

RIVER ECOSYSTEMS

SUPPORT MATERIALS

INSIDE

This workshop encourages visual learning through the use of group work and printed materials. We recommend clearing some space in your room, taking yourselves into some open space to complete some of these activities.

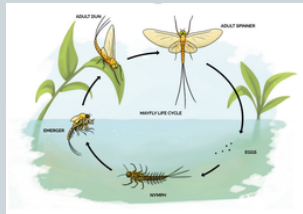
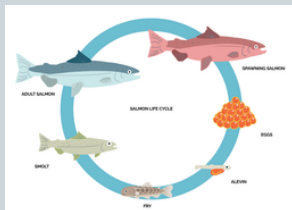
OVERVIEW

This workshop explores the creatures that live in our rivers, delving into their lifecycles and connections between one another. There is an opportunity to further your river investigations by exploring what happens when humans interrupt our ecosystem balance. To encourage practical learning, print-outs are provided to get students up and moving around the workspace.

Subjects: Science, Geography
Age Range: 7-11 years
Location: Classroom
Time required: 1-2 hours

KIT LIST

- Printed mayfly life-cycle - [link to downloads]
- Printed salmon life cycle - [link to download]
- Printed wildlife images - [link to download]



PREP

Before the workshop, print out one copy per group of the PDF 'River Ecosystems' linked on the website with this pack. Groups can be of any size for this workshop.

It is recommended that these printouts be laminated and shared between classes to allow them to be used for multiple workshops.

Mix the images up so as not to give any clues away during the workshop; however, ensure they stay within their correct pack.



1

SLIDES - What lives in our Rivers?

Setting the scene: Explain to learners that for this session, we will be exploring what wildlife lives in our rivers and how they are all connected to one another, creating our river ecosystem. We will start by 'testing' the learners' existing knowledge of river species.

Use the slides provided to work through each taxonomy class: Mammals, Birds, Fish, Molluscs, Invertebrates and Plants. Give the learners a chance to identify each species before clicking onwards to the answer. This can be a timing exercise - make it a quickquiz to speed this section up if needed.

Slide 1 - Mammals

Water Vole: This species has burrows at the side of the river; you may see small holes in the riverbank kept tidy from vegetation that belongs to water voles. They feed on grass, weeds and vegetables.

Eurasian Otter: An Otter house is called a 'Holt', this is usually a hide under shrubs or tree branches. Otters feed mainly on fish and molluscs.

Daubentons Bat: This nocturnal creature is most active at dawn and dusk when they appear from their roost to feed on invertebrates. They have a preference for rivers as they prefer large open spaces to hunt their prey.

Eurasian Beaver: This damn building species, creates habitats that support multiple other river species. They are herbivores, feeding on plants and fruits.

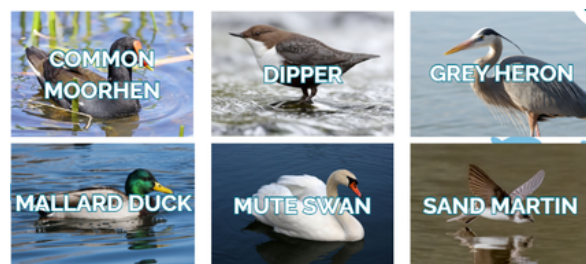
**Slide 2 - Birds**

Common Moorhen: This species loves all wet areas. They are omnivorous and feed on a wide variety of food including; seeds and small aquatic creatures.

Dipper: These birds prefer fast-flowing, oxygen-rich streams and rivers, making them a great indicator of river health. They feed underwater on small invertebrates.

Heron: Herons are found on every continent except Antarctica, primarily inhabiting wetlands, marshes, and coastal areas. They primarily feed on fish, amphibians, small mammals and sometimes molluscs.

Mallard Duck: These are very adaptable and can live in almost any environment as long as there is plenty of water. They feed on mostly seeds, acorns, berries and plants but also insects and shellfish.



1 SLIDES - What lives in our Rivers?

Slide 2 - Birds

Mute Swan: The mute swan's long, curved neck and graceful glide a regular sight on our waterways and waterbodies. They feed on plants mainly water weed, insects and snails.

Sand Martin- These forage for insects over water and in open areas like grassland and farmland, so rivers often make the ideal habitat for this species.

Slide 3 - Fish

Brown Trout: These varies from light silvery brown to the more common golden brown hue. They feed on small fish, insect larvae, crustaceans, and flying insects.

Pike: A large fish that hide in vegetation ready to burst out with remarkable speed to catch fish, frogs, small mammals or ducklings.

Salmon: This fish only spend part of their life in freshwater. While in our rivers they feed mainly on invertebrates.

European Eel: Eels are great climbers and can survive outside of the water for several hours. They feed on small fish, insects, crustaceans and even small amphibians and birds.

Perch: With tiger-like stripes, red fins and a humped back, the perch is a striking fish often in shoals. As a predator, they feed on invertebrates, crayfish and fish.

Barbel: This fish uses its four barbels around its mouth to locate its food; insects, crustaceans, small fish and algae.



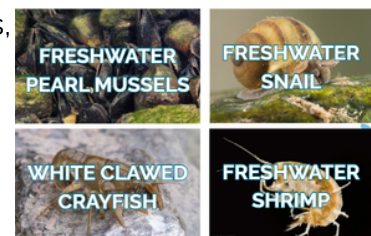
Slide 4 - Molluscs

Freshwater pearl mussels: Spend their adult lives anchored to the river bed, filtering water through their gills, eating tiny organic particles and improving the quality of the water for other species.

Freshwater snail: Most freshwater snails are herbivores, feeding on algae and decaying plant material. Some are filter feeders and eat tiny organic particles.

White clawed crayfish: The only species of crayfish native to the UK. As omnivores, they eat invertebrates, aquatic plants and organic matter.

Freshwater shrimp: There are hundreds of thousands of these tiny shrimp in each healthy river. They feed on small pieces of aquatic plants and organic matter.



1 SLIDES - What lives in our Rivers?

Slide 5 - Invertebrates

Water boatman: These have oar-like legs to help them swim! They feed on algae, aquatic plants and microorganisms.



Dragonfly: Dragonflies are ancient insects that existed long before dinosaurs roamed the Earth. They are predators and feed on other insects.



Mayfly: These only live as flying insects for 2-3 days, spending most of their life underwater. They feed on aquatic plants and microorganisms while in their juvenile form.

Pond Skater: They have tiny hairs on their legs that trap air, allowing them to stay afloat. They are predators that feed on small insects.

Caddisfly: Adults have hairy wings and like mayflies, spend most of their life underwater feeding on aquatic plants and microorganisms.

Slide 6 - Plants

Water crowfoot: This plant has white, buttercup-like flowers with yellow centres that float on the water surface.



Willow: Willows play a crucial role in stabilizing soil and preventing erosion along riverbanks due to their extensive root systems.



Common Reed: This tall grass provides essential cover and nesting sites for various wildlife.

Algae: These plants produce over 50% of the earth's oxygen, however some can be harmful to animal life. These plants provide essential nutrients to the rest of the ecosystem.

All plants make their food from sunlight and CO₂ - a gas in the air! This makes them primary producers, the base building blocks for our river ecosystem.



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Slide 5 - Invertebrates

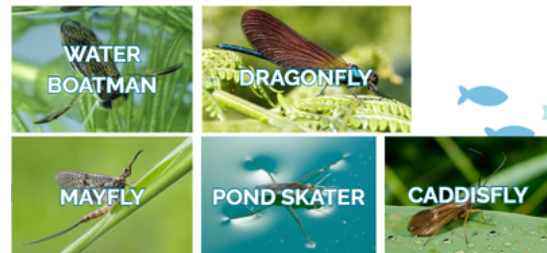
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Now it's time to delve a little deeper into the lives of our river creatures...

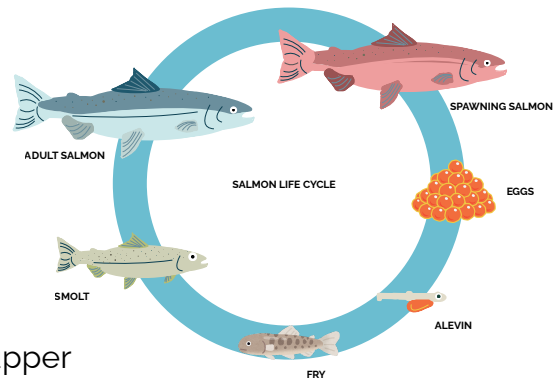


2

ACTIVITY - Life Cycles

Salmon Life Cycle

Split the class into groups, and give each group a 'Salmon Life Cycle' pack that you previously printed. Each group should have 6 stages of the salmon life cycle. Give the learners 5-10 minutes to place the print-outs in the correct order.

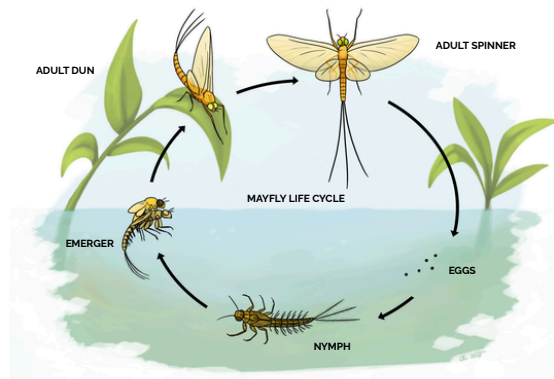


Explanation -

1. **EGGS:** A salmon lays its eggs in the most upper parts of rivers and streams in gravel nests called redds.
2. **ALEVIN:** The eggs hatch, emerging as alevins. They are small and still have a yolk sac attached to their bodies.
3. **FRY:** The yolk sac is absorbed, alevins become fry and start to explore and feed living in the river for up to a year.
4. **SMOLTS:** Fry's undergo changes to adapt them for saltwater, known as 'smolting' as they begin to travel downstream to the sea.
5. **ADULTS:** In the ocean salmon grow rapidly and mature into adults. They spend 1-6 years out at sea before returning to the river they were born.
6. **SPAWNING SALMON:** No longer feeding, spawning salmon make the tough journey up river dodging obstacles to spawn and complete the life cycle.

Mayfly Life Cycle

Hand out the 'Mayfly Life Cycle' pack. Each group should have 5 stages of the life cycle. Give the learners 5-10 minutes to place the print-outs in the correct order.



Explanation -

1. **EGGS:** Layed on the water surface, over a thousand at a time to increase survival rate
2. **NYMPH:** After hatching, nymphs live underwater for up to three years, breathing through their gills and feeding on organic matter.
3. **EMERGER:** Nymphs rise to the water surface and molt into a winged form.
4. **ADULT DUN:** A newly emerged adult with dull-coloured wings that lasts only a few hours.
5. **ADULT SPINNER:** Spinners do not feed, they return to the water to lay their eggs completing their life cycle.



3 ACTIVITY - Food Chains

Hand out the 'Food Chain' packs to the groups. Each group should have 17 species in their pack. Give the learners 10-15 minutes to see how many food chains they can create with their animals. Do an example with them first if you think it is necessary.

- Explain that energy travels from one to the other, and when drawn, arrows are added to show the direction of energy transfer.



ACTIVITY - Making our ecosystem

Make space in your room for this up and moving activity!

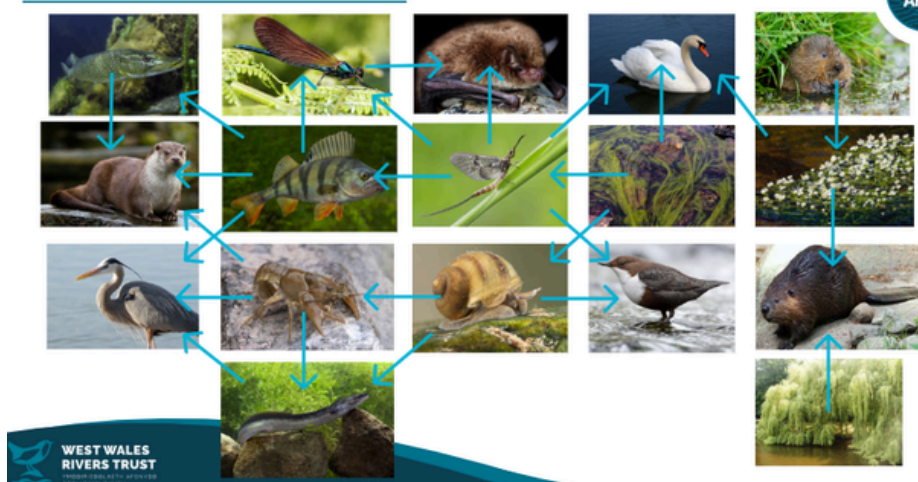
Instruct the learners to hold one animal card each. We are now going to create food chains and food webs as a class to create our ecosystem.

Start by creating a food chain that the learners made in their groups during the last activity. Instruct the learners who are holding the animals that belong in this food chain to stand up in the correct order so that the rest of the learners can see.

Prompt the learners to start adding on additional species one by one onto their existing food chain. For example, this might be 'what other animals eat algae?'.

Keep going until all of your animals have been placed into the food web.

OUR RIVER ECOSYSTEM

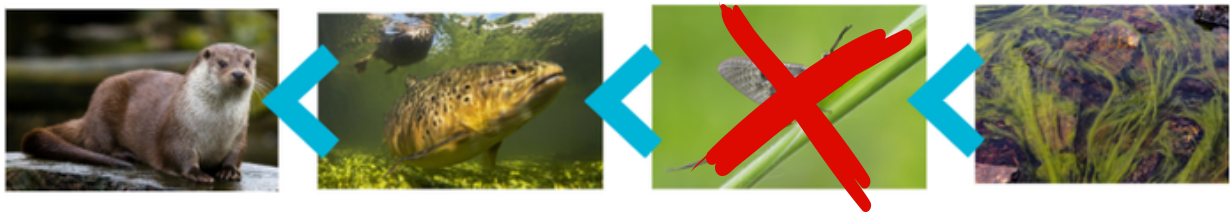


4 Discussion

*You may continue this section visually, by continuing to guide the learners around the workspace, or this discussion can be had seated. Decide what will be most effective and engaging for your learners here.

As we have seen, everything within our ecosystem is connected. So what affects one species, in turn, will affect another.

For example, if there is a water pollution incident in the river that kills all the mayflies and other river invertebrates, it has an effect on other species.



- ☞ If all the invertebrates in the river die, what will the fish eat?
- ☞ Can the fish eat more of something else?

After a decrease in invertebrates, we often then see an aligned decrease in the number of fish too.



- ☞ What does a decrease in fish mean for our Otters?
- ☞ Can they eat more of something else?

If there are limited fish numbers, the otters will feed elsewhere, searching for alternative food sources like molluscs.

- ☞ What happens to the mollusc population then?

5 Conclusion

The key take-aways from this workshop:

- Learners can visually identify some river species ✓
- Learners understand the life-cycle of some key river species ✓
- Learners understand how species are connected to create our river ecosystem ✓



7

Stretch Activity

For this activity, the learners can go into pairs or groups of 3.



Set-Up

- Print one of each of 'Stretch Activity Worksheets' and place one sheet (or more for visibility) on a separate wall of your learning space.
- Print one 'River Research Log' per pair/group.

The Activity

The learners must visit each of the stations and gather facts about each, filling in their 'river research log'.

Give the learners 15 minutes to collect their relevant information.

Once they have collected their information, assign each group one of the following headings:

- Overfishing
- Algal Overgrowth
- Beaver Culling
- Oil Spill

Instruct each group to create a mini-poster or A3 sheet showing:

- The human activity
- A simple river food chain (e.g. algae → insect → fish → bird)
- Arrows showing what changes happen following the human activity (↓ fish numbers, ↑ algae, etc.).

Then take it in turns to present their findings to everyone.

End of workshop - Thank you for incorporating rivers in your education.



Overfishing

What is overfishing?

Overfishing happens when people catch too many fish from rivers, lakes, or seas, so fish populations don't have time to recover.

How does overfishing affect the ecosystem?

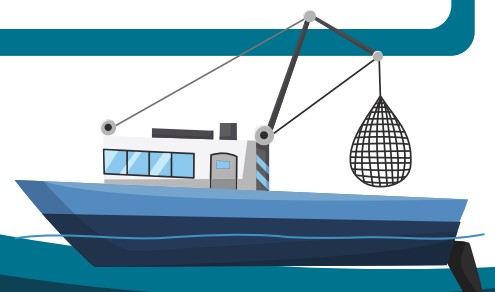
- Fish populations become much smaller or can disappear completely.
- Predators that rely on fish (such as otters, herons, and kingfishers) struggle to find food.
- The balance of the ecosystem is disrupted because fish often control numbers of smaller organisms.

How does this affect food chains?

- Fewer fish = less food for predators.
- Animals lower down the food chain (like insects or algae-eating organisms) may increase too much because fewer fish are eating them.
- This can lead to an unstable food chain, where some species increase rapidly while others decline.

UK example

- Atlantic salmon populations in UK rivers such as the River Severn and River Wye have declined.
- Overfishing in the past, combined with pollution and barriers like dams, reduced salmon numbers.
- Fishing limits and conservation rules are now used to help populations recover.



Beaver Culling

Why are beavers important?

Beavers are ecosystem engineers – they build dams that slow water flow and create wetlands.

What is beaver culling?

Beaver culling means removing or killing beavers to reduce flooding or damage to farmland.

How does culling affect the ecosystem?

- Fewer beavers = fewer dams.
- Wetlands may dry out or disappear.
- Loss of habitats for frogs, insects, fish, and birds.
- Fewer dams = faster river flow and more flooding downstream.

How does this affect food chains?

- Wetlands support many food chains; losing them reduces biodiversity.
- Species that rely on slow-moving water lose feeding and breeding areas.
- Predators have fewer prey species available.
- Beavers are herbivores, feeding on soft wood and plants.

UK example

- Beavers were reintroduced to parts of Scotland and Devon.
- In some areas, landowners have culled beavers due to flooding concerns.
- Studies on the River Otter (Devon) showed beavers increased fish numbers and wildlife diversity.



Oil Spills

What is an oil spill?

An oil spill happens when oil leaks into rivers or coastal waters from boats, pipelines, or industrial accidents.

How do oil spills affect the ecosystem?

- Oil coats animals and plants, making it hard for them to survive.
- It can poison fish and invertebrates.
- Birds lose the waterproofing of their feathers and may freeze or drown.

How does this affect food chains?

- Small organisms die first, removing food for fish.
- Fish deaths affect birds and mammals higher up the food chain.
- Toxins from oil can move up the food chain, affecting many species.

UK example

- In 2013, an oil spill on the River Mersey affected fish and birds.
- Clean-up operations were needed to reduce long-term damage.
- Even small spills can have long-lasting effects on river ecosystems.



Algal Overgrowth

What is Algae Overgrowth?

Algae can grow too quickly when fertilisers and sewage enter rivers. These contain nutrients like nitrogen and phosphorus.

How does algae growth affect the ecosystem?

- Thick algae can cover the water surface, **blocking sunlight**.
- Underwater plants struggle to photosynthesise and may die.
- When algae die and decompose, they use up oxygen in the water.

How does this affect food chains?

- **Low oxygen levels** can kill fish and invertebrates.
- Animals that eat fish lose an important food source.
- The ecosystem may shift to species that can survive in low-oxygen conditions, reducing biodiversity.

UK example:

- Algal blooms have occurred in parts of the River Thames and Norfolk Broads.
- Run-off from farming and sewage overflow has increased nutrient levels.
- Fish deaths have been recorded during severe blooms.



River Research Log



Overfishing

- Which part of the ecosystem is affected first?
(e.g. producers, consumers, habitat, water quality)
- Describe one direct effect and one indirect effect. (Direct = happens immediately, Indirect = happens later as a result)
- How does energy flow through the food chain change? (Who gains less energy? Who might gain more?)

Beaver Culling

- Which part of the ecosystem is affected first?
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