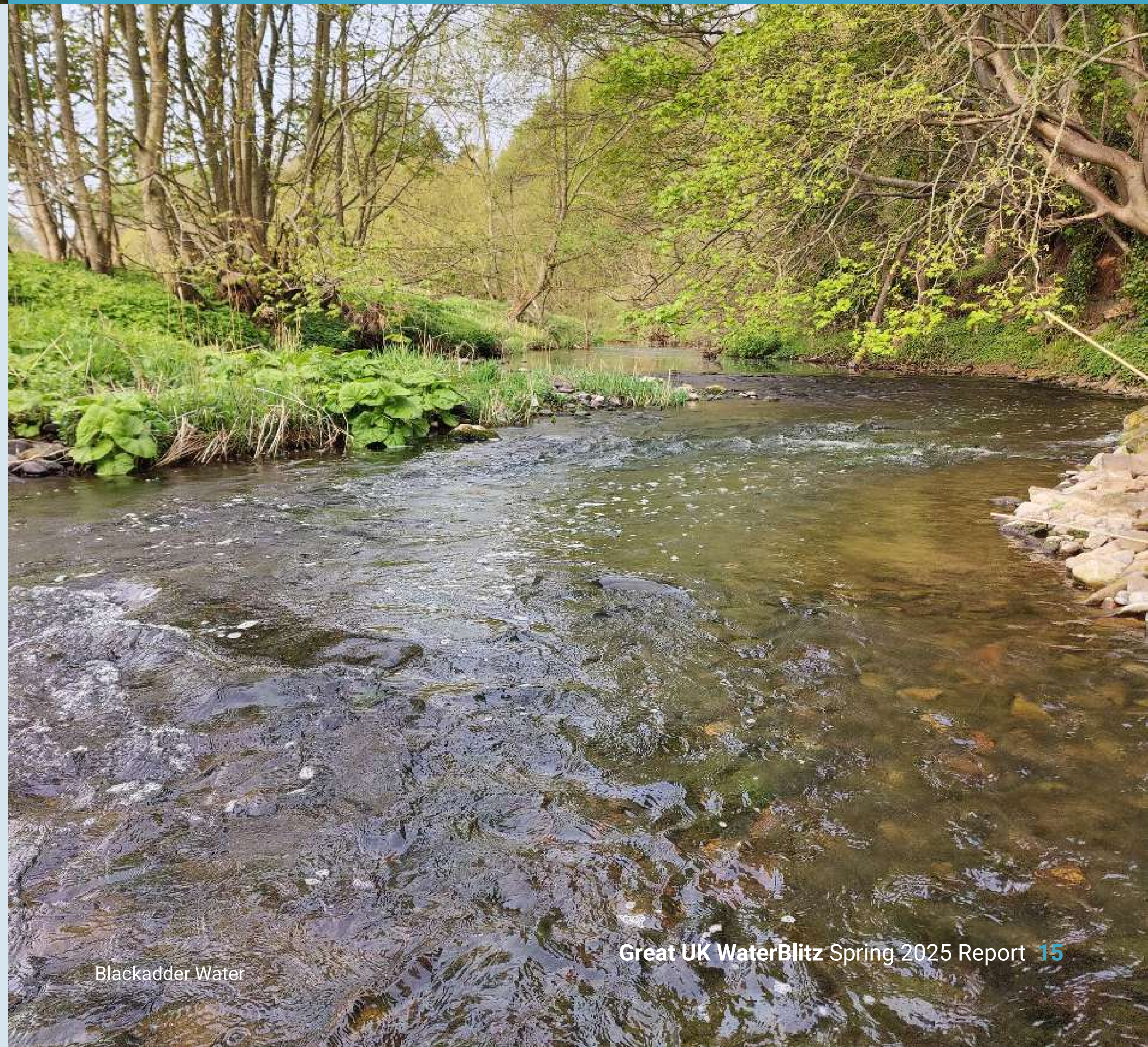


Figure 4. % of acceptable water quality across WaterBlitzes



Blackadder Water

Which river basin districts are worst-hit?

A river basin, also known as a drainage basin, is an ecological term for the area of land around a river from which all water is drained. A **river basin district** includes one or more river basins. Each river basin district has a river basin management plan that outlines the objectives, standards, and measures for managing water.

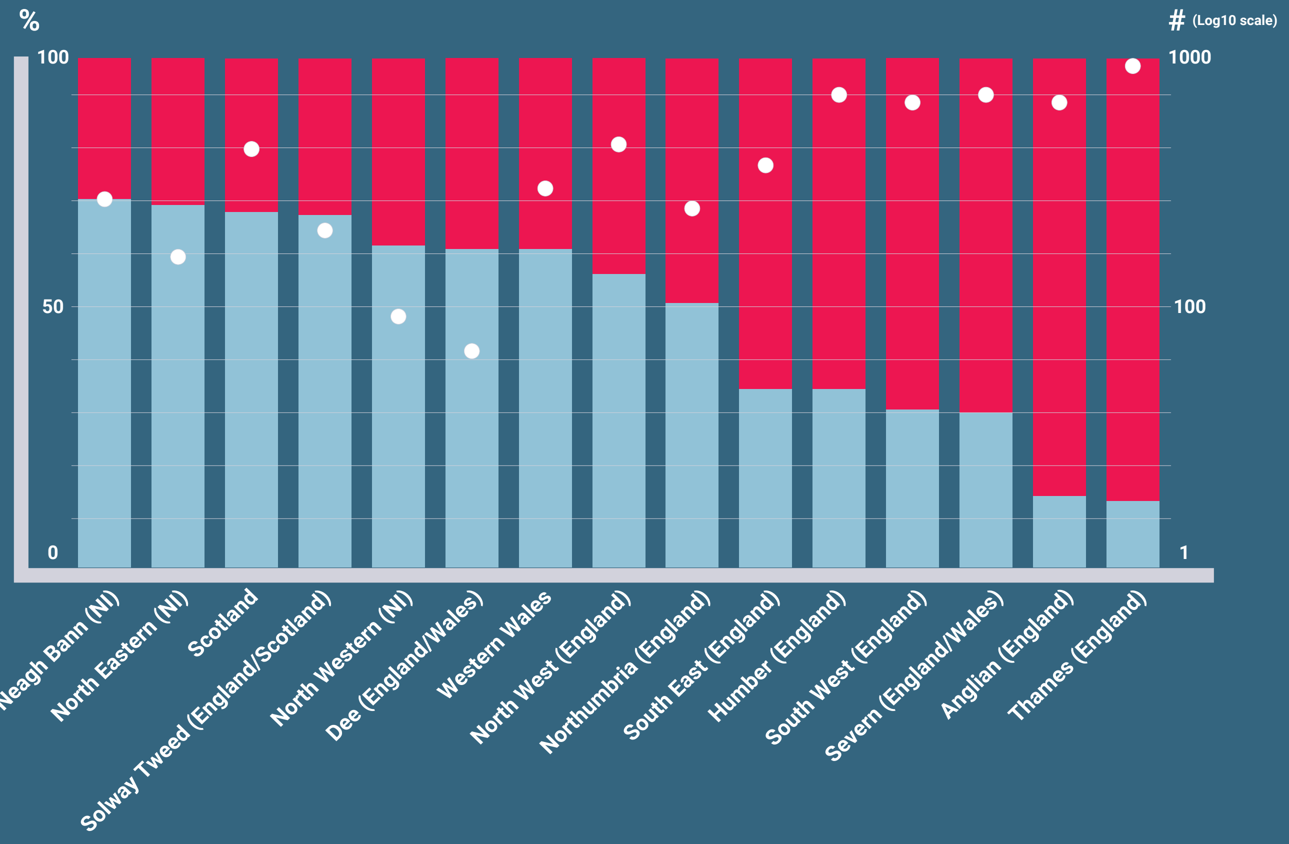


Figure 5. Water quality by river basin district

Acceptable **Unacceptable** **# Datapoints**

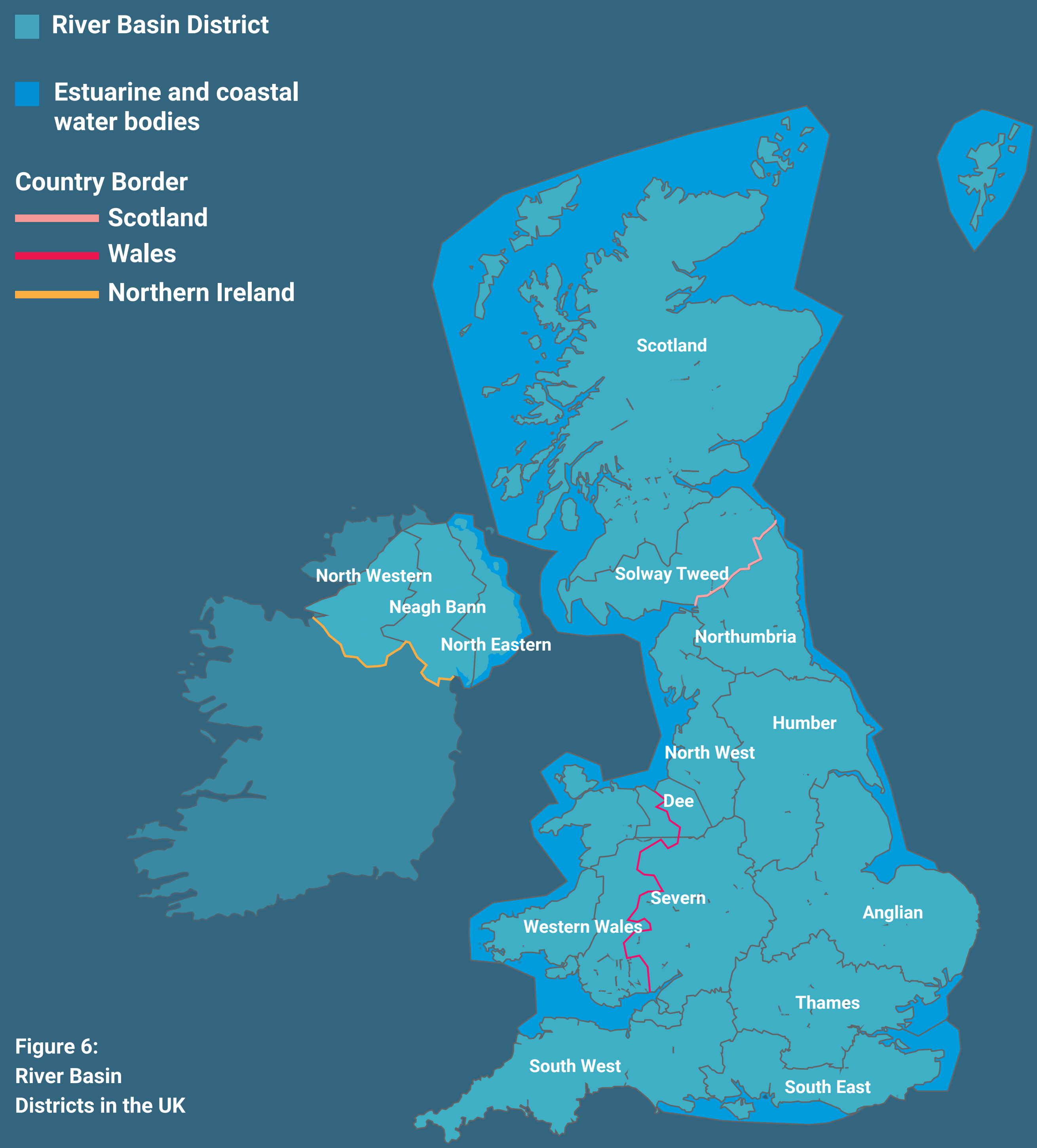


Figure 6: River Basin Districts in the UK

Thanks to increased sampling efforts by citizen scientists in Northern Ireland, we have been able to include a more detailed analysis of water quality in this country.

The results shown in Figure 5 suggest that the **Neagh Bann river basin district in Northern Ireland has the best water quality in the UK**, with 71% of measurements indicating low concentrations of nutrient pollution, and good water quality (based on 126 datapoints).

The Thames and Anglian river basin districts have the worst water quality in the UK, with less than 14% of measurements showing good water quality (based on 880 and 455 datapoints, respectively).

Which river basins are most polluted?

We can delve deeper into the data to look at specific river basins (Figure 7). For example, in the **Neagh Bann** river basin district, **60%** of the surveys collected showed good water quality, for the **five out of the six river basins** where data was available.

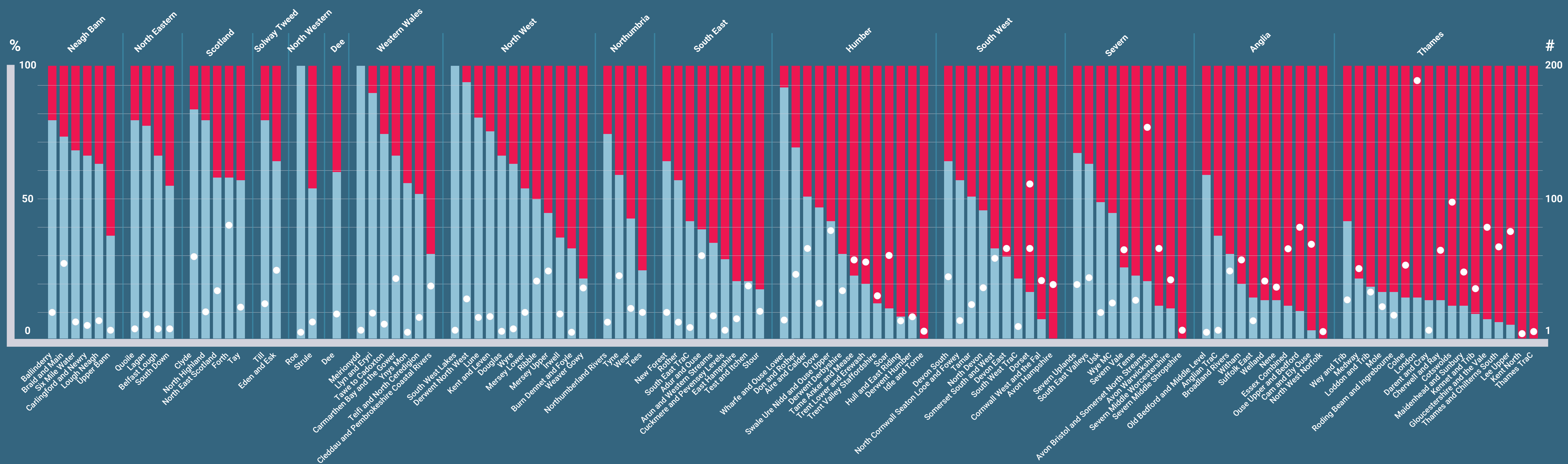
In stark contrast, **only one of the seventeen river basins** sampled by citizen scientists in the **Thames** region had more than **40%** of measurements indicating good ecological status.

The Thames TraC catchment appears to have the worst water quality in the UK. However, we must qualify this result by highlighting that FreshWater Watch kits are intended to investigate freshwater sites only, and that waters in this catchment are transitional; meaning that the gradient of salinity may have affected these results.

> Our club delivers paddle sessions on the local canal and river, so it is extremely important for us that water quality is acceptable. We collected data from a few places in the Wakefield District and we will share our findings with the wider community.
>
> **Marek Janiel, Umbrella Canoe Club, Wakefield, West Yorkshire**

Figure 7. Water quality of river basins in river basin districts

Acceptable **Unacceptable** **# Datapoints**



How healthy is freshwater in your county?

In this report we have used ceremonial counties because local governmental legislation counties are continually updated, with boundaries that change over time.

We have ranked counties by country and by water quality so that you can see the percentage of unacceptable water quality measurements taken in your county and how it compares to others (Figure 8). Thanks to your increasing sampling efforts from WaterBlitz to WaterBlitz, the number of counties we can include has risen from 56 in June and 67 in September 2024, to 82 this April.

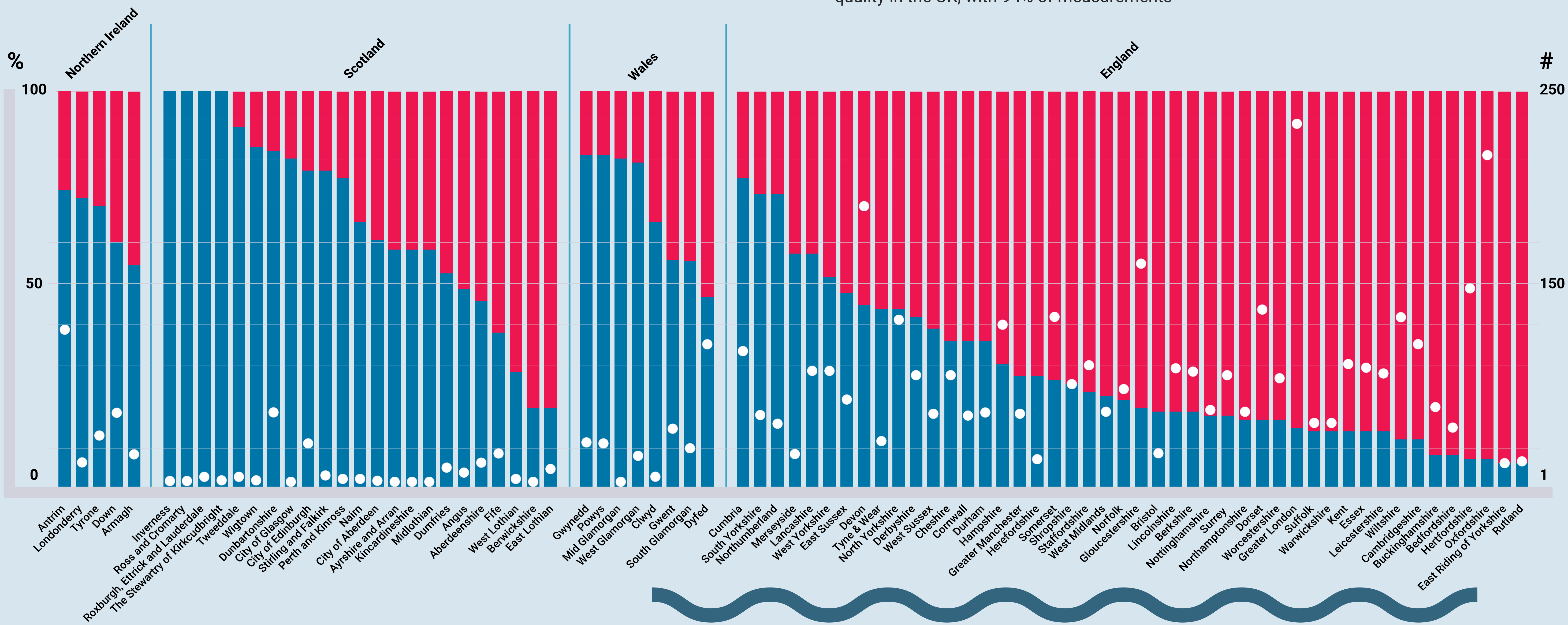
Our data show that the Scottish counties of **Roxburgh, Ettrick and Lauderdale, Ross and Cromarty, Kirkcudbrightshire** and **Inverness** have the best water quality in the UK, with 100% of measurements indicating good ecological status (based on 10, 6, 6 and 5 datapoints respectively).

The English counties of **East Riding of Yorkshire** and **Rutland** have the worst water quality in the UK, with 94% of measurements indicating poor ecological status (based on 16 and 17 datapoints respectively); followed closely by **Oxfordshire** and **Hertfordshire** with 93% of measurements showing unacceptable levels of nutrient pollution (with 205 and 121 datapoints each).

Note that while there is a *correlation* between the number of datapoints and unacceptable water quality, this is possibly due to larger volumes of data being collected where there are naturally more people; in urban areas where there are fewer green spaces and more pressure on sewage treatment works.

A shout out to the residents of Greater London, who took the greatest number of measurements – 220!

Figure 8. Water quality by county Acceptable Unacceptable # Datapoints



What about bacterial contamination?

Scientists and public health officials test for E. coli as an indicator of disease-causing bacteria.

Citizen scientists used different methods to determine E. coli levels in freshwater sites across the UK: R-Cards and/or one of three different laboratories, (1) Simplex, (2) IDEXX, or (3) Pathology Management Services (see methods section).

Our data show that **24% of freshwater sites tested for E. coli would be classified as Poor with respect to bathing water status (>900 cfu/100ml)** with significant regional variation (Figure 9).

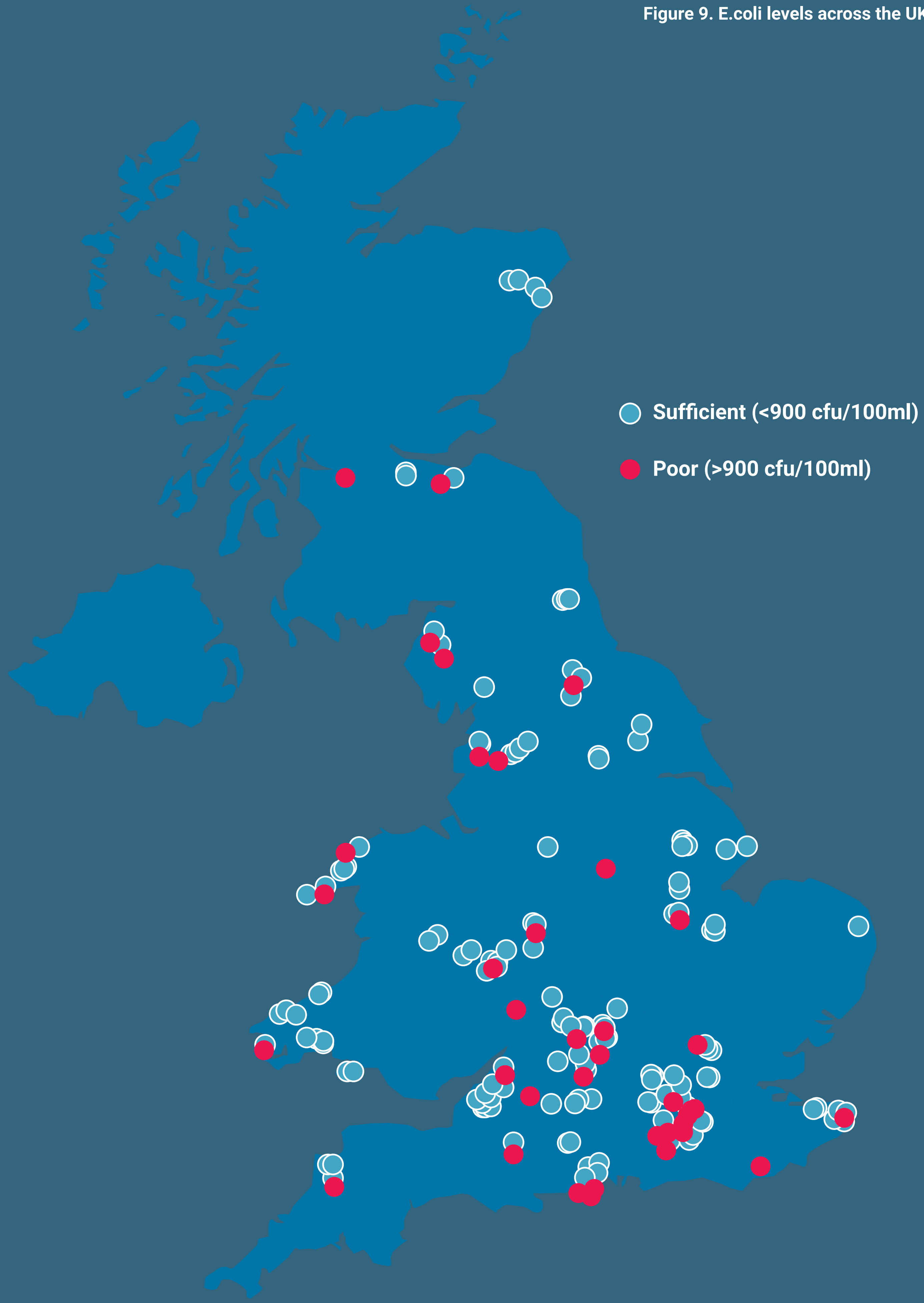
Different methods were used in different locations, so the percentage of Poor sites can also be split by method: 20% of R-Cards, 22% of Simplex samples, 78% of IDEXX analysed samples, and 0% of Pathology Management Services samples were Poor. Nevertheless, we see a strong correlation between R-cards and lab results using a statistical test called *Spearman's rank correlation coefficient* which measures the relationship between two variables. Using this test, R-Card and Simplex laboratory results had a strong positive correlation (rho = 0.66, $p < 0.0001$), showing that **R-Cards are a useful citizen science tool that can compare well with laboratory testing.**

Why do our nitrate and phosphate results suggest 66% of freshwater sites have unacceptable levels of nutrient pollution, but only 24% of sites would be classified as Poor in terms of E. coli levels?

Remember, nitrate and phosphate enter freshwater through agricultural run-off and sewage discharges, with proportionally more nitrate coming from agricultural run-off and more phosphate through sewage discharges. Our data show that phosphate concentrations and E. coli levels (as determined using R-Cards) have a positive correlation (rho = 0.40, $p = 0.006$), indicating that **elevated phosphate concentrations occur when E coli levels are high**, very likely in relation to discharges from sewage treatment works.

However, our data suggest that E. coli levels do not correlate with nitrate levels. This means that, while a useful indicator of sewage discharges, E. coli levels alone do not provide a complete picture of water quality and ecological health. It's why we continue to use nitrate and phosphate as indicators of both agricultural run-off **and** sewage discharges, and why we collaborate with partners such as Imperial College London to further investigate the cocktail of chemicals polluting our precious waterbodies.

Figure 9. E.coli levels across the UK

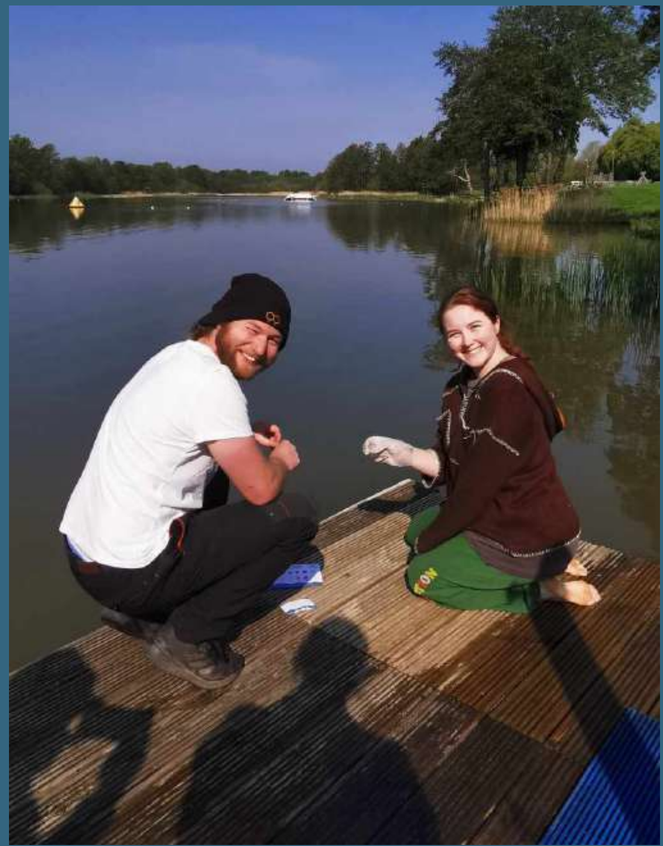


WaterBlitz Story: Coggeshall Cold Water Dippers

Joe Baynham and the Coggeshall Cold Water Dippers

We are the Coggeshall Cold Water Dippers. We have been dipping as a community group in North Essex for three seasons now.

On Sunday morning, my group had our usual dip at Gosfield Lake Open Water Swimming. Whilst we were there, we asked for permission to test the water as part of the Great UK WaterBlitz and to add the results to Earthwatch Europe's FreshWater Watch database. I was so happy, and not at all surprised, to find that the Gosfield Lake test returned "very good ecological status", showing as green on the map. The results map really puts into perspective just how lucky we are to have such a beautiful body of water to swim in so local to us. Gosfield Lake is quite literally a green haven in a sea of red in our part of the country!



In total, we tested five different locations between Halstead and Kelvedon. Only Gosfield Lake came back as green – the other locations came back red with nitrate and phosphate scoring really, really high.

Unfortunately, this means high nutrient loading from the surrounding catchment and may also be indicative of a local pollution source.

Since my group dips in nature so regularly, I feel it is really important that we try to do what we can to give back and support the very thing that brings us so many benefits: fresh water. By taking part in this campaign, we can raise awareness around water quality issues and improve British waterways in the future.

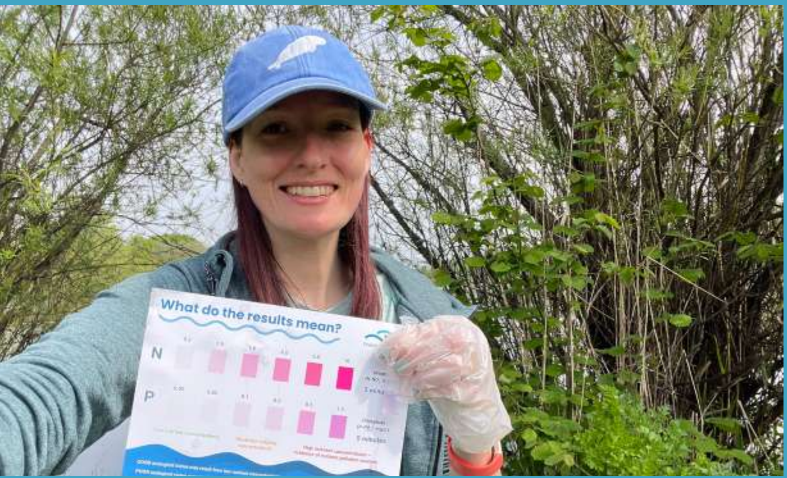
As the founder of the Coggeshall Cold Water Dippers, I am passionate about the good that cold water immersion and open water swimming can bring us – it is literally a life changing practice! I have seen first-hand the benefits that getting out into nature in this way has brought to the Coggeshall Cold Dippers. We have members who come for a variety of health-related reasons, including Long COVID, depression, anxiety, menopause, arthritis, ADHD as well as loneliness and other personal challenges.

The Great UK WaterBlitz is such a simple yet important way to give back to nature. It's important for helping us to better encourage engagement with nature, and for people to stay aware of what is going in their local freshwater sources.

What do we know about our participants' experience?

7,978 participants took part in the WaterBlitz and 914 responded to our questionnaire about their experience. 34% of participants not been involved in the environmental sector before the WaterBlitz, and 35% had previously taken part in a WaterBlitz event (thank you!). Most people wanted to do something for the environment (84%) or had a personal interest in a local waterbody (54%).

As in previous WaterBlitzes, many participants agreed that their understanding of water quality issues and river health was improved through taking part (67%); and 22% reported a positive shift in their relationship with nature. We're really pleased that, as a result of taking part in our WaterBlitz, 33% of participants report that they will start taking part in other citizen science initiatives and 19% will get involved in local environmental initiatives.



WaterBlitz Story: Portal House School

Kieran Renihan, Head of Geography

Portal House School is a specialist secondary school in Kent for pupils with Social, Emotional and Mental Health needs (SEMH).

As Head of Geography, I am always looking for ways to get the boys out into the real world. When I heard about Earthwatch Europe's Great UK WaterBlitz... well this was a perfect opportunity to learn about the relationship between humans and our local river, the Dour, which flows through Dover in East Kent.

In Year 7, the students undertake a study of the River Dour. We walk down the Dour from source to mouth. The students know this river and some of the students live in Dover, so this is their local river. As a chalk stream it is a globally significant ecosystem as there are only 200 or so on the whole planet, 85% of which are in the UK.

The students enjoyed the process and were surprised at the results. We will be undertaking some further investigations to see where the high nitrate levels are coming from. We will be continuing up the river to try and locate the source of pollution. We are keen to get involved in future WaterBlitz events!

What can I do and where do we go from here?

There are many actions we as individuals can take that collectively add up to ease the pressure on our freshwater systems. Outside, a **water butt** connected to the drainpipes from our roofs can reduce the volume of water running into the sewage system during rainfall events. Where catchments are built up, rainwater runs off faster and has less chance to permeate into the ground than in catchments with more green spaces. Making our gardens and driveways more **permeable** allows surface water to soak into the ground rather than into drains.

Using **eco-friendly** cosmetic and cleaning products, avoiding products which contain PFAS (including clothing and cook wear), as well not over-washing manmade materials like polyester, reduces chemicals and microplastics flowing into freshwater bodies.

The average person uses 142 litres of water per day. Lowering overall **consumption** puts less pressure on water resources, while using water at off-peak times helps the sewage system to cope better throughout the day. Being mindful of what we put down the toilet or pour down the drain reduces the risk of blockages as well as pollutants entering freshwater bodies. Remember, **what we pour down our sink cycles back to our drink**.

You can also write to your local Member of Parliament, requesting that they use their authority to take action for freshwater.

Earthwatch Europe believes in the power of data for change.

We believe in open, transparent data. It's why all our graphs have been plotted to include the number of datapoints; so that you can see how large a dataset has been used to draw conclusions. We want to see the same level of transparency and, indeed, accountability from all types of polluters: from agriculture, urban run-off and sewage overflows.

We want to see the law enforced, so that pollution from all sources becomes unprofitable. We want to see resources focused on ecologically sensitive areas like protected nature sites and chalk streams; and for nature-based solutions to be prioritised. Finally, we want to see Government take action to engage and empower communities.

We believe that citizen scientists can provide extensive, accurate, and timely information on water quality at a national level. We've shown that our participants can generate robust datasets, and reliable status reports on how seasonal variations can impact pollution dynamics and water quality. While acknowledging that the Environment Agency has steadily increased the number of water quality measurements they take annually, we nevertheless urge authorities to recognise the added power of citizen science for freshwater monitoring at a national scale. We recommend that citizen-generated data be integrated into their freshwater monitoring frameworks and be used to identify poor water quality so that Government resources can be targeted on these priority areas. Finally, we call upon our citizen scientists to continue monitoring and advocating for their local rivers, streams, lakes and ponds.

A healthy freshwater future starts today. With each and every one of us.

Please join us in September 2025 for our Autumn WaterBlitz, and continue the fight for healthy freshwater.

WaterBlitz Story: Linking the Levels

Sally Pattison

Linking the Levels is a nature recovery project which aims to improve, restore and create habitat for wildlife along the River Severn. We are in the scoping phase, gathering wildlife data and getting to understand the wildlife around the estuary.

We have used eDNA testing to look for fish and especially eels which are critically endangered. We now know that eels are present in some rivers and rhines (the local name for the drainage ditches in our area), and the Great UK WaterBlitz tests have allowed us to overlay this data with water quality. I was expecting that our positive eels' records might match up with the cleanest water. This doesn't seem to be the case, maybe in part because so few of the ten watercourses we surveyed had good water quality, so eels can't be too choosey. In fact, the tests showed that the cleanest water was in the grotty-looking ditches on the industrial estate!

One of the rhines which we surveyed near Almondsbury is designated as a Site of Nature Conservation Interest. We saw damselflies and signs of water vole, so we speculated that the water quality would be good. However, it scored very high for nitrates and phosphates, which you'd never know from just looking at it. This nature site is obviously struggling and the poor water voles are living in really dirty water. This is something my project can flag up and investigate further as we speak to the local parish council and landowners.

Methods

Participant recruitment and feedback

Citizen scientists were recruited through promotional campaigns on social media. Following the WaterBlitz, participants were sent a follow-up questionnaire to report on their experience of the WaterBlitz and their knowledge, attitudes and behaviours towards nature.

Nutrient testing

The FreshWater Watch (FWW) measurements of nitrate and phosphate are made colourimetrically in closed tubes using a standard plastic cuvette for a fixed volume of 1.5mL. Nitrate measurements are based on the Griess reaction, with a reduction reaction using zinc, which reduces the nitrate (NO3-) to nitrite (NO2-) and a colourimetric reaction for the determination of nitrite. PO4 is detected using 4-amino-antipyrine with phosphatase enzyme to produce hydrogen peroxide, which then undergoes a colourimetric reaction. Both colours are compared to standard reference colour charts provided to the citizen scientists, assigning colour brightness to one of seven concentration intervals. Side-by-side measurements have shown an overall accuracy of 75% to 85% of the citizen scientist estimated PO4 concentrations compared to concentrations measured at the same site and day by professional scientists using standard laboratory analysis[4,5]. Participants submitted data via the ArcGIS Survey123 app, the FWW platform or via paper copy. All data uploaded from 25 April until 1.30pm on 29 April were included in the analysis (following quality control). Additional data uploaded outside of this period were not included in the analysis but could still be visualised on the public map and will form part of the overall FWW database.

Nutrient data analysis

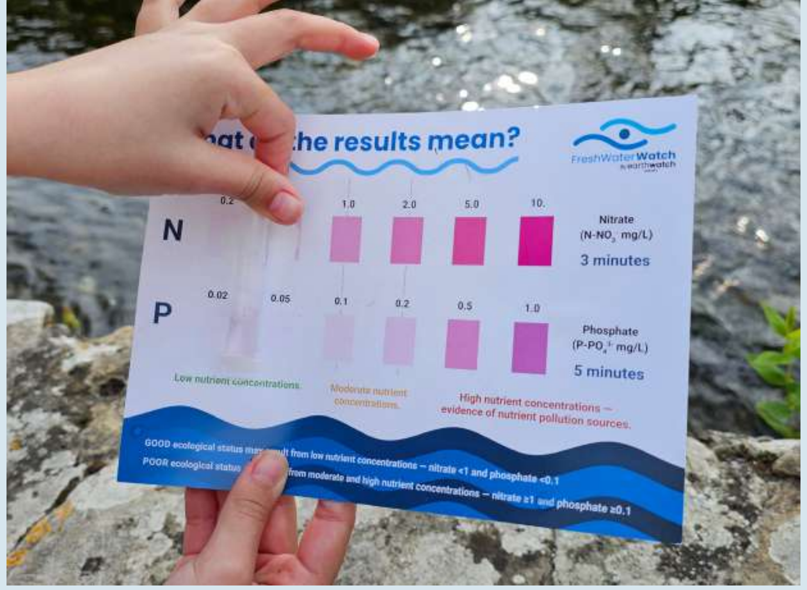
On closing the survey, the data were exported, and quality control – including locational accuracy, removal of incomplete and duplicate records, and removal of saltwater surveys as indicated in participant notes (“sea”, “harbour”, “tidal river at high tide” etc.) – was undertaken. Each record/survey result was then enriched with nitrate and phosphate nutrient pollution ratings based on the measured concentrations, from which, in turn, the acceptable/unacceptable water quality classification was generated (based on the N and P thresholds mentioned earlier in the report). Lastly, our FWW narrative feedback was generated for each survey by a matrix based on the nitrate and phosphate measurements and the observed parameters.

For the spatial analysis of the data points, we enriched our data set using geospatial layers including Open OS Boundaries, WFD (Water Framework Directive) for England and Wales, and SEPA (Scottish Environment Agency) for surface water catchments. Correlations were made using the Spearman’s Ranked Correlation Coefficient Test.

Polygons for spatial analysis

The following polygons were used for spatial analysis:

- Country, from Ordnance Survey Boundary-Line™ consisting of the 'Country Region' shapefile and can be found at https://osdatahub.os.uk/downloads/open/BoundaryLine
- County, from
  - Ordnance Survey Boundary-Line™ consisting of the 'Boundaryline ceremonial counties region' shapefile for England, Scotland and Wales, which can be found at https://osdatahub.os.uk/downloads/open/BoundaryLine
  - 'Northern Ireland, County, Boundaries' shapefile. This data was collected by Ordnance Survey Northern Ireland and can be found at https://www.opendatani.gov.uk/ on the open data NI portal.
- River basin districts/management area (using RBID_NAME) field as defined by the WFD Surface water management catchments (Cycle 2) database.
- River basin (using MNCAT_NAME) field as defined by the Water Framework Directive (WFD) Surface water management catchments (Cycle 2) database, enhanced by Welsh sub-regions (field name ManCatID, and ManCatName) from WFD River Waterbody Catchments Cycle 2.
- Geolocation quality control: Using Building and ImportantBuilding shaped file polygons from OS Openmap https://osdatahub.os.uk/downloads/open/OpenMapLocal to determine points that were recorded at a building instead of a waterbody. This was then checked against distance from SurfaceWater waterbody shape file polygons and lines from the following sources – OS Open Rivers https://osdatahub.os.uk/downloads/open/OpenRivers, OpenStreetMap https://www.openstreetmap.org/ and regional extracts fromGeofabrik https://download.geofabrik.de/europe/united-kingdom-latest.osm.pbf. Geolocations were then corrected accordingly.



A sample from the WaterBlitz analysis. Samples are analysed by a technique called liquid chromatography-mass spectrometry where all the chemicals in the water are separated out, detected and quantified. (CREDIT: *Imperial College London / Jo Mieszkowski*)

Datapoints per polygon

The number of datapoints per polygon was determined to assess the representativity of the data. All datapoints were included in the overall and national analyses. River basin districts with fewer than 10 points were excluded from that level of analysis. River basins and counties with fewer than 5 datapoints were excluded from analysis at those levels.

Of the 157 river basins defined by the WFD Surface Water Management Catchments Cycle 2 polygons (see Polygons for spatial analysis above), 135 were sampled, and 113 had more than 5 data points. These river basins contained 98.8% of the 4,017 datapoints that were collected by citizen scientists during the WaterBlitz.

Of the 97 counties defined by boundary shapefiles (see Polygons for spatial analysis above), 93 were sampled, and 82 had more than 5 data points. These counties contained 99.5% of the 4017 datapoints that were collected by citizen scientists during the WaterBlitz.

Data sources

- Earthwatch – Great UK WaterBlitz April 2025
- OS Open Boundaries Data source link
- OS OpenMap Local Data source link
- OS Open Rivers Data source link
- OpenStreetMap via Geofabrik Data source link
- SEPA River Basin Districts Data source link
- Water Framework Directive (WFD) River Basin Districts Cycle 2 Data source link
- WFD Surface Water Management Catchments Cycle 2 Data source link

Tools used

- ESRI ArcGIS Python API
- ESRI ArcGIS Online and Python Notebooks
- ESRI ArcGIS Pro
- Microsoft Excel (Microsoft Office 365)
- Microsoft Visual Studio Code
- Pandas library

E. coli testing

Community groups engaged through Earthwatch Europe's FreshWater Watch programme, the Rivers Trust's CaSTCo project demonstration sites in collaboration with Water Rangers, and Surfers Against Sewage conducted additional E. coli testing alongside FreshWater Watch nitrate and phosphate testing. A combination of R-Cards and laboratory testing methods were used.

R-Cards™

R-Cards were used by FreshWater Watch community groups and at CaSTCo project demonstration sites. Briefly, 1ml of freshwater was applied to three R-Cards from one site. R-Cards were incubated at 35°C for 24h, after which the number of E. coli colonies were counted, averaged and multiplied by 100 to report cfu/100ml.

IDEXX Lab

CaSTCo demonstration sites also analysed E. coli in the Water Rangers community lab using the IDEXX Colilert Most Probably Number (MPN) method. The Colilert Test uses proprietary Defined Substrate Technology (DST) to simultaneously detect total coliforms and E. coli. Two nutrient-indicators, ONPG (o-Nitrophenyl-β-D-galactopyranoside) and MUG (4-Methylumbelliferyl-β-D-glucuronide), are the major sources of carbon in Colilert and can be metabolised by the coliform enzyme β-galactosidase and the E. coli enzyme β-glucuronidase, respectively. As coliforms grow in the Colilert Test, they use β-galactosidase to metabolise ONPG and change it from colourless to yellow.

Simplex Health Lab

Water samples were collected by FreshWater Watch community groups and shipped for analysis by Mercian Science Ltd on behalf of Simplex Health (UKAS accreditation 2450, Accredits to ISO/EC 17025:2017. BS17025. Note that it is important to qualify these results by highlighting that lab tests should be analysed within 24 hours of sampling, and – at least for Simplex lab results – this was not the case due to delays in couriers.

Pathology Management Services Lab

Water samples were collected by Surfers Against Sewage community groups and analysed by Pathology Management Services.

References

1. Environment Agency (2019). 2021 River Basin Management Plan: Nitrates
2. White, P.J. & Hammond, J.P. (2009). The sources of phosphorus in the waters of Great Britain. J Environ Qual, 13;38(1):13-26
3. DEFRA (2000). Sewage Treatment in the UK: UK Implementation of the EC Urban Waste Water Treatment Directive
4. Hegarty, S., Hayes, A., Regan, F., Bishop, I., & Clinton, R. (2021). Using citizen science to understand river water quality while filling data gaps to meet United Nations Sustainable Development Goal 6 objectives. Science of The Total Environment, 783, 146953.
5. Moshi, H. A., Kimirei, I., Shilla, D., O'Reilly, C., Wehrli, B., Ehrenfels, B., & Loiselle, S. (2022). Citizen scientist monitoring accurately reveals nutrient pollution dynamics in Lake Tanganyika coastal waters. Environmental monitoring and assessment, 194(10), 689.

I work at the EA, managing the team that lead an exciting project called 'Supporting Citizen Science'. I wanted to get involved and have firsthand experience of this growing initiative since attending Earthwatch's launch event for the Great UK WaterBlitz report in September 2024. I sampled my local river, the Meon, a chalk stream. It was lovely to spend some time down by the water, listening to the birds. I followed up the sampling for the Great UK WaterBlitz with The Rivers Trust's Big River Watch monitoring. It's great to be able to compare those findings with the EA's data.

Kerry Sims from the Environment Agency, River Meon, Hampshire

FreshWater Watch

By earthwatch

EUROPE

earthwatch.org.uk