

## DEE RIVER

<b>Title</b>		<b>Restoration of freshwater features in River Dee and Bala Lake/Afon Dyfrdwy a Llyn Tegid SAC. LIFEDeeRiver</b>	
<b>Organization</b>		Natural Resources Wales	
<b>Start</b>	<b>End</b>	September 2019	December 2024
<b>Length</b>		55 km	
<b>River typology</b>		Meandering	
<b>Q mean</b>		30 m <sup>3</sup> /s	
<b>Target species/habitat</b>		Atlantic salmon, Brook lamprey, River lamprey, Sea lamprey, freshwater pearl mussel	
<b>Contact</b>		lifedeeriver@cyfoethnaturiolcymru.gov.uk (Natural Resources Wales)	

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## LOCATION & CONTEXT

The Dee River is the largest river in North Wales with 110 km long and a catchment of more than 1,800 km<sup>2</sup>. Its source is in the uplands of Snowdonia in North-eastern Wales, it feeds the waters of Llyn Tegid lake, largest natural lake in Wales, it opens in a broad valley, crosses the Welsh foothills and continues northward until reaching the tidal area (Fig. 1).

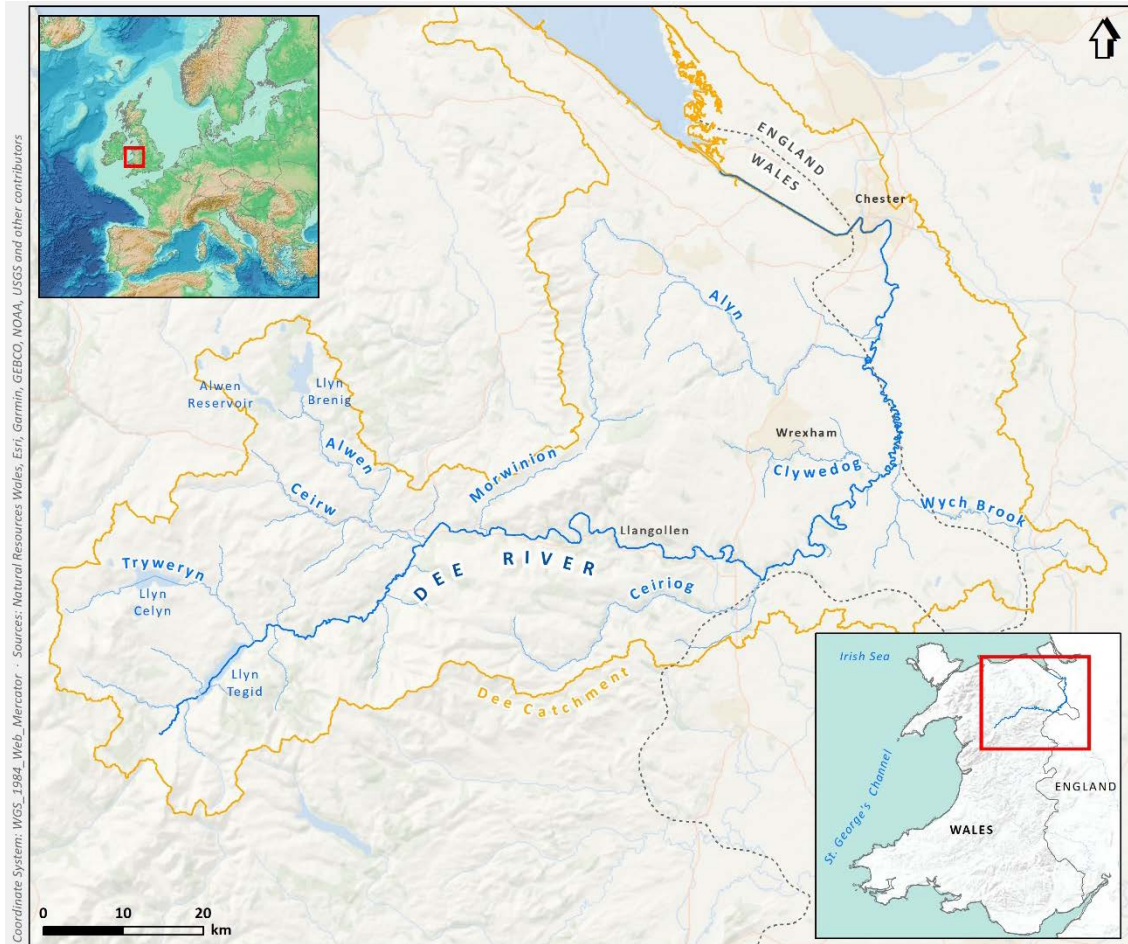


Figure 1. Location of Dee River

The Dee River has been long use for industrial, agriculture and recreational activities, with relevant water extractions with reservoirs at the top of the river that regulate the water flow resulting in it being one of the most highly regulated rivers in Europe. The river is classified as a Special Area of Conservation, although due to the pressures on the river all fish species are classified as in “unfavourable” conservation status.

## PRESSURES & IMPACTS

- 1) Physical modification
- 2) Farming, cattle and sheep grazing
- 3) Pollution to surface waters
- 4) Invasive non-native species
- 5) Water abstraction for 3m people
- 6) Changes to hydraulic and biotic conditions

The objectives of the project are:

- Remove the constraints to fish migration and wider ecological connectivity currently caused by weirs in the River Dee;
- Restore or improve natural riverine physical processes, features and habitats over at least 55 km of river;
- Improve agricultural and forestry land management practices to reduce the input of nutrients and sediment entering the SAC;
- Initiate conservation management for the critically-endangered freshwater pearl mussel (*Margaritifera margaritifera*) by the captive rearing and release at least 3 000 juveniles in suitable locations;
- Establish and build long-term positive relationships with key stakeholders;
- Revise the Core Management Plan for the Afon Dyfrdwy a Llyn Tegid / River Dee and Bala Lake SAC, and increase uptake of agri-environment funding by liaising with farmers.

## OBJECTIVES

Overall objective:

- **Catchment-based approach to rehabilitate and restore natural processes, features and habitats**

Specific objectives:

- **Restoration of natural riverine processes and morphology**
- **Improve Salmon and other fish populations**
- **Improve agricultural and forestry land management practices; reduction in pollution of the river with biodiversity and drinking water benefits**
- **Conservation management for endangered freshwater pearl mussel**
- **Establish and build long-term positive relationships with key stakeholders**

The project contributes to the implementation of the EU Habitats Directive, the UKs Prioritised Action Framework (PAF) for Natura 2000 for 2014-2020, the EU Biodiversity Strategy to 2020 (targets 1 and 2), Water Framework Directive, Floods Directive, and other EU and national policy.

This is a cross-border project, between Wales and England. The actions are delivered in the river Dee, as well as in other tributaries such as Morlas Brook and the Ceiriog River (a key spawning tributary for Atlantic salmon) among others.

**Target species/habitats**

**Salmon, Lamprey, freshwater pearl mussel**

**RESTORATION ACTIONS**

The LIFE Dee River project includes different restoration actions along all the Dee River catchment (Figure 2): barrier removal or permeabilization, buffer strips, revetment, spawning substrate introduction, tree planting.

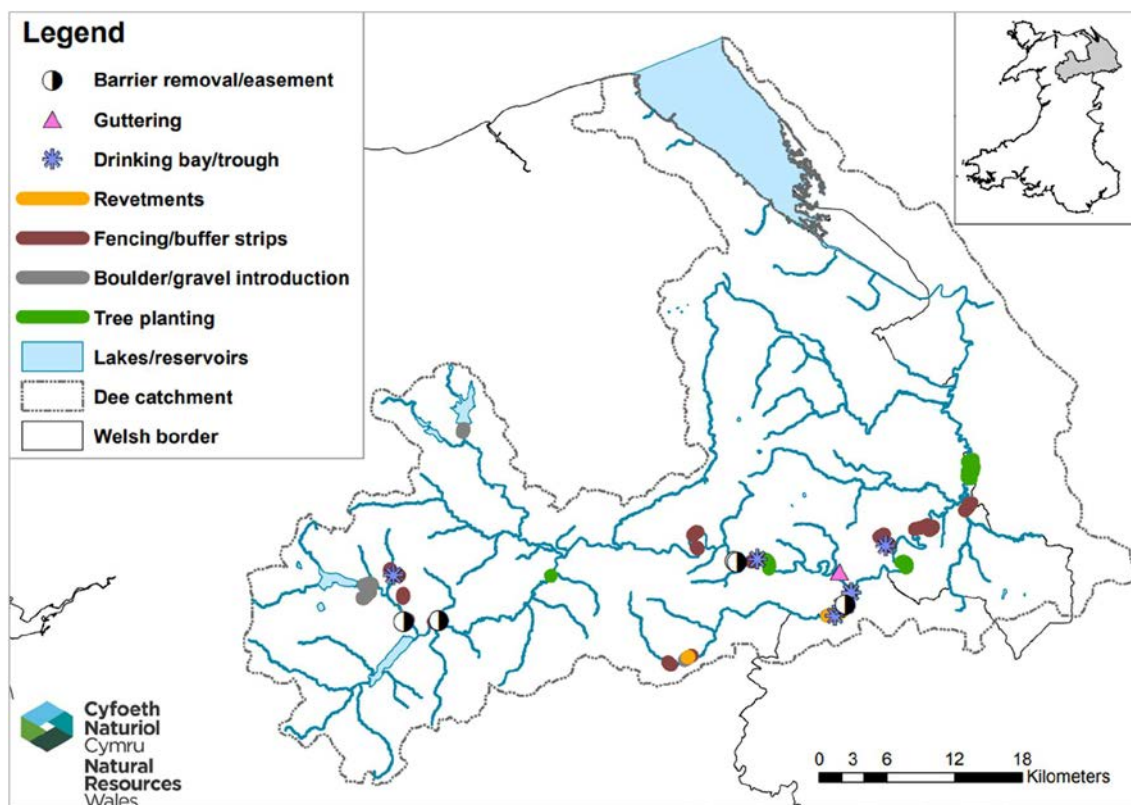


Figure 2. Restoration actions along Dee River and tributaries. Source: Dam removal Europe

**1) PERMEABILIZATION OF WEIRS (REMOVAL OR FISH PASSAGE SOLUTIONS)**

The project seeks to improve fish passage at 11 weirs in the river Dee and tributaries: removing, fully or partially 5 structures, and improving fish passage elements in other 6. So far (May 2023) 3 have been fully removed, in the Afon Tryweryn, Morlas (0.6m-high and 12m wide) and Afon Meloch, and they have partially removed 2 weirs in Llangollen (Upper Weir, 3-m-wide notch and



Lower Weir, 4-m-wide notch) and constructed a rock ramp fish pass at Nant Gwryd, a tributary of the Afon Ceiriog.



Figure 3. Llangollen Lower Weir partial removal works where a 4-m-wide notch has been done. Left, before. Right, after. Photos by Cyfoeth Naturiol Cymru-Natural Resources Wales, LIFEDeeRiver



Figure 4. Weir removal in Meloch River. Left, before removal; Right, after removal. Photos by Cyfoeth Naturiol Cymru-Natural Resources Wales, LIFEDeeRiver

Because of some road improvements and the introduction of gabions into the channel of Nant Gwryd, a tributary of the river Ceiriog, the river incised 1.8 m, preventing the migration upstream of the fish, which was confirmed by electrofishing surveys. This, historically, was an important fish spawning tributary for sea trout and salmon. The solution proposed was a rock ramp of different size boulders and gravels, constructing a stepped ramp that will allow fish to move upstream (Fig. 5). This structure was not included in the project original proposal. It will be monitored with electrofishing survey.



Figure 5. Rock ramp fish pass in the Nant Gwryd, a tributary of the river Ceiriog.

These measures will increase the accessibility for fish and improve the hydromorphology, sediment connectivity of 33 km of river, benefiting all habitats and species (oxygenation, temperature regulation, providing in-channel river gravels for invertebrates to live and fish to spawn, otters to forage, etc.).

One of the objectives of this permeabilization is to increase access for sea lamprey, *Petromyzon marinus*, to an additional 7.4%, as well as improving the habitat.

## 2) HYDROMORPHOLOGICAL IMPROVEMENT: GRAVEL INTRODUCTION

Restoration/improvement of the natural riverine physical processes, features and habitats in at least 55 km of the river.

Specifically, more than 4,000 tonnes of gravel, 4,500 tonnes of boulders and 1,000 tonnes of woody material will be used to improve in total 6 km of river habitats. The quantities of gravel were decided based on prior experience and discussion with colleagues and other organisations (the Wye and Usk Foundation staff). The introduction of gravel is mostly to provide spawning material for salmonids, the introduction of boulders is to provide refuge areas and habitat for all species.

Up to now, 5,500 tonnes of material have been introduced during the first half of the project; more will be added in the last two years. During summer, 2022 gravel and boulders were introduced in the upper reaches of some tributaries (Alwen, Brenig and Tryweryn), as they, all have dams upstream, which retain gravel and sediment. This gravel introduction in addition to the improvement of sediment continuity and channel geomorphology, improves spawning areas, diverse natural habitats for invertebrates, provide much shelter for juvenile fish and other aquatic species. Electric fishing surveys were done before gravel and boulder addition to assess the impact of this action.





Figure 6. Before and after gravel introduction

### 3) HYDROMORPHOLOGY IMPROVEMENT: REMOVAL OF BANK PROTECTION AND RIVERBANK RESTORATION

2 km of bank protection and historic artificial embankments will be removed or breached. So far over 29 km of fencing has been completed and 15,500 trees have been planted.

### 4) FRESHWATER PEARL MUSSEL MANAGEMENT PLAN

Initiation of management plan for the conservation of the critically endangered freshwater pearl mussel. Juvenile pearl mussels from the River Dee stock will be captured, reared and released in suitable habitat, aiming to increase their wild population. The management of this population will continue until its re-establishment. The long-term goal is to help re-establish a healthy, self-sustaining breeding population in the river and promote a lasting recovery in the hope of preventing extinction.

Up to now, fifty adult mussels have been recovered and relocated to the Clywedog hatchery, in the last twelve months these have successfully reproduced (spatting) to develop as larvae (known as glochidia).

### 5) IMPROVE AGRICULTURAL/FORESTRY PRACTICES

Improvement of the agricultural and forestry land management practices with the ultimate goal to decrease the amount of nutrients and sediment that enter the Special Area of Conservation. At least 35 km of land along the river bank is being restored through managed grazing, fencing and planting. The objective is to prevent livestock from poaching the banks, reducing the nutrient and sediment input to the river, and allowing the recovery of the riverside ecosystems. The average width of the buffer strips created is around 10 m, in some places extending to 75 m.



Figure 7. Before and after of fencing riverbanks

Forestry practices introduce an excess of sediment and other contaminants to the river. They have improved forestry infrastructure by installing a river crossing and upgrading 11 forest drain culverts which will reduce pollution risk in 600 ha of forestry in the SAC catchment “*Sediment traps were installed along the culverts as a simple method of catching sediment. The traps involve excavating a hole above or below a culvert to interrupt the flow of the water, this allows particles to settle whilst still allowing water to pass through the outflow, leaving sediment behind in the trap. Diverted water from the traps will also create wet flushes and sumps for the excess water. These flush areas will be managed in future forest resource plans for the removal of conifer trees that will not thrive in the wetter areas and allow deciduous native species of willow and alder to populate*”





Figure 8. Sediment traps and culvert improvements

Additionally, at Penaran, a bridge will be constructed on the main arterial forest road to replace the existing river crossings. Working closely with farmers, will help improve agricultural practices to reduce the input of nutrients, chemicals and sediment entering the SAC.

## MONITORING

The project is in process, with some monitoring actions having started, and results will be available in the coming years.

### Monitoring of lamprey

The project is monitoring the migration of both lamprey species: sea lamprey (*Petromyzon marinus*) and river lamprey (*Lampetra fluviatilis*). Data collection on “the time of year that they enter the river, how they migrate upstream, how far they travel, any barriers to migration, and establish the key areas where they spawn.”

Information about the population size is also collected through intensive trapping program capturing adult lamprey along with visual counts.

A sonar camera that registers sound to collect migration data is being used, which allows to collect data even during darkness hours or not clear water (Chadwick and Mowat, 2021). This has been successful: “In early 2022, we successfully observed river lamprey migrating into freshwater for the first time and the recordings from summer 2022 are currently being analysed to obtain an approximate run size for adult sea lamprey”.

As a part of citizen science they are working with members of the public and other organisations to carry out lamprey surveys for river lamprey, which spawn in mid-late April 2023. A team of spotters report any river lamprey spawning to the project managers so they can map their distribution. The same work has been done in June 2023 when the sea lamprey are spawning within the Dee.

Acoustic tagging work has also been carried out on river lamprey, allowing us to understand their current range within the river. 25 river lamprey were tagged over the last few months, and the data will be gathered from a network of around 45 receivers deployed in the river to look at their movements.

### Electrofishing surveys of permeabilized obstacles

Electrofishing surveys in 2020 and 2021 indicated that juvenile Atlantic salmon were present only below the Morlas Weir, meaning that it had been impassable to migrating adult individuals, at least for three consecutive years.

The ecological benefits of the Morlas Weir removal became obvious less than a year after the works were completed. In August 2022, juvenile Atlantic salmon were collected through electrofishing at three different locations above the site of the former barrier, indicating that adult Atlantic salmon have already reached and exploited the newly open section of the river.

### Observation of spawning beds

Observation of spawning beds (redds) to assess the results of obstacles permeabilization and gravel introduction, especially on salmon numbers. Redds were observed on the gravels introduced to the Afon Tryweryn, Alwen and Brenig.

## ACHIEVEMENTS

The LIFE Dee River project is ongoing. Up to now, May 2023, the progress is:

- 15,500 trees planted
- 5,500 tonnes of gravel, boulders and woody material introduced into the river
- 29 km of riverside fencing completed
- 11 forest drain culverts upgraded
- 7 barriers removed or adapted
- 1 new forestry river crossing installed

## BUDGET

The budget of the project is 8,105,116 €.

### Funding

The LIFE Dee River project (LIFE18 NAT/UK/000743) is funded by the EU LIFE programme, Welsh Government, Environment Agency, Dŵr Cymru/Welsh Water and Snowdonia National Park Authority. Welsh Government, Environment Agency, Dŵr Cymru/Welsh Water and Snowdonia National Park Authority



## SOCIAL IMPACT

As the project is in process, there are not still measurable social impacts. The project seeks the *“establishment of productive, long-lasting relationships with the relevant stakeholders (local communities, landowners and contractors). More than 50 events will take place during the project’s lifetime including river walks, talks, workshops, open days and a one-day river festival, aiming to encourage people to get involved with the project to understand the biological, social and economic value of the river, its habitats and species”*.

## SIMILARITIES WITH DORDOGNE RIVER

- Fish species habitat and migration recovery.
  - ✓ The Acoustic Fish Tracking in Action could be an interesting monitoring tool for Dordogne LIFE project managers.
- Sediment continuity and gravel addition.

## WEBSITES

[https://webgate.ec.europa.eu/life/publicWebsite/index.cfm?fuseaction=search.dspPage&n\\_pr oj\\_id=7322](https://webgate.ec.europa.eu/life/publicWebsite/index.cfm?fuseaction=search.dspPage&n_pr oj_id=7322)

<https://naturalresources.wales/about-us/what-we-do/our-projects/nature-projects/life-dee-river-project/?lang=en>

<https://damremoval.eu/portfolio/llangollen-wales/>

## BIBLIOGRAPHY

Chadwick, P., Mowat, R. 2021. Acoustic Fish Tracking in Action. The Bala Sluices Smolt Study and LIFE Dee River Project, North Wales. *Eco*, Summer2021: 40-41.

<http://digital.ecomagazine.com/publication/?m=9890&i=708376&p=40&ver=html5>

Videos:

[LIFE Dee River Project - Tryweryn Weir Removal](#)