Trout in the Classroom

by South Cumbria Rivers Trust for the LIFE R4ever Kent Project

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Trout in the Classroom is part of the LIFE *R4ever Kent*, a collaborative 5-year project between Natural England, South Cumbria Rivers Trust, Freshwater Biological Association, and the Environment Agency.

LIFE R4ever Kent project aims to **revive**, **revitalise**, and **restore** the River Kent system, ensuring it is **resilient** to future changes.

www.r4everkent.co.uk

Trout in the Classroom provides a unique opportunity to get close to these fabulous fish and learn more about life in our rivers, watch a life cycle start and discover how important Brown trout and Atlantic salmon are to the critically endangered Freshwater pearl mussel.

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January 2025

In the Classroom

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The tank is set up to replicate natural river conditions.

Keeping Cool

In winter when the trout spawn, water temperatures are around 6-8°C so each tank is connected to a water chiller to maintain this temperature in the classroom. As the fish develop the temperature is increased, again in line with natural changes, so each chiller has an adjustable thermostat.

Reducing Light

The tank is covered with insulating sheets to help maintain the temperatures and also to reduce light, mimicking riverbed conditions. One side of the tank has a removable panel so you can check on progress. This panel can be removed once the fish are swimming around.

Water Flow

Flowing, bubbling water helps maintain oxygenation around the eggs and later for the fry. Moving water in the river also helps prevent silt settling over the eggs and pushes away waste products. An external filter box is added to the tank set-up to recreate this, but some of the water may need to be changed every couple of weeks to help maintain clarity.

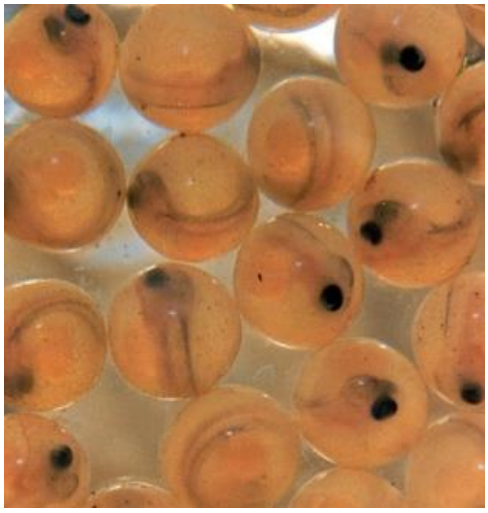
Location of tank

The tank should ideally be placed on a table in a quiet corner, away from as much light or heat as possible. There will be some low-level noise from the chiller and the external filter. The chiller should be next to the tank, with space underneath for the filter box. It will need three sockets. The system will be arranged to avoid any water dripping onto sockets and all pipework will be insulated to reduce the effects of condensation. The tank will be placed on a sheet of polystyrene/carpet to ensure it is level.

The Eggs

The trout eggs you receive will be in the "eyed" stage of development, where two dark spots (the eyes) can be seen in the egg, which is about halfway through their incubation period.

It is important at this stage to check on the tank regularly. You will need to remove any dead eggs – these will be white, check the water temperature and clarity and make sure it stays at 8°, keeping the tank covered.



Hatching - Alevins

This is dependent on water temperature, so at 7°C the eggs may take 60 days to hatch, and at 5°C may take 90 days to hatch. If the temperature goes above 8°, then the eggs will hatch quicker, but the alevins are more likely to develop abnormalities and be unlikely to survive.

After the incubation period, the eggs will begin to hatch and hopefully all of the eggs should hatch within about 4 days.

The baby trout, known as alevins, still have their yolk sac and will feed off this. Alevins tend to stay on the gravel or even bury themselves a little bit.

At this point the water temperature should be raised by **one degree per day up to 13°C** which will aid growth.

The tank will still need to be checked regularly, any dead alevins removed, and the front cover kept on.

Swim Up - Fry

As the alevin use up their yolk sac the trout may start to swim around looking for food. When you see the first fry do this, you can start feeding them.

You can also remove the front cover but **keep the temperature at 13°C** and check the water for clarity.

The trout only need a tiny amount of food, twice a day. Overfeeding can affect the water quality.

You can also add Easy Balance twice a week to boost the water quality (follow the instructions on the bottle provided).

Fry

The trout fry will continue to feed and grow, though you will see some mortalities.

Dead fry should be removed from the tank. Some fry may not feed properly, "pinheads" that have a big head and little body should also be removed as they will not develop properly and will die.

Don't forget….

- Wash hands without soap before carrying out any activities with the tank/eggs/fry (this removes chemicals from soap or creams you may have used)

- Wash hands with soap after all your checks and actions

- Do not put your hands in the tank if they have any open cuts or wounds

- Use the checklists to keep track of your actions, cleaning and feeding

- Always dry your hands before dealing with any of the electrical appliances

- Be careful around the tank area to avoid any knocks

- Wipe up any water spillages as soon as you can to avoid slips

Key Points

- The equipment provided should be checked regularly to make sure it is working properly, with the external filter and chiller maintaining the temperature and oxygen levels.

- The water temperature should be checked every day, as there may be a difference between the temperature on the chiller to the actual temperature of the water, which should be 6-8°C. The cover should remain on the tank except for when the checks are being carried out.

- Failed eggs (white in colour) should be removed as soon as possible.

- When lifting open the tank lid please ensure that the intake pipe stays in the water. If this lifts out, then the water will no longer circulate through the filter and chiller, and the system will have to be restarted.

Intake pipe must stay in the water

Maintaining Water Flow and Temperatures

The system is set up to mimic river conditions, with an external filter, aerator and chiller.

307 Fluval Filter

This is the external filter which removes waste and filters out ammonia and phosphate. The end of the intake tube must be always in the water otherwise circulation will stop. The filter takes water in from the tank, passes it through filter media then passes it out to the chiller, then back into the tank.

The water needs to circulate through the system before the chiller can be switched on. If the circulation is interrupted, then it needs to be restarted.

1. Turn filter and chiller off and unplug.
2. The filter needs emptying of water before restarting. To do this:
    a. Disconnect the canister cover from the canister box, watch out for water leaking from the hoses.
    b. Empty out the water then securely fasten the cover back on. If you take out the media, ensure that it is put back in the correct order.
    c. Ensure the AquaStop valve (small grey lever) is fully down (open).
    d. Check that the intake pipe is in water.
    e. Manually pump the instant-prime handle a few times until you hear water being drawn into the unit and circulating through. This may take a couple of minutes as the addition of the chiller extends the circulation.
    f. Return prime handle to the down position, and water should begin to flow through the system.
    g. Once circulating the filter can be plugged in, it should start to work straight away.
3. The chiller can then be plugged in and switched on.
4. Check the temperature and reset as necessary.

Chiller

The chiller should only be switched on once the water is circulating through.
To set the temperature:

1. Switch on the chiller
2. Press and release the "set" button. The display will show "set"
3. Press "set" again and display will show a value eg. 2.5°C
4. Use the up/down arrows to set required temperature – initially 7°C
5. Press "set", display will show "set"
6. Press FNC to return to temperature reading

The temperature will need to be increased at the alevin stage, 1° each day until 13°C is reached. Follow steps 2-6 to do this.

Troubleshooting

The key to the project and solving problems is observation. What is the water like? Are the fry dying in large numbers? Are the fry eating?

Everyone should expect to lose a few eggs and fry as death is a natural part of fish development. Some eggs never hatch, and some alevin never progress to fry stage but as the fish hatch, grow and age then survival rates should improve.

There are two naturally high mortality periods in the trout life cycle; firstly at the egg incubation stage and secondly when the trout first learn to feed. Some trout fry never learn to feed.

Losing many free swimming fry is an indication that the tank environment is not healthy so you may need to change a bit more water – up to 50% (with Aquasafe), clean the sides of the tank to remove algae, and clean and change the filters. As the fish grow, they do produce more waste which can affect the water quality. We can change the sponges/media in the external filter box if needed.

Overfeeding can negatively impact water quality and clog up the filter system so remember to remove any uneaten food after 10 minutes. A tiny bit of food two to three times a day is better than a larger amount once a day.

It is really important to remove dead eggs, dead fish and waste matter as soon as possible. This will reduce spreading infection, reduce stress and help keep the water in a better condition. Checking the tank at least once a day especially in the critical periods will help keep your trout alive.

If you have any problems with the tank such as a leak, then contact us as soon as you can. Please remember that with a chiller system there will be condensation. You may want to wipe up excessive amounts.

If power is lost to the system for more than an hour or two, you will have to carry out a fish rescue. Fill the grey bucket ¾ full of tank water, add the fish and battery-operated aerator and keep somewhere cool as a temporary measure. Please contact us as soon as you can.

Kath Smith 07825873109 Emma Wright 07570259700

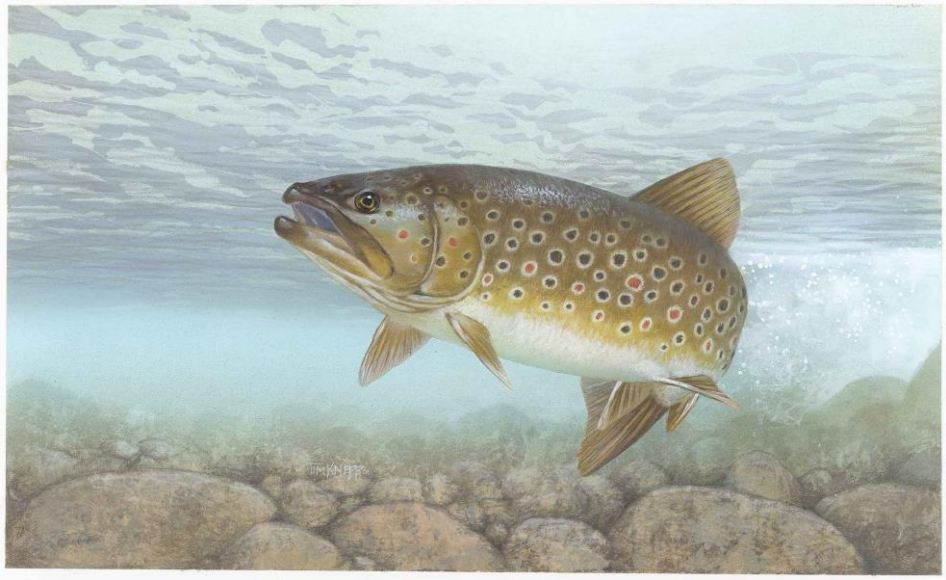
Trout in the River

Why trout?

The eggs provided for *Trout in the Classroom* come from Brown trout. Brown trout and Atlantic salmon play a key role in the life cycle of Freshwater pearl mussel, so we need to ensure these fish thrive in the River Kent system.

Brown Trout

Brown trout (*Salmo trutta*) are native to the UK and are part of the salmon family (**salmonid**). These medium to large fish have a golden body with paler ringed dark spots and a creamy-yellow belly. They can grow up to 80cm in length and weigh as much as 14kg and are smaller than Atlantic salmon. The lifespan of a brown trout is usually 15-20 years.



Brown trout are not as widespread or abundant as they used to be so are now classed as a priority species. Brown trout are an **indicator species** and give clues on the health of a river. By making our rivers good for trout they will be good for a wider range of species.

Rainbow trout are a non-native species, introduced into the UK from America. Rainbow trout can be identified by their purple side stripe. Rainbow trout are on the whole non-breeding, with the exception of a small population in the River Wye in Derbyshire.

Brown trout are very adaptable and can live in both fresh water and sea water. Some brown trout will remain in a river throughout their whole life and are described as resident trout.

Others will **migrate** out to sea when they are two to three years old. These **smolt** turn silvery and adapt their body and internal organs to live in salt water. After a few years the sea trout will return to the river to **spawn**. These trout, like Atlantic salmon are **anadromous**.

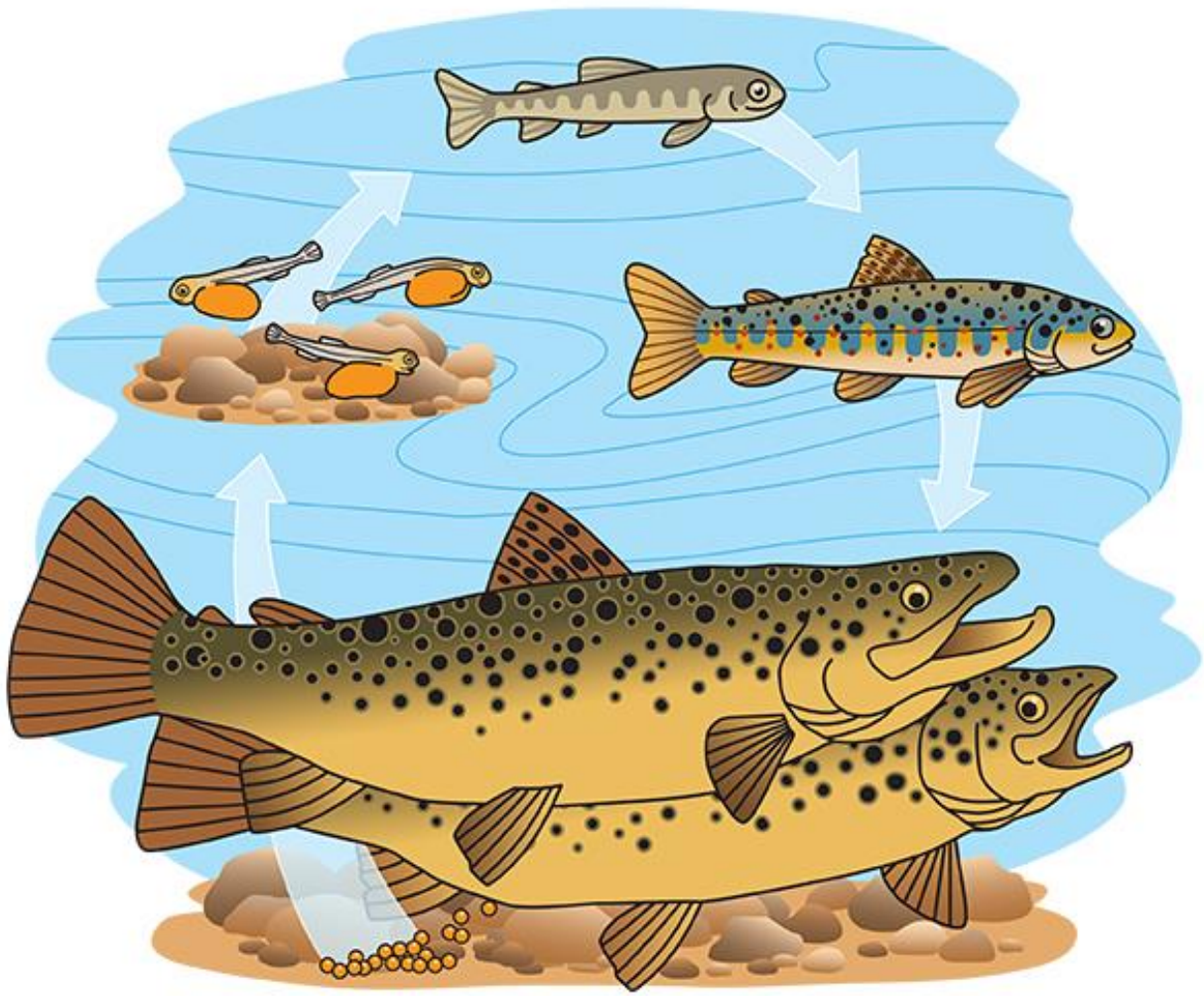
Trout are very territorial and will chase away other trout from their feeding areas and hiding places. They are hard to spot as they are well camouflaged in a river and prefer to lurk under bridges and overhanging plants and trees.

Brown trout spawn in the winter (Nov – Jan) when the river temperatures are much cooler. Females create depressions called **redds** in the gravels on the riverbed and lay their eggs in them, which are then fertilised externally by the males before being covered over. A female trout may lay 2000 eggs in one redd.

The eggs remain in the gravels and take two to three months to hatch. These little fish are known as **alevins** and after hatching will feed off its attached **yolk sac** for two to four weeks, staying hidden in the gravels. Only when the egg sac is almost finished do the fish begin to feed on freshwater **invertebrates**, venturing out of the gravels. These young fish are known as **fry**. After a few months the fry become known as **parr** or fingerlings, and are more noticeably marked, with fingerprint-like patterns on their body.

Trout lose these markings when they become adults, developing the distinctive paler ringed dark spots.

Life cycle



Trout and Freshwater pearl mussels

Trout and salmon have an amazing relationship with Freshwater pearl mussels, a species of **mollusc** that is classed as **critically endangered** by the International Union for Conservation of Nature (IUCN). There has been a decline in population of 90% in the last one hundred years, putting Freshwater pearl mussels firmly on the IUCN Red List.

www.iucnredlist.org/species/12799/3382660

Freshwater pearl mussel (Margaritifera margaritifera) is an incredibly rare shellfish. It is a **bivalve**, meaning its case is in two parts held together with a hinge. The shell protects the soft body of the mussel. They have a large muscular "foot" which anchors them to the riverbed.

Pearl mussels are **filter feeders**. The mussel has a siphon which sucks up the water, passing it through the gills where tiny pieces of plant and animal are trapped and absorbed as food, the "cleaned" water is then squirted back out.

One adult mussel will filter around 50 litres of water a day, making them amazing cleaners, improving the river environment for a wide range of species including trout and salmon as well as freshwater invertebrates.

Mussels like most river species need clean, well oxygenated water and a riverbed with gravels and rocks free of silt and without too much algae. **Sediment** and **silt** can affect how mussels breathe and feed. They are very sensitive to pollution so are also an indicator species.

The mussels have a very interesting and unusual life cycle and relies on the presence of salmon and trout. Without these fish the young mussels will not develop into adults.

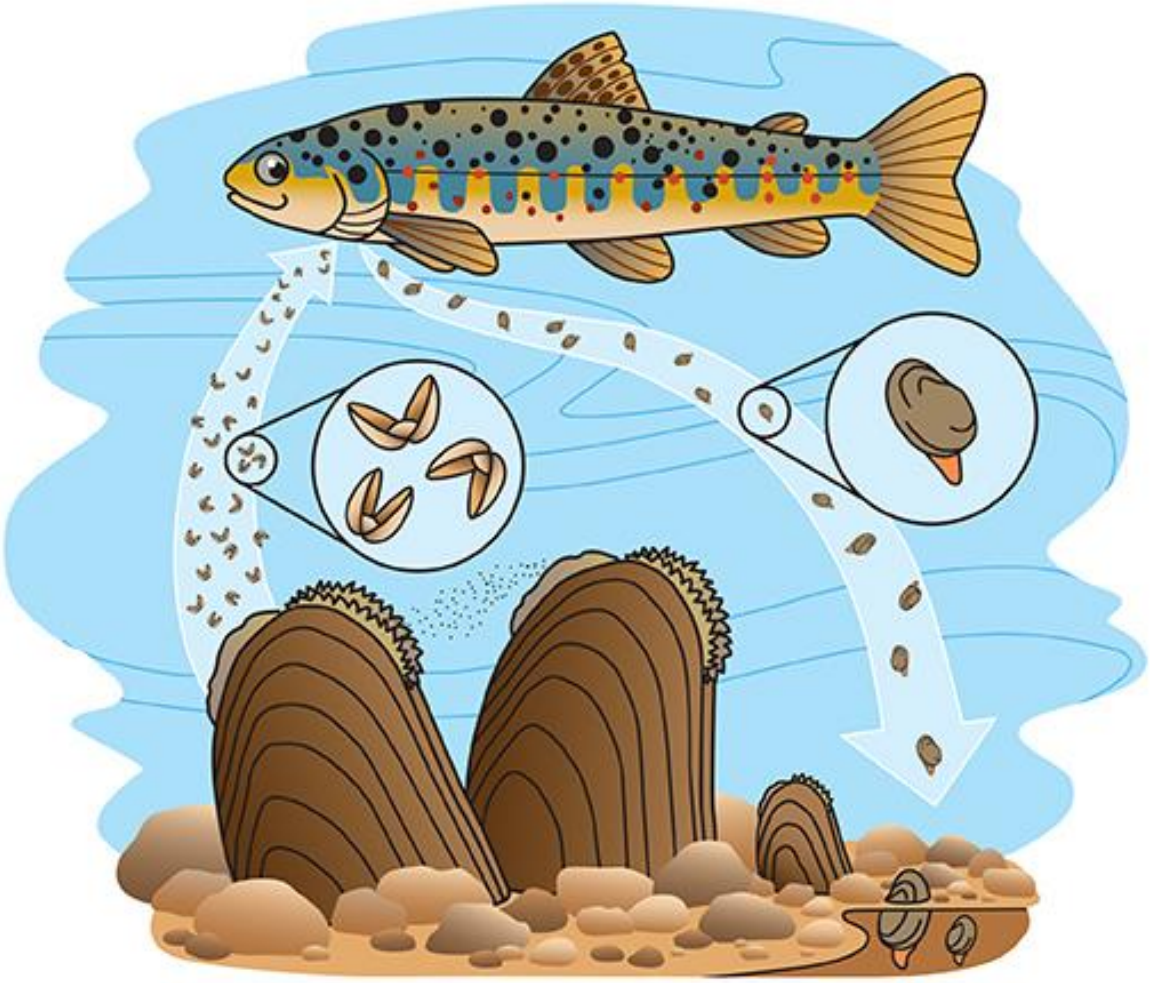
An adult mussel releases 1-4 million **larvae** in the summer. Most of these **glochidia** are swept away but some get inhaled by young salmon and trout into their gills. The tiny glochidia attached themselves firmly to the gills where they stay until the following spring, so for about 9 months. This does not harm the fish in any way but helps the young mussels thrive in the safe, oxygen-rich nursery.

When ready the small mussels drop off the fish and bury themselves in the gravels at the bottom of the riverbed. At this stage the mussels are about 0.5mm. If they land in mud, or silt then they will not survive. It is important that the gravels are just the right size to protect the little mussels and allow oxygenated water to swirl around them.

Mussels grow very slowly; they become adults at 10-15 years old when they start to produce eggs. They carry on growing and each year a layer is added to their shell, which you can sometimes see as a ring in the shell. The mussels can be as long as 15cm.

Only a few mussels will make a pearl. This happens when a **parasite** gets into the shell and the protective "mother of pearl" coating that lines the inside of the shell grows over it in layers. These natural pearls can vary in size, shape, and colour.

Freshwater pearl mussels can live for one hundred years but human impact, poor water quality, illegal harvesting, and climate change mean that they are now at risk of extinction.



Did you know……

- Trout don't have scales for the first month of its life
- Trout have elliptical eyes – this means they can watch out for food and predators at the same time
- The biggest brown trout caught in a British river weighed 14.4kg
- Four hundred in one million mussel glochidia will successfully attach to suitable fish
- Of these 400, 20 will survive on the fish host
- Of these 20, just one or two will fall into suitable habitat and continue to grow
- Between 3- and 5-years Freshwater pearl mussels develop gills
- There are more than 60 weirs on the rivers in the Kent catchment – that's a lot of leaping by salmon and trout
- The River Kent is home to Freshwater pearl mussel, white-clawed crayfish and bullhead – which makes it unique!
- Freshwater pearl mussels are a protected species
- European eels are also critically endangered, are on the IUCN Red List and are found in our rivers too!

Threats to trout and freshwater pearl mussels

Habitats & Water Quality

- Man-made changes to rivers such as straightening and **revetment** work can reduce the range of suitable habitats, making fish and invertebrates more vulnerable to predation as they have fewer places to hide.

A section of river modified; no variable flow, or vegetation along the edge to hide in

- Declining water quality impacts on fish and invertebrate populations via the food chain.
- Pollution incidents can wipe out freshwater invertebrates, small fish, and large fish.

Sewage fungus – evidence of sewage pollution in a river

The way we use land by our rivers can also affect water quality and freshwater habitats.

- Soils from fields that have been ploughed or grazed right up to the river edge can wash into the water when it rains, adding extra sediments and silt.
- The silt settles on the riverbed, reducing the amount of oxygen that flows through the gravels to the fish eggs and fry.
- Sometimes there can be so much silt going into the river that the eggs and fry are smothered completely.
- Fertilisers that have been added to the fields can also wash away into the nearby watercourse when there is heavy rain.
- Fertilisers are a nutrient which helps things grow, but too much in the water can encourage lots of algae to grow, which is bad for the river and the wildlife.

Barriers to migration

- Salmon and some brown trout migrate out to sea before returning to the rivers to spawn.
- Barriers in the form of weirs can hinder this movement, often trapping the fish in front, making them an easy target for predators.
- Leaping the barriers also takes a lot of energy and can also result in some injuries.
- Once heading out on their migration fish undergo a transformation so have a limited time to make it out to sea or back to the river.

This is a double weir; the upper step is 1.4m high. The lower step is 40cms high

Climate Change

- Scientists are seeing the ocean currents slowing and moving due to the effects of climate change which will impact on fish migration.
- Our rivers warming up which might sound good to us, but for a lot of wildlife it is bad. Increasing periods of drought can also dry up smaller streams, forcing fish into smaller pools with a greater risk of predation.
- Warmer, stiller water has less oxygen in it, which affects fish and their food source.
- Warmer conditions can also increase some types of algae, including toxic blue-green algae.
- Additionally, climate change is causing more flood events which is bad for our river wildlife.

Helping our Rivers

There are many ways we can help fish and our rivers.

- Raise the profile of fish and other species through education and engagement just like Trout in the Classroom
- Encourage people to learn more about rivers through education and engagement
- Improve river habitats through engaging with landowners and people to reduce pollution, nutrient enrichment, and sedimentation.
- Make river habitats better through practical work such as making rivers 'wiggly' again and varying water flow.
- Plant trees. Trees help shade the river, keeping the water cooler in the summer. Tree roots help to stabilise riverbanks and overhanging branches in the water provide a safe place for little fish and invertebrates.
- Improve migration by removing barriers, bypassing them, or installing fish passes and ladders.

Ideas for the Classroom

- Keep a diary of Trout in the Classroom or make a video.
- Tell the rest of your school about it in an assembly – you could act out the parts of a life cycle
- Make a food chain for trout and freshwater pearl mussel. Think of fun names for its food.
- Write a poem about trout, how they move and how they look.
- Make or draw some trout. Do they need to be camouflaged?
- Draw a river that is full of wildlife, how may it look?
- Think about endangered wildlife. Can you name any other species that are found in Cumbria or England?
- Make some pearl mussels or draw a picture of the mussel's life cycle.
- Complete the wordsearch.

Visit a River

- Explore your local river.
- Can you see any places where trout might live?
- Can you spot any barriers?
- Can you find some freshwater invertebrates?
- What natural features can you see?



Our Rivers

A healthy river system is key for good **biodiversity** with it often reflecting the health of the surrounding environment. Ideally a river should be as natural as possible with good bankside and in-river vegetation, water flow variation and be full of wildlife. Trees add shade, while tree roots give stability to the banks, reduce erosion, and provide river corridors for a range of species from birds to bats.

The majority of our rivers have been altered in some way or other and are under a lot of pressure as a result of human impact from development and water extraction, to how we manage the land. This often results in a lack of suitable habitat for fish, birds, mammals, and invertebrates and often alters flow. Water flow is important for sorting gravels, moving sediments, and circulating oxygen, all of which are vital to sustaining healthy fish and invertebrate populations.

Good water quality is really important for rivers and wildlife. Water quality is classified under the Water Framework Directive, assessing the water on ecology and chemical levels. Originally the aim was for all UK waters (lakes, rivers, streams) to achieve "good" status by 2015, this has since been extended to 2021, then 2027.

- In 2019 no water achieved good status, with all failing on chemical assessments, and only 14% were classed as good ecologically.

- Research shows that in the last 100 years we've lost an estimated 90% of our freshwater habitats across the world.

- Freshwater **ecosystems** are the fastest declining of all, with a 76% decline in freshwater species in the last 30 years.

- Since records began, 26% of UK freshwater species have become extinct.

Freshwater invertebrates are vital to supporting a wide range of other freshwater species as well as birds and bats. Many freshwater invertebrates are intolerant of pollutants so can be used as an indicator of water quality. Key species include stonefly, caddisfly, and mayfly, as they all have their larval stage in freshwater.

The River Kent

The River Kent flows for approximately 20 miles from the hills of Kentmere, through Kendal then to Morecambe Bay.

Its main **tributaries** are the River Gowan, The River Sprint and the River Mint.

The River Kent and its wider **catchment** is very special and has lots of **designations**.

In the UK it is protected as a **SSSI** – A **S**ite of **S**pecial **S**cientific **I**nterest. This is because of the rare species and special habitats that are found within it. It is also classed as a Principal Salmon River.

It is recognised as being an important place in Europe as a **SAC** – A **S**pecial **A**rea of **C**onservation

It is also recognised as being an important place in the world and forms part of the Emerald Network.

Glossary

Salmonid – a fish of the salmon family e.g. brown trout, Atlantic salmon

Indicator species – a species that is sensitive to change in the quality of its environment. This could be lots or none depending on whether conditions are good or bad.

Migrate – to travel from one place to another

Smolt – a young salmon or trout that has adapted its body to go out to sea

Spawn – to deposit eggs

Anadromous – a fish which spends most of its life at sea but returns to the river to spawn

Redd – a hollow in the riverbed made by a female salmonid in which to lay eggs

Alevin – newly hatched fish that has a yolk sac attached

Yolk sac – contains food needed for growth

Invertebrate – an animal without a backbone

Fry – young fish that feed for themselves

Parr – next growth stage of fish after fry and before adulthood

Mollusc – a type of animal with a soft body, with most having a hard shell to protect it

Critically endangered - something that is at risk of extinction

Bivalve – a shell with two parts hinged together

Filter feeder – animal that feeds by sieving its food from water

Sediment – particles/matter that drops to the bottom of the river

Silt – very fine particles of stone smaller than sand

Larvae – newly hatched insect in the first stage of its life cycle

Glochidia – tiny larvae of freshwater pearl mussel

Parasite – an animal that feeds off or lives on another species

Biodiversity – a range of wildlife in a particular place or habitat

Ecosystem – a group of living things that interact with each other and their non-living environment including water, soil and air

Revetment – man-made wall put up along a bank to reduce erosion

Tributary – a river or stream that flows into a larger river

Catchment – an area of land where water flows from into rivers, streams, and lakes

Designation – saying that a place is particularly special or important

LIFE R4ever Kent

This is a collaborative 5-year project between Natural England, South Cumbria Rivers Trust, Freshwater Biological Association, and the Environment Agency. It is co-funded by LIFE, part of the European Commission. The project started in October 2021 and will run until September 2026.

LIFE R4ever Kent aims to revive, revitalise and restore the River Kent system, ensuring it is resilient to future changes. Habitat restoration, invasive species control and species recovery research are key to the survival of Freshwater pearl mussel, White-clawed crayfish, Bullhead and a healthy wider freshwater ecosystem.

A partnership project. Co-funded by the European Union.

Co-funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them.

Checklists & manuals

Risk Assessment