

River





This education pack was produced by two long standing partnerships, The Pen Llŷn a'r Sarnau SAC and the Llŷn Partnership. All the organisations represented in these partnerships are shown below:



For more information and extra resources please visit:

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Welcome...

Wales' freshwater habitats are the integral link that connects the land to the sea and completes the eternal cycle of water. The tiny upland rivers, seasonally springing to life as the hills are pummelled with autumn rain, are as rich and necessary as the slow moving bends of the lowland rivers that have been used by communities for centuries. Wales is a country very familiar with rain. It creates our lush green countryside and feeds our watercourses. Fast flowing and cold, our upland rivers are home to hardy specially adapted species like stonefly nymphs. As the current slows and the river widens downstream, more vegetation can take hold and provide shelter for various larger species like trout. You are never very far from a lake in Wales, and Snowdonia alone has over 250. Looking calm from above, their depths are alive with voracious predators, complex life cycles and fascinating adaptations. Wetlands are the true merging of landscapes. The unique interaction of water, soil, and vegetation creates our network of marshes, bogs, and fens. Of particular interest are Wales' upland bogs, where dying vegetation, submerged and deprived of oxygen, traps carbon and becomes peat. Freshwater is vital to our lives, providing the water we use daily in our homes, keeping us alive as drinking water, used by thousands of people for recreation, and so intertwined with human life that we can become complacent. Water is not an infinite resource and many people around the world feel the effects of lack of water everyday. We need to understand how the water cycle connects us to the rest of the world and do our best to value, protect, and conserve this most precious resource.

How to use this pack:

Each topic begins with a basic introduction and ideas for further study. Every activity within that topic starts with the teacher instruction sheet and then the pupil worksheets. (These can also be found as separate sheets to be printed directly from the electronic resources).

The symbols below are found in the top right-hand corner of every activity and provide a quick reference guide for preparing and planning:



Activity booklet type,
in this case River



Activity takes place outside
or inside



Individual, partner or group
activity



Time of year this activity
is suitable for - spring,
summer, autumn, winter, or
all year



Time this activity
takes to complete

Where to get more information:

This printed pack is intended to act as a starting point for a much bigger collection of activities that will regularly be updated. These resources will be made available on the Pen Llŷn a'r Sarnau SAC website as they are created and further physical additions will be issued as and when funding becomes available. All activities are available as separate downloads on the website.

Activity overview

This provides an overview of all the activities provided in this edition of Tir a Môr. The key stage information is just to use as a guide, all the activities can be expanded by the teacher to cater for varying levels of abilities and interests. Most activities can be done year round but if there are any that require a specific season they are shown on the activity sheet.

Activity name	Booklet	Topic	Key stage	Outdoor / Indoor
Safe place game	Land	Habitat loss	KS1	Either
Habitat match	Land	Habitat loss	KS2	Indoor
Corridors	Land	Habitat loss	KS2/3	Indoor
Build a bug hotel	Land	Hibernation	KS1/2	Outdoor
Hibernation match	Land	Hibernation	KS2	Indoor
Heathland hunt	Land	Choughs	KS1/2	Either
Legends	Land	Choughs	KS1/2	Indoor
River speed	River	Invasive species	KS2/3	Outdoor
Species survey	River	Invasive species	KS2/3	Outdoor
Match it	River	Invasive species	KS3	Indoor
Which one am I?	River	Invasive species	KS2	Indoor
Ollie Otter's diary	River	Otters	KS1/2	Indoor
Make me	River	Otters	KS1	Indoor
Water wheel	River	Water cycle	KS2	Indoor
Salty saucers	River	Water cycle	KS1/2	Indoor
Strandline hunt	Sea	Strandline	KS1/2/3	Outdoor
Sea search	Sea	Strandline	KS1/2	Indoor
Hidden haiku	Sea	Strandline	KS2	Indoor
Find the food chain	Sea	Food chain	KS1/2	Indoor
Predator versus prey	Sea	Food chain	KS1/2	Either
Make a food chain	Sea	Food chain	KS2	Indoor
Beach detectives	Sea	Pollution	KS1/2/3	Outdoor
Coconut Crusoe	Sea	Pollution	KS1/2	Indoor

Invasive species

Invasive species

Introduction:

A non-native species refers to a species that is present in a location that it has never been in before. If this species starts to cause problems to native wildlife then it is termed an invasive non-native species. They can cause problems by out-competing local species for food or space. They may change the physical habitat or spread disease. They may even feed on the local species.

There are many different ways in which invasive non-native species can spread, depending on what it is and its life cycle. Some are purposely introduced, for example, exotic plants in gardens, some come accidentally in cargo ships, and through trade and travel. Once established they spread through the new country by wind, rivers and humans. Invasive non-natives have been identified as one of the top causes of extinctions worldwide. Invasive species have contributed to 40% of extinctions in the last 400 years.

The best solution is to stop invasive species from arriving in the first place. This is done using various methods and is called biosecurity. Biosecurity can happen on an international scale like disinfecting at airports, controls on shipping and customs inspections. On a local scale, stopping the spread and removing the invasive species before they have a chance to damage local populations is most important and can be done by cleaning and disinfecting or by physical removal of the species.

Interesting facts:

- 80% of world trade is carried by ships
- 7,000 species are transferred in ballast water every hour of every day
- In 2010 it was estimated that the annual cost of invasive species to Wales was £132,244,000
- Invasive species are the third most severe threat to European threatened species
- There are approximately 2,000 established non-native species in the UK, but they do not all pose a threat to native wildlife

Further research keywords:

Alien species, bio-control, island bio-security, ballast water, Himalayan balsam, giant hogweed, GBINNS (Great Britain invasive non-native species), carpet sea squirt, Holyhead harbour, American mink in UK, wireweed

River speed

30-45 mins



Activity guide:

Equipment required:

- Clipboards
- Stopwatches
- Biodegradable paint (optional)
- Water safety equipment - throw line and buoyancy aid

Before arriving at the river:

1. Introduce rivers as a means of spreading invasive species throughout countries. This activity demonstrates how fast that can happen.
2. Scout out a location that offers good safe positions to start and end the race where the river is easily seen. Bridges make this a lot easier.

At the river:

1. River safety explained. Class search the area to collect sticks of similar shapes and sizes. The children measure a distance of 10m or 20m downstream. This is the recording point.
2. Spilt the class into two groups. One half of the children start upstream (preferably on a bridge).
3. The other half of the children go to the downstream recording point with stopwatches. Teacher does a countdown, the sticks are dropped into the water and the stopwatches started.
4. The stopwatches are stopped as soon as the sticks pass the children. The groups keep swapping and the experiment is repeated several times. Biodegradable paints could be used to colour code the sticks and the class divided into teams with each team only measuring their colour.
5. **This can be done in the classroom:** The average times are worked out from all the runs. The children could then use this information to work out how long things would take to travel from certain towns down to the sea or from one town to the next etc. The distances could either be supplied to the class or groups could use maps to measure the distances for themselves.

Species survey

60 - 120 mins



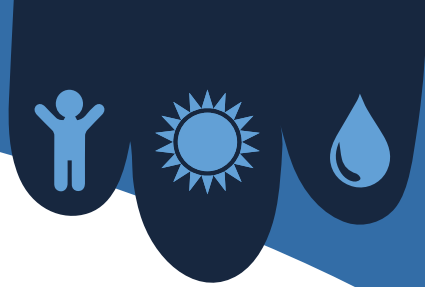
Activity guide:

The survey activity can be done in two ways, either as a supervised group walk or as a take home activity that each child does with their family. The results are then discussed in the class.

Below is some information about the species listed on the survey to help start your discussions.

<h3>Grey squirrel</h3>	<h3>Himalayan balsam</h3>	<h3>Giant hogweed </h3>
<p>Originally from Canada and the USA, introduced in the early 20th century. Grey squirrels are much larger than reds and are able to out-compete them for food and nesting sites. Greys also carry the squirrel-pox virus, which they are immune to, but is sadly fatal to reds.</p>	<p>First recorded in 1839, being cultivated in a greenhouse as an annual garden plant. It forms dense thickets, especially in wetlands, which alters the normal balance of the environment. Seeds drop into rivers and contaminate land downstream. The plants explosive seed release, which can send seeds into the air up to 4m away, means it can cover areas rapidly.</p>	<p>The earliest recorded introduction was in 1817 from its native Russia to Kew Gardens. Widely planted in fashionable gardens throughout Britain they quickly escaped and the first ('wild') population was recorded in 1828. Now widely distributed throughout Britain and Europe. They can grow up to 6m tall and contain chemicals that can cause burns and blisters. Their sheer size means they swamp all other plants and change the natural species present.</p>
<h3>Rhododendron ponticum</h3>	<h3>Japanese wireweed</h3>	<h3>Japanese knotweed</h3>
<p>First recorded in Britain, probably originating from Spain or Portugal, in approximately 1763. Mostly used in botanical gardens and big estates. It forms very dense clumps which stop light reaching native species. Its leaves are toxic to nearly all wildlife and it is thought to carry sudden oak death disease. It is estimated that the plant now covers over 98,700 hectares in Britain.</p>	<p>First seen in the UK in the Isle of Wight in 1973, it has spread along the south and west coasts and has now been found in every country of the British Isles. It is a very fast growing seaweed and its 1m long frond type leaves out-compete native algae and sea grasses for light and space. It has also become a nuisance in shallow harbours and on beaches.</p>	<p>It is thought that Japanese knotweed first arrived in the UK in the 1840s as a specimen for botanical gardens. The thick bamboo-like stems of the plant can regrow from fragments of root left up to 2.5m under ground. Incredibly fast growing, between May and July it can add 10cm a day and can grow to 3m tall. It forms very thick patches which out-compete other plants and its strong stems can grow through man-made structures, damaging brick work and tarmac.</p>

Species survey



Scientists monitor where and when invasive species are found all over the country. How many items on the list can you find in your local area?



Grey squirrel

Parks, gardens and woodland

Seen:

Where:

When:



Himalayan balsam

River banks, wasteland and gardens

Seen:

Where:

When:



Giant hogweed

Widespread especially on river banks

Seen:

Where:

When:



Rhododendron ponticum

Moorland, woodland and riverbanks

Seen:

Where:

When:



Japanese wireweed

Seashore, rockpools and harbours

Seen:

Where:

When:



Japanese knotweed

Urban areas and gardens

Seen:

Where:

When:



Giant hogweed can grow to the height of 4.5m to 6 meters.

* Remember not to touch any of the species listed above. Giant hogweed can cause painful blisters and touching any of the plants could help them spread!

Match it

30
mins



Activity guide:

Equipment required:

- Card packs printing out
- Answer sheet printouts

Before the activity:

1. Print out the 3 pages that contain the game cards; they are labelled R_IS_1.

The activity:

1. Split class into small groups
2. Each group gets a pack of cards with 5 species, 5 effects and 5 locations
3. They work as a group to match the species, locations and effects and fill these out on their answer sheets
4. The game can be extended by putting the packs in order of distance travelled, most likely to affect the local area or talking about how they think each species was introduced - these answers could be done as a discussion with the whole class.

Answers - Match it game:

Geographical references in the species names were removed for game play. Their full names are shown below:

- Mitten crab (Chinese mitten crab)
- Destabilises river banks by creating burrows
- China

- Rhododendron ponticum
- Toxic leaves make area uninhabitable for other species
- Bulgaria, Turkey, Spain, Portugal

- Himalayan balsam
- Out-competes native species for space, light and water
- India and Nepal

- Carpet sea squirt
- Spreads very rapidly smothering all other species
- Scientists are unsure of origin

- Mink (American mink)
- Eats bird eggs, young birds and other small animals
- USA



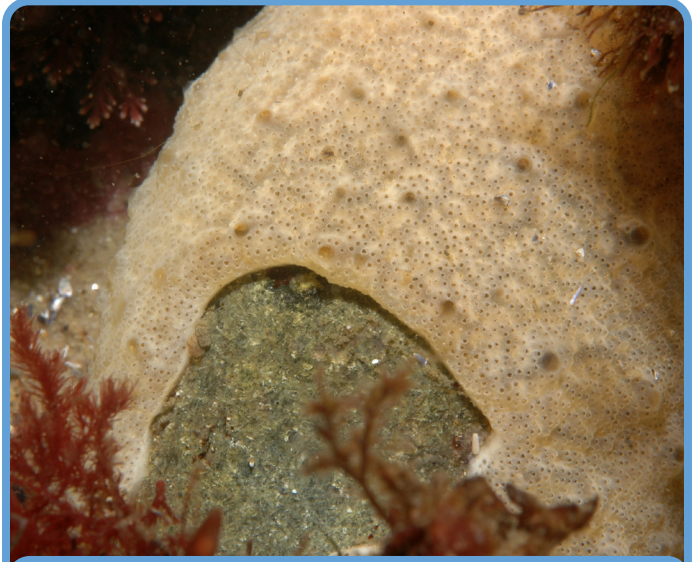
Mitten crab



Rhododendron ponticum



Himalayan balsam



Carpet sea squirt



Mink

Destabilises river banks by creating burrows

Toxic leaves make area uninhabitable for other species

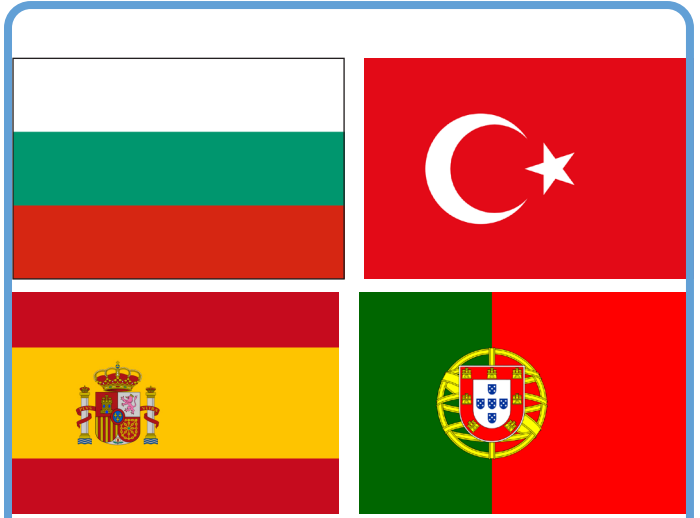
Out-competes native species for space, light and water

Spreads very rapidly, smothering all other species

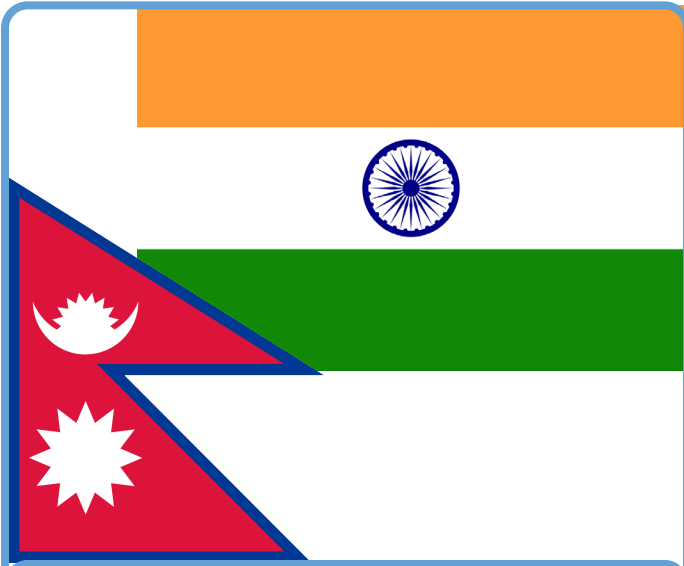
Eats bird eggs, young birds and other small animals



China



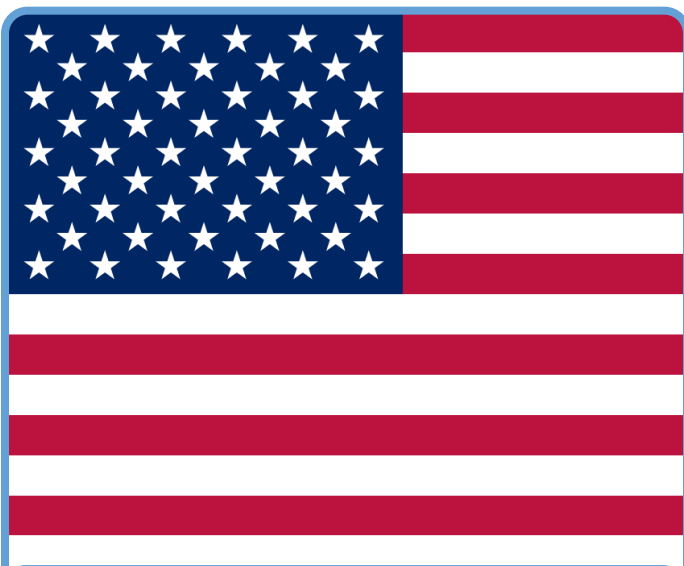
Bulgaria, Turkey, Spain, Portugal



India and Nepal



Not known



USA

Match it



Game rules: As a group, match the species to the effect it has on the environment and the country it originally came from.

Species:

1 Effects:

Comes from:

Species:

2 Effects:

Comes from:

Species:

3 Effects:

Comes from:

Species:

4 Effects:

Comes from:

Species:

5 Effects:

Comes from:



There are about 2.5 million grey squirrels in the UK, compared to 160,000 native red squirrels.

Which one am I?

30 mins



Activity guide:

Equipment required:

- Printed worksheet
- Pens and pencils

Before starting the worksheet:

1. This works best if it is done after some introductory work on invasive species and after the other activities within this topic so that the pupils are familiar with common invasive species.

To complete the worksheet:

1. Split class into partners
2. The partners work through the sheet trying to use the clues to identify which species is being described.

Answers - Which one am I?

- 1) Himalayan balsam
- 2) American mink
- 3) Giant hogweed

Which one am I?



Scientists use key features to identify different species.
Using the descriptive clues below, work out which invasive species they are describing and tick the right box.

1) Which one am I?

Leaves have jagged edges and a reddish middle line

Trumpet-shaped pink flowers that sometimes have white spots inside

Bright green leaves join the stem in layers of 3 to 5 leaves each time

Himalayan balsam

Chinese mitten crab

Giant hogweed

2) Which one am I?

Mostly nocturnal or active at dusk

White patches on chin and throat

Tail between 13-23cm and covered in dark brown fur

Grey squirrel

American mink

Chinese mitten crab

3) Which one am I?

Sharply divided and serrated leaves with bristles underneath

White or pinkish umbrella shaped flowers up to 80cm across

Very tall, can grow up to 6m tall

Himalayan balsam

Giant hogweed

Japanese hogweed



Himalayan balsam can grow up to 2.5m high from seed in one summer season.

Otters

Otters

Introduction:

One of the UK's 66 resident wild mammals, the otter is the largest of the UK weasel family. Males can be over a metre long including the tail and weigh about the same as a toddler. They have a varied diet and their combination of sharp canine teeth and flatter back teeth mean they can easily eat both slippery fish and hard shelled crustaceans. In order to maintain their feeding needs otters establish long territories along river catchments. Otters travel large distances everyday and visit different habitats whilst foraging.

They are largely nocturnal animals meaning that they can occupy areas in good numbers whilst remaining unknown. Most of the day is spent sleeping in their holts (dens built into river banks or tree holes) or in hiding places surrounded by long vegetation. The most obvious signs that otters are living on a waterway are their well worn pathways to and from the river, remains of prey species, footprints in the muddy banks and their oddly sweet smelling droppings which are known as spraint.

Otters were once widespread all across the UK but a combination of pollution in rivers, loss of vegetation along rivers and new drainage schemes meant that by the 1970s otters had disappeared from most British rivers. The news is good though, a combination of reintroduction, clean up of rivers, building artificial holts and increasing the habitat around river banks has meant that populations are successfully re-establishing themselves across the UK.

Rivers still need good management to sustain fish stocks at good levels so that otters can thrive but they are facing a new threat. Many young otters are being killed on roads every year and people are working hard to find solutions like underground tunnels.

How are otters adapted to life in the water:

- They have valves in their ears and eyes that allow them to seal them underwater
- They have the densest fur of all UK mammals. It consists of two layers and is waterproof
- They have a powerful rudder-shaped tail to help with swimming
- They have webbed feet for more powerful swimming and they have fur on their feet to keep them warm and add grip on slippery rocks
- Long whiskers help them to navigate underwater

Further research keywords:

Lutra lutra, The UK Wild Otter Trust, otter hunts, mustelids, International Otter Survival Fund, vibrissae, apex predator, protected species, otter field signs, otter hovers and couches

Ollie Otter's diary

45 - 60
mins



Activity guide:

Equipment required:

- Rulers
- Graph paper
- Print outs of 'Ollie Otter's diary'

To do the activity:

1. Pupils are provided with copies of the otter's diary.
2. They use the information within the diary to create a bar graph showing how much of each prey the otter eats. This can either be done daily or for the whole week.
3. The activity can be extended by creating another graph based on estimates of how far the otter has travelled to get the food everyday. On the map there is a scale and the diary details where the otter has been so the routes can be measured and then graphed.
4. As a class, the results can be discussed and the distances can be compared to local places that are an equivalent distance so that the pupils can get an idea of how far the otters are travelling for food.

Ollie Otter's Diary

Monday:

It was a sunny day today so we decided to go down to the coast to eat some crabs. It seemed to take ages to swim all the way to the estuary and then round to Rocky Bay. There was lots of food though; I ate eight crabs! On the way back I ate a salmon for dinner and two frogs. Time for bed now.

Tuesday:

It was raining a lot today and I didn't feel like going far, so I had three frogs for breakfast and then went for a short swim to Big Blue Lake. There were a few trout there so I had two for lunch and then headed home for my two frog dinner.

Wednesday:

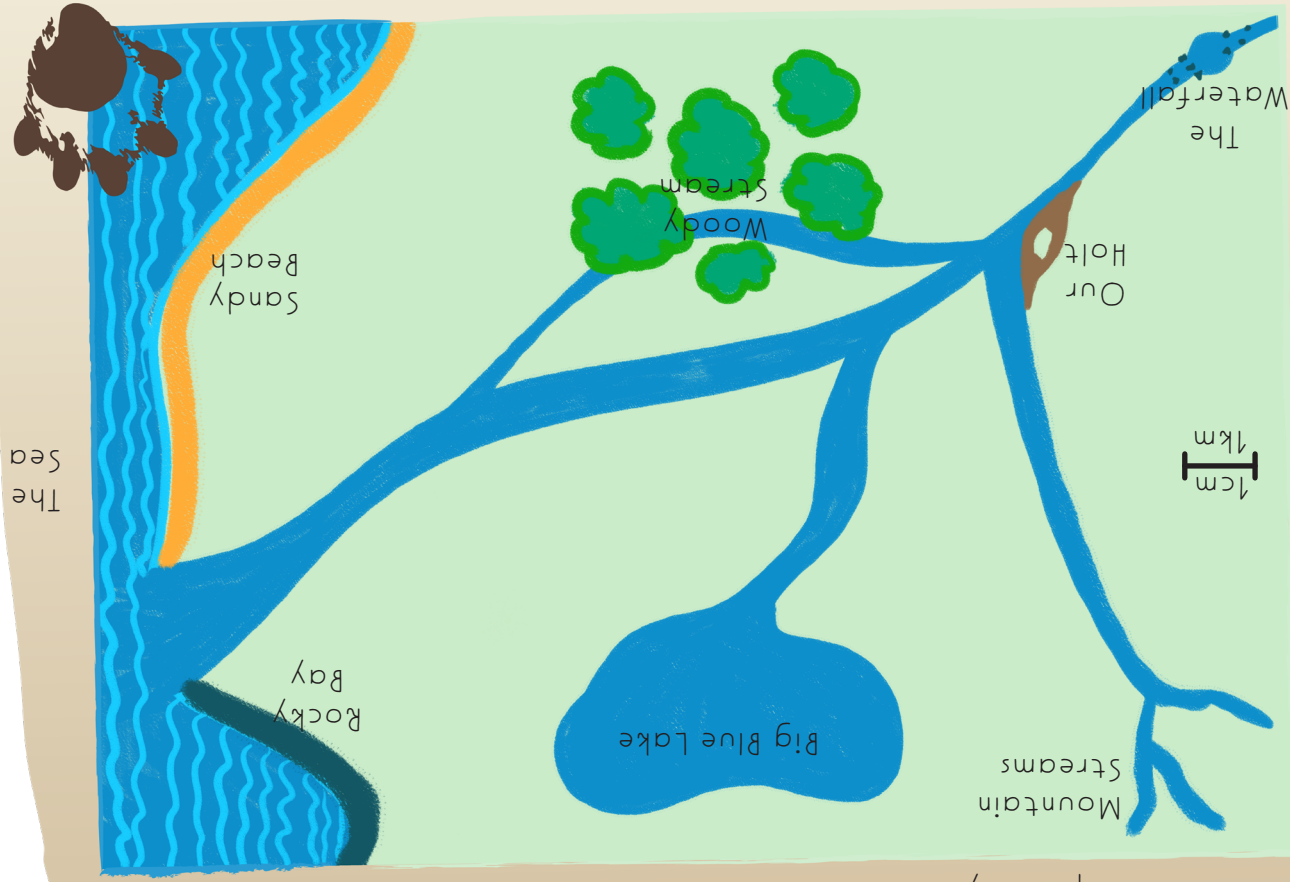
I had a very busy day today, lots of swimming. Mum wanted me to help get food for everyone so we swam up to the waterfall to catch salmon. I ate a big one for breakfast. We then went down to Woody Stream to look for frogs. I was so hungry that I had three as a snack. After that we carried on down to Sandy Beach to look for crabs, we found loads so I had four for my dinner. It seemed to take ages to swim back to the holt tonight.

Thursday:

I was really tired today so I didn't want to do much. We went for an early swim around Big Blue Lake, ate two trout for breakfast. Then we went to play in the mountain streams. I had my favourite food for lunch, four crayfish! It was really tasty. I had a nap and then went with mum to the waterfall where we had a salmon for dinner. I fell asleep as soon as I got back to the holt.

Friday:

It was a stormy day today so mum decided that we should go to the sea to look for crabs. We headed off down the main river and came across lots of eels. I had three small ones for breakfast. We went right to the edge of Sandy Beach today as far as you can get from the estuary - it was exciting. I had six crabs for lunch and two more in Rocky Bay. Once we got home mum gave us three frogs for dinner and we went to bed.



I drew this map of my home area so that I could remember it forever...

Make me

30 - 45
mins



Activity guide:

Equipment required:

- Printed worksheet 'Make me'
- Pens and pencils

Before starting the worksheet:

1. An introduction to otters and also to adaptations is needed before pupils can complete the worksheet independently but it could be used as a whole class activity to introduce the concept of adaptation.

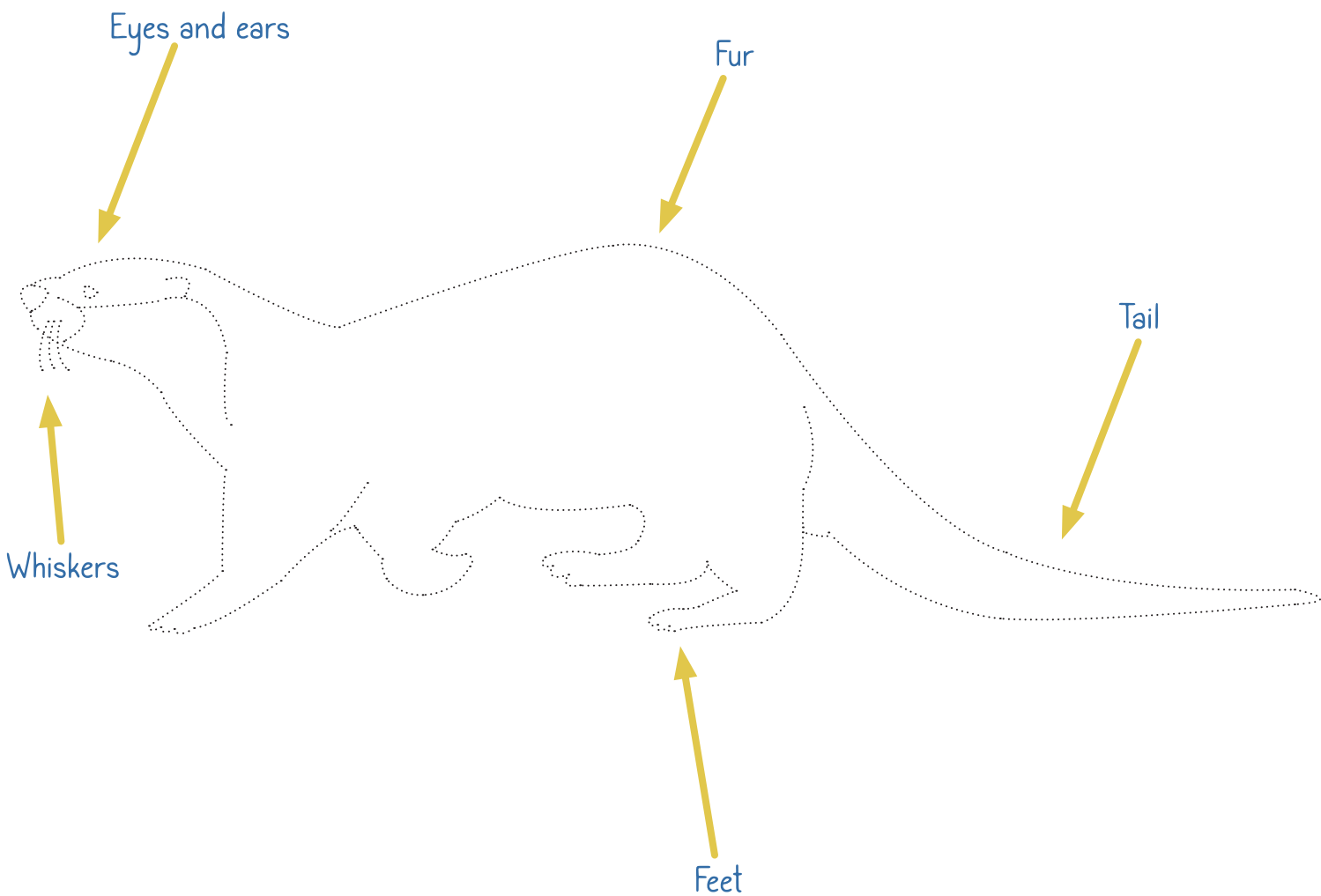
To do the activity:

1. Pupils are provided with copies of the worksheet 'Make me'.
2. The pupils colour in the otter and add information about how all its body parts are specially adapted to its life in and around rivers.

Make me



Colour in and complete the otter. Then add labels to the arrows to describe how each part is adapted to the otter's life in the water.



In one 2.5cm square of an otter's body, there are around one million hairs!

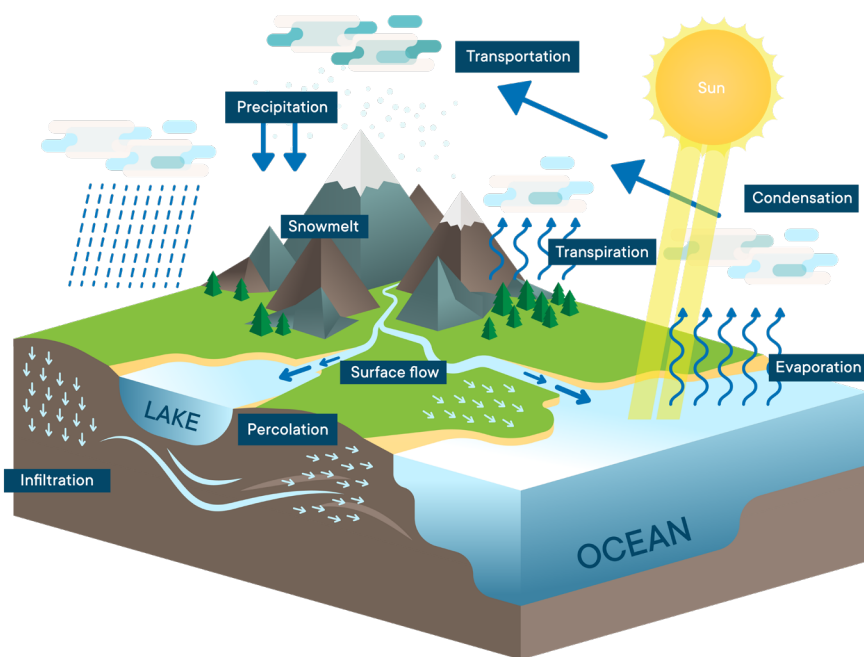
Water cycle

The water cycle

Introduction:

The water cycle is a way of showing how water moves around the planet. Water is continually transferring between the atmosphere and the earth's surface, moving around the globe all the time. This is important to understand, not just for our water needs but also because it means that pollutants can easily be carried large distances within the water cycle .

The cycle begins with the sea. The surface layers of the ocean are heated by the sun, turning it into vapour (tiny droplets of water). This vapour rises and cools into clouds. The clouds are then moved by the wind. As the droplets within the clouds collect and get bigger they become too heavy to stay suspended and begin to fall as rain. The water that falls to the earth eventually flows through rivers, over the land surface or through ground water back into the sea and so the cycle begins again.



Key terms:

Evaporation - heating liquid water so that it becomes vapour.

Transpiration - water vapour given off by plants.

Condensation - the water vapour cools and becomes liquid again.

Transportation - winds move water around the atmosphere in the form of clouds.

Precipitation - water falling back to earth in many forms e.g. rain, snow, sleet, hail.

Infiltration - water trickles down through the earth's surface and travels by **percolation** through the rock.

Surface flow - liquid water running across the surface of the land into rivers and sea.

Interesting facts:

- 70% of the earth is covered in water. 97% of all water is in oceans.
- Of the 3% that is fresh water, 2% is inaccessible in ice caps and glaciers, leaving only 1% to travel around the water cycle and for our daily use.
- The same water that existed on earth billions of years ago still exists today. Water that comes from your tap could contain the same molecules that dinosaurs drank.

Further research keywords:

Hydrological cycle, aquifer, deposition, (relief, frontal and convectional rainfall), river discharge, runoff, hydrograph, meteorology, dew point, rain shadow, sea surface temperature

Water wheel

45 - 60
mins



Teacher's pack

Topic: Water cycle

KS: 2

Activity guide:

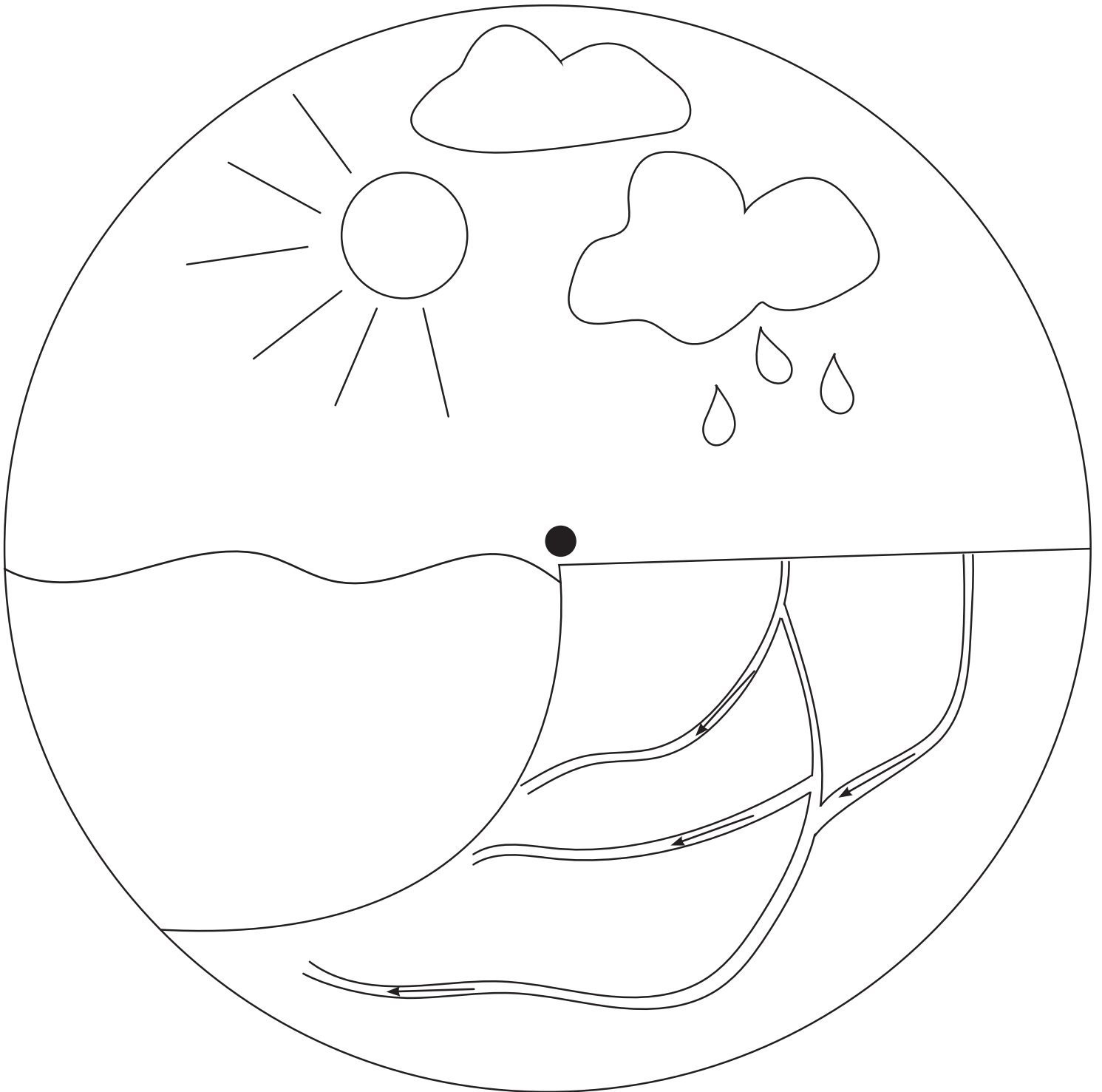
Equipment required:

- Printout of template - preferably on card or can be stuck onto a paper plate (R_WC_1)
- Scissors
- Split pin
- Glue

To do the activity:

1. Pupils are provided with copies of the water cycle template sheet (R_WC_1).
2. The pupils colour in and decorate the worksheet. Encourage them to add details like trees, mountains, sea life, different kinds of precipitation etc to make each one unique.
3. They then cut out the words and the water movement arm.
4. Align the two black central dots and put the split pin through so that the arm can be moved around the circle in the direction of the water cycle.
5. Stick the labels onto the circle in the correct places for the water movement that it refers to. Pupils can add extra information or labels to their wheel.

Water movement ●



Evaporation

Precipitation

Condensation

Collection

Salty saucers

2-4 days



Activity guide:

Equipment required:

- Shallow wide dishes
- Salt
- Water
- Blue food colouring

This activity demonstrates the often invisible element of the water cycle, evaporation. Variations in where the saucers are located can be used to demonstrate the power of heat to speed up water loss. The salt and food colouring will crystallise as the water evaporates, providing a really clear demonstration.

To do the activity:

1. This can be done in groups or as a whole class activity.
2. Give each group a few different bowls.
3. Mix the water and salt together in the bowls, then add a few drops of the food colouring.
4. There's lots of different ways the children can experiment, by adding more or less water, increasing the quantities of salt and placing the bowls in different locations, some in the sun, some in the shade, some by radiators.
5. Once each group has decided on its variations they need to label each bowl.
6. The pupils will need to check their bowls twice a day for a few days. The results should be collected and discussed as a class. Which one evaporated faster? What was different about it?



For more information and extra resources please visit:
www.penllynarsarnau.co.uk
or email:
info@penllynarsarnau.co.uk

