Broken Rivers

HOW ARTIFICIAL BARRIERS ARE DRIVING WILD FISH DECLINE – AND HOW WE CAN RESTORE CONNECTIVITY

WildFish.

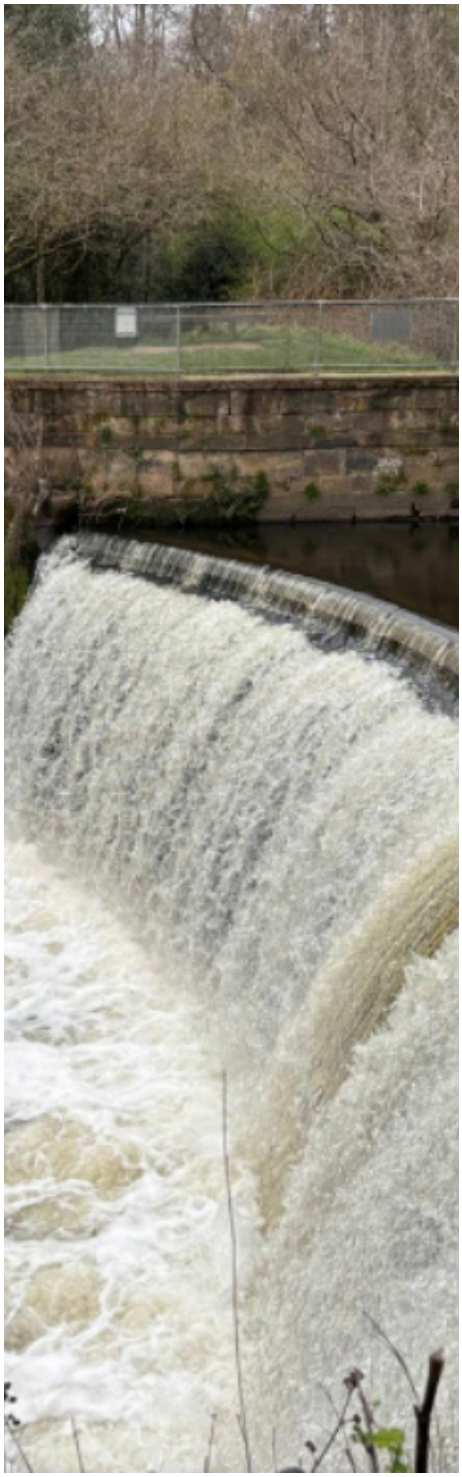
The problem

The UK's rivers are among the most fragmented in Europe. Artificial barriers, including weirs, dams, culverts, sluices and locks, interrupt natural river processes and prevent fish from accessing the habitats they need to feed, spawn and complete their life cycles. While many barriers were originally constructed to support navigation, industry, water management and power generation, thousands now serve little or no purpose.

River fragmentation has become a major driver of biodiversity loss. Only around 1% of rivers in Great Britain remain free of artificial barriers, while just 3.3% of the river network allows unrestricted movement of aquatic species. **Across Great Britain, there are an estimated 0.75 barriers per kilometre of river.**

The ecological consequences are severe. Migratory species such as Atlantic salmon, sea trout, European eel, lamprey and shad depend on free movement between freshwater and marine environments. Barriers delay or prevent migration, reduce breeding success, isolate populations and increase extinction risk. Atlantic salmon are now classified as Endangered in Great Britain by the International Union for Conservation of Nature (IUCN).

Scientific evidence demonstrates that restoring river connectivity- particularly through the removal of redundant barriers- is one of the most effective and cost-efficient actions available to reverse freshwater biodiversity decline. Yet the UK currently lacks a strategic national target for river reconnection and has failed to implement long-promised fish passage legislation designed to address historic barriers.



Harrison's Weir. River Tame, Stockport.

This report sets out the scale of the challenge, the ecological and legal case for action, and the policy reforms needed to restore healthy, connected rivers across the UK.

THE SCALE OF RIVER FRAGMENTATION

Artificial barriers are now a defining feature of the UK's river network. **We estimate there are over 60,000 man-made barriers in the UK, including approximately 38,000 culverts and 17,000 weirs.** Many structures date from previous centuries and are no longer required for their original purpose.

Although most barriers are relatively small, often less than one metre high, their cumulative impact is substantial. Less than 1% of barriers are equipped with fish passage facilities, leaving the overwhelming majority as obstacles to fish movement.

The effect is not limited to individual structures. Research consistently shows that multiple small barriers can collectively have a greater impact on fish migration than a single large obstruction. In many lowland and urban rivers, fish encounter a succession of barriers that progressively reduce the likelihood of successful passage. The result is a highly fragmented river network that no longer functions as an interconnected ecological system.

Obselete barriers

Obsolete barriers can impede or block fish passage entirely, whilst no longer serving their intended purpose. Many obsolete river barriers date from the Victorian period, where landowners built them to secure water rights and power mills and factories.

Wright's Folly, on the River Goyt, was built in 1804, and has never been used for any purpose, owing to legal disputes which arose over water rights. Instead it has remained unused for over 200 years. It's low height and the removal of larger barriers downstream in recent years has meant that salmon a recently been returning to and spawning in the Goyt, yet it still remains an obstacle to fish passage.

Wright's Folly Weir, River Goyt, Stockport.

WHY CONNECTIVITY MATTERS

Connectivity is fundamental to healthy river ecosystems.

Fish move throughout river systems for a variety of reasons, including reproduction, feeding, refuge from adverse conditions and dispersal. When rivers become fragmented, populations become isolated and less resilient. Reduced genetic diversity increases vulnerability to disease, environmental change and local extinction.

The impacts are particularly severe for migratory species. Atlantic salmon, sea trout and European eel rely on unobstructed migration routes between rivers and the sea.

Barriers can:

- Prevent access to spawning and nursery habitat;
- Delay migration, reducing reproductive success;
- Increase stress and energy expenditure;
- Increase mortality rates;
- Reduce overall population resilience.

Evidence suggests that even relatively small barriers can reduce successful fish passage by 50–80%. Where multiple barriers occur in sequence, their effects compound rapidly.

The consequences are already evident. Hundreds of English rivers fail ecological assessments because of barriers to fish migration and river impoundment. In 2023, 674 rivers failed to achieve good ecological status in England alone because of barriers.

Several of the UK's most threatened freshwater fish species are directly affected by river fragmentation. Of the 7 species of fish classified at risk of extinction in the UK by IUCN, barriers are explicitly cited as one of the driving forces of decline in 4 species (European Eel, Allis Shad, Atlantic Salmon and Twaite Shad).

Atlantic salmon jumping a barrier.

WIDER ENVIRONMENTAL IMPACTS

River barriers affect far more than fish movement.

Disruption of Natural Sediment Processes

Healthy rivers transport sediment naturally from source to sea. Barriers interrupt this process by trapping sediment upstream and starving downstream habitats of the gravels, sands and nutrients needed to sustain biodiversity.

For salmon and trout, clean gravels are essential for spawning. Excessive fine sediment accumulation can smother eggs and reduce survival rates.

Sediment retention also reduces water storage capacity within impoundments and can alter flood dynamics over time.

Water Quality and Pollution

Barriers act as sediment traps, accumulating contaminants including heavy metals, pesticides and industrial pollutants.

Many structures hold decades of contaminated sediment behind them, creating long-term ecological risks. These pollutants can degrade aquatic habitats, affect invertebrate populations and accumulate within food chains.

Rising Water Temperatures

Impounded water bodies change the thermal dynamics of rivers. Small barriers (which are most prevalent in the UK) can increase downstream temperatures by releasing warmer surface water over them. Larger impoundments which release deep sub-surface water can cool river systems. Our aquatic wildlife is not adapted for these sudden and unnatural temperature changes.

This presents a growing threat to cold-water species such as Atlantic salmon and trout, particularly as climate change drives more frequent periods of extreme heat. Elevated water temperatures can reduce survival, increase disease risk and limit suitable habitat availability.

Barriers degrade water quality

The River Mole, a tributary of the Thames, contains sluice structures built to hold water at a higher level for aesthetic and flood-risk reasons, turning a naturally variable river into a static, impounded one. The Environment Agency outlined the negative consequences of the sluices as follows:

Impounded water is poorly oxygenated, prone to summer algal blooms that strip out further oxygen, and carries a much greater risk of fish kills than free-flowing sections.
Pollutants, rather than being flushed through, settle into fine sediment on the riverbed and are only released when the gates are opened at higher flows. When the sediment is released, it smothers and pollutes the gravel beds downstream.

While there was consideration for removing all gates as part of the Lower Mole Flood Alleviation Scheme, recent updates indicate the Environment Agency is mostly focusing on repairs and maintenance. Complete removal of the sluice gates is no longer considered viable for all structures, and public consultations recognised local desire to retain current impounded water levels, rather than prioritise restoring natural flow conditions to the river.

Zenith Sluice on the River Mole, which currently prevents fish passage.

Restoring connnectivity

The evidence supporting barrier removal is clear and growing. When obsolete barriers are removed, rivers frequently show rapid ecological recovery.

Benefits include:

- Reconnection of habitats from headwaters to estuaries;
- Increased fish movement and recolonisation of upstream reaches;
- Restoration of natural sediment transport;
- Improved habitat diversity;
- Enhanced ecosystem resilience;
- Increased biodiversity.

Studies from across Europe and North America demonstrate that fish populations often respond within a few years of barrier removal.

Fish passes can play an important role where removal is not feasible. However, even well-designed fish passes rarely achieve complete effectiveness and may not work equally well for all species or life stages. By contrast, removal restores natural connectivity for the entire ecosystem.

Consequently, barrier removal should be considered the preferred option wherever structures are redundant or provide limited public benefit.

Barrier removal

Two concrete flow-gauging weirs on the River Gelt's tributaries have been major barriers to fish migration since their construction in 1998. Electrofishing surveys confirmed both weirs were impassable for resident brown trout and sea trout, while very few migratory salmon were found upstream.

In 2024, the Wild Trout Trust removed both weirs in under two weeks, at a cost of around £36,000. Fish can now reach vital spawning and nursery habitat upstream unimpeded, and the channel is beginning to naturalise as natural sediment transport processes re-establish.

New Water Weir before (top) and after (bottom) removal, River Gelt, Cumbria.

THE POLICY AND LEGAL GAP

The need to maintain river connectivity is not new. Concerns about barriers date back to the Magna Carta, which required the removal of fish-weirs from major rivers in order to restore navigation.

Today, river connectivity remains a legal requirement under water environment legislation. The Water Framework Directive (WFD), retained in domestic law across the UK, requires governments and regulators to prevent deterioration of water bodies and achieve Good Ecological Status (GES) or Good Ecological Potential (GEP). River continuity and the ability of aquatic organisms to migrate are recognised components of ecological status. However, progress has been slow.

River Basin Management Plans (RBMPs) are intended to identify the measures needed to achieve environmental objectives. In practice, barriers are frequently addressed through exemptions based on technical feasibility or cost considerations, resulting in limited action on the ground.

Successive governments have also failed to implement Fish Passage Regulations first proposed in 2009. These regulations were specifically designed to address historic barriers and help fulfil WFD obligations and to make it easier for regulators to remove barriers. Despite repeated commitments, we still don't have such laws.

This policy failure has contributed to continued ecological decline and growing legal concern.

In 2025, WildFish submitted a complaint to the Office for Environmental Protection (OEP) regarding Defra's failure to adequately address barriers to fish migration.

In January 2026, the OEP confirmed that there may have been failures by Defra and the Environment Agency to comply with obligations under the Water Framework Directive Regulations, particularly in relation to River Basin Management Plans and fish passage measures.

The OEP is currently seeking assurances that future plans will contain sufficient measures to address barriers that prevent fish movement.

Barriers are a driver of the decline of Twaite shad, an endangered species in the UK (Photo: Jack Perks).

Fish passage has to be considered at catchment scale

The Colwick fish pass on the River Trent, the largest in the UK, opened passage past Holme Sluices for salmon, lamprey, eels and other migratory fish. But it's just one barrier solved - fish able to pass Colwick must still negotiate seven more weirs, which are impassable in all but ideal high flow conditions, before reaching prime spawning gravels on tributaries like the Dove and Derwent.

Restoring passage at a single site doesn't restore passage along a river, it just relocates the bottleneck upstream, and full removal of all the weirs isn't realistic here, since it's ruled out by the legal right of navigation the Trent carries.

The Colwick project also illustrates a recurring conflict in barrier mitigation: engineers had to ensure that diverting water into the new fish pass wouldn't reduce flow to the adjacent hydropower turbines or the canoe slalom course. In practice, this meant fish passage had to be designed *around* existing hydro and recreational demands on the water, rather than being treated as the primary use of the flow.

The UK's biggest fish pass was constructed at Holme Sluices on the River Trent, but other weirs remain impassable.

POLICY RECOMMENDATIONS

Restoring river connectivity requires more than isolated restoration projects. It demands a coordinated national strategy supported by clear legal duties, dedicated funding and measurable targets.

1

Establish a National Target for River Connectivity

UK governments should commit to targets for restoring river connectivity, equivalent in ambition to the EU Biodiversity Strategy for 2030, which aims to restore 25,000 kilometres of free-flowing rivers across Europe.

A target should include:

- Measure kilometres of river reconnected;
- Track barriers removed, modified or bypassed;
- Prioritise catchments supporting migratory fish and threatened species;
- Be reported annually through Environmental Improvement Plan monitoring.

Unlike the EU, the UK currently has no specific national target for reconnecting rivers, despite the critical role connectivity plays in achieving freshwater biodiversity recovery.

2

Create a National Barrier Removal Programme

UK governments should establish a funded, long-term programme to identify, prioritise and remove obsolete barriers.

A national programme should:

- Maintain a comprehensive barrier inventory, detailing type, height, width, fish passage status and use status;
- Prioritise barriers according to ecological and hydrogeomorphic benefit;
- Focus initially on redundant and low-value structures;
- Support delivery by regulators, local authorities, Rivers Trusts and environmental organisations.

Unlike the EU, the UK currently has no specific national target for reconnecting rivers, despite the critical role connectivity plays in achieving freshwater biodiversity recovery.

3 Introduce the Long-Promised Fish Passage Regulations

In England, Fish Passage Regulations have been proposed since 2009 but remain unimplemented.

The government should urgently introduce the regulations to:

- Require improvements at historic barriers;
- Strengthen regulatory powers to secure fish passage and/or barrier removal
- Support compliance with Water Framework Directive obligations;
- Improve migration routes for salmon, sea trout, eel, lamprey and other migratory species.

The absence of these regulations remains one of the most significant policy gaps in freshwater conservation.

4 Strengthen River Basin Management Plans

River Basin Management Plans should contain specific, funded and time-bound measures for improving river connectivity within the Programmes of Measures (PoMs) that are detailed enough to cover barriers on all affected waterbodies.

Future plans should:

- Identify priority barriers for removal or modification;
- Include catchment-scale connectivity objectives;
- Establish delivery timetables;
- Assign implementation responsibilities and funding pathways.

Connectivity should become a central component of river basin planning rather than a secondary consideration.

Conclusion

River fragmentation is one of the most widespread and significant pressures affecting freshwater ecosystems in the UK. Thousands of barriers continue to disrupt natural river processes, restrict fish migration and undermine efforts to restore biodiversity.

Scientific evidence demonstrates that the impacts extend beyond fish passage alone. Barriers fragment habitats, isolate populations, alter sediment transport, degrade water quality, trap pollutants and reduce ecosystem resilience. For species such as Atlantic salmon and European eel, already facing severe declines, restoring connectivity is increasingly essential for long-term survival.

The solutions are well understood. Barrier removal consistently delivers the greatest ecological benefits, often producing rapid improvements in habitat quality, species abundance and ecosystem function. Where removal is not possible, effective fish passage measures remain essential.

The UK has both an opportunity and a legal obligation to address river fragmentation.

A flowing river free of artificial barriers.

GET IN TOUCH

www.wildfish.org
info@wildfish.org

WildFish.