

COLD AREAS: THE ARCTIC

LINKS TO NATIONAL CURRICULUM

Science

- Identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other (Year 2, Living things and their habitats).
- Identify and name a variety of plants and animals in their habitats (Year 2, Living things and their habitats).
- Describe how animals obtain their food from plants and other animals, using the idea of a simple food chain, and identify and name different sources of food (Year 2, Living things and their habitats).
- Recognise that environments can change and that this can sometimes pose dangers to living things (Year 4, Living things and their habitats).

Geography

- Identify.....the location of hot and cold areas of the world in relation to the Equator and the North and South Poles (Key stage 1).
- Identify the position and significance of latitude, longitude, Equator, Northern Hemisphere, Southern Hemisphere, the Tropics of Cancer and Capricorn, Arctic and Antarctic Circle (Key stage 2).

KEY LEARNING OBJECTIVES

1. Where are the hot and cold areas and why?
2. What is it like in the Arctic?
3. How are Arctic animals adapted to their environment?
4. How do Arctic animals depend on each other??
5. How is climate change affecting the Arctic?

Notes to Teachers

- These teaching notes run alongside a Powerpoint presentation and all slides are referred to in the notes. The information can be adapted to suit different ages of students by adding/deleting slides on the presentation and varying the level of detail used from the teacher notes.
- Activities given are suggestions only. The main purpose of these resources is to provide key information and visual aids for teachers to adapt to their needs.

KEY WORDS

Equator - an imaginary line around the Earth. Everywhere on the Equator is equally distant from the North Pole and the South Pole.

Northern Hemisphere - the half of Earth that is north of the equator.

Southern Hemisphere - the half of the Earth that is south of the equator.

North Pole - the most northern point of the earth.

South Pole - the most southern point of the Earth.

Arctic Circle - a special line of latitude that forms a circle around the North Pole (approximately 66.5 degrees north of the Equator). Anything north of this imaginary circle is in the Arctic.

Antarctic Circle - a special line of latitude (approximately 66.5 degrees south of the Equator). Anything south of this imaginary circle is in Antarctica.

Polar Regions - the regions of the Earth surrounding the North and South Poles.

Tundra - a harsh, treeless environment in which the soil is permanently frozen.

Weather - the daily state of the atmosphere in any given place (in regard to heat or cold, wetness or dryness, calm or storm, clearness or cloudiness).

Climate - the average of the weather conditions in an area over a long period of time (usually 30 years).

Adaptation - the process of change by which an organism or species becomes better suited to its environment.

Mammal - a warm-blooded animal with a backbone that feeds its young with milk produced by the mother and has skin usually more or less covered with hair.

Marine mammal - have the same characteristics as all other mammals, but they have adapted to living all or part of their life in the ocean.

Food chain - shows how each living thing gets food, and how nutrients and energy are passed from creature to creature.

Predator - an animal that lives by killing and eating other animals.

Prey - an animal taken by a predator as food.

Carnivore - an animal that eats meat.

Herbivore - an animal that only eats plants.

Plankton - countless tiny living things that float and drift in the world's oceans.

Interdependence - depending on one another.

Global warming - a raising of average global temperatures that is thought to be a result of increased levels of certain gases e.g. carbon dioxide and methane in the atmosphere.

Albedo Effect - sea ice reflects more sunlight than the darker ocean. As the sea ice melts, there's less "white" to reflect the sunlight and more "dark" to absorb it.

1. WHERE ARE THE HOT AND COLD AREAS?

SUGGESTED STARTER ACTIVITIES

1. Hotter and Colder Experiences (Slide 4)

Ask the children if they have visited a part of the world where it was much hotter or colder than it is in the UK. Locate these areas on a world map and share their experiences of what it was like to be in a hotter or colder place.

Or you could use the contrasting photos on slide 4 to prompt discussion about the differences between hot and cold places.

2. Labelling the World Map (Slide 5)

You could use the map on this slide or ask the children to look at a world map in an atlas to complete this task. It is also useful to show the children a globe and point out the lines that go around it. On a map, they don't look like circles as the map is flat, but when they look at a round globe they will see that they are circles that go the whole way around the Earth.

On an outline of a world map (see page 6) help the children to label the following:

- **The UK**
- **Lines of latitude and longitude**
- **Equator**
- **Tropic of Cancer**
- **Tropic of Capricorn**
- **Arctic Circle**
- **Antarctic Circle**
- **Northern Hemisphere**
- **Southern Hemisphere**
- **North Pole**
- **South Pole**
- **Arctic**
- **Antarctica**

Shade the following (and include a key):

- **A country/region that is very hot (shade in red)**
- **A country/region that is very cold (shade in blue)**

Able students could shade more hot and cold areas.

TEACHER INPUT

Slide 5: Using their labelled and shaded maps (or using the map on the slide) , ask the children if they notice anything about where the hot and cold parts of the world are. Hopefully they will notice that hot countries are near the **Equator** and cold countries are near the **Poles** (prompt if necessary).

Slide 6: The **Equator** is an imaginary line around the Earth. Can the children name the continents that the Equator 'runs through'? Temperatures on the Equator are very high.

Slide 7: The **North Pole** is the most northern point of the Earth and the **South Pole** is the most southern point. Temperatures are very low at both.

Slide 8: Ask whether anyone can attempt to explain why closeness to the Equator or Poles affects how hot or cold the **climate** is? At the Equator, the sun stays almost directly overhead everyday. This means the sun's rays come in at a steep angle so they are concentrated over that area and temperatures are always high. At the Poles, the sun's rays strike the Earth at a very low angle, so they are spread out over a greater area and temperatures are icy cold. Also, ice makes these regions even colder by reflecting the sun's light and heat back into space.

Do we live nearer the Equator or the Poles? What is our climate like?

SUGGESTED ACTIVITIES

Crossword Puzzle (see page 7)

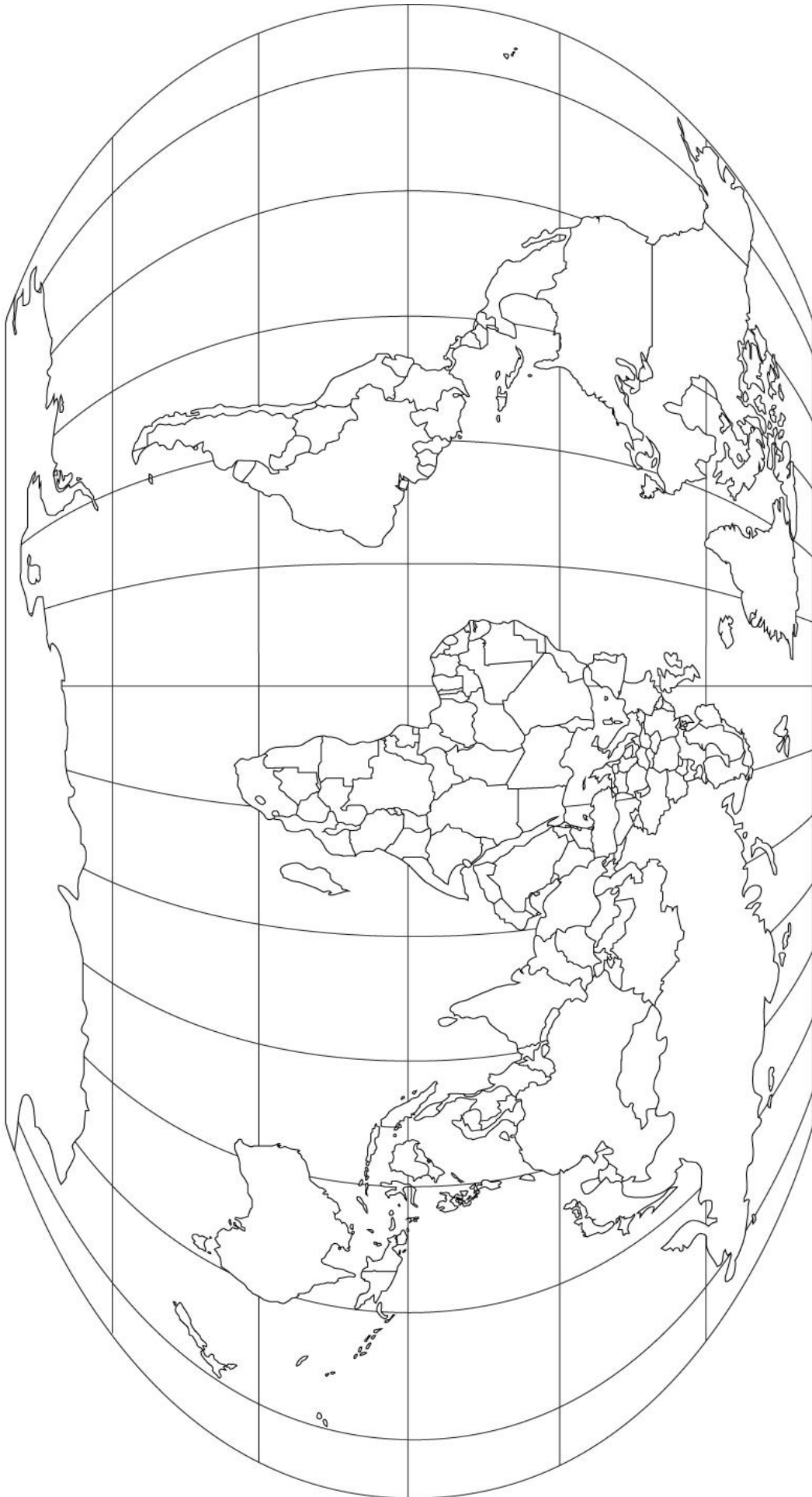
This crossword puzzle checks understanding of key terms covered in this section.

Annotated Diagram

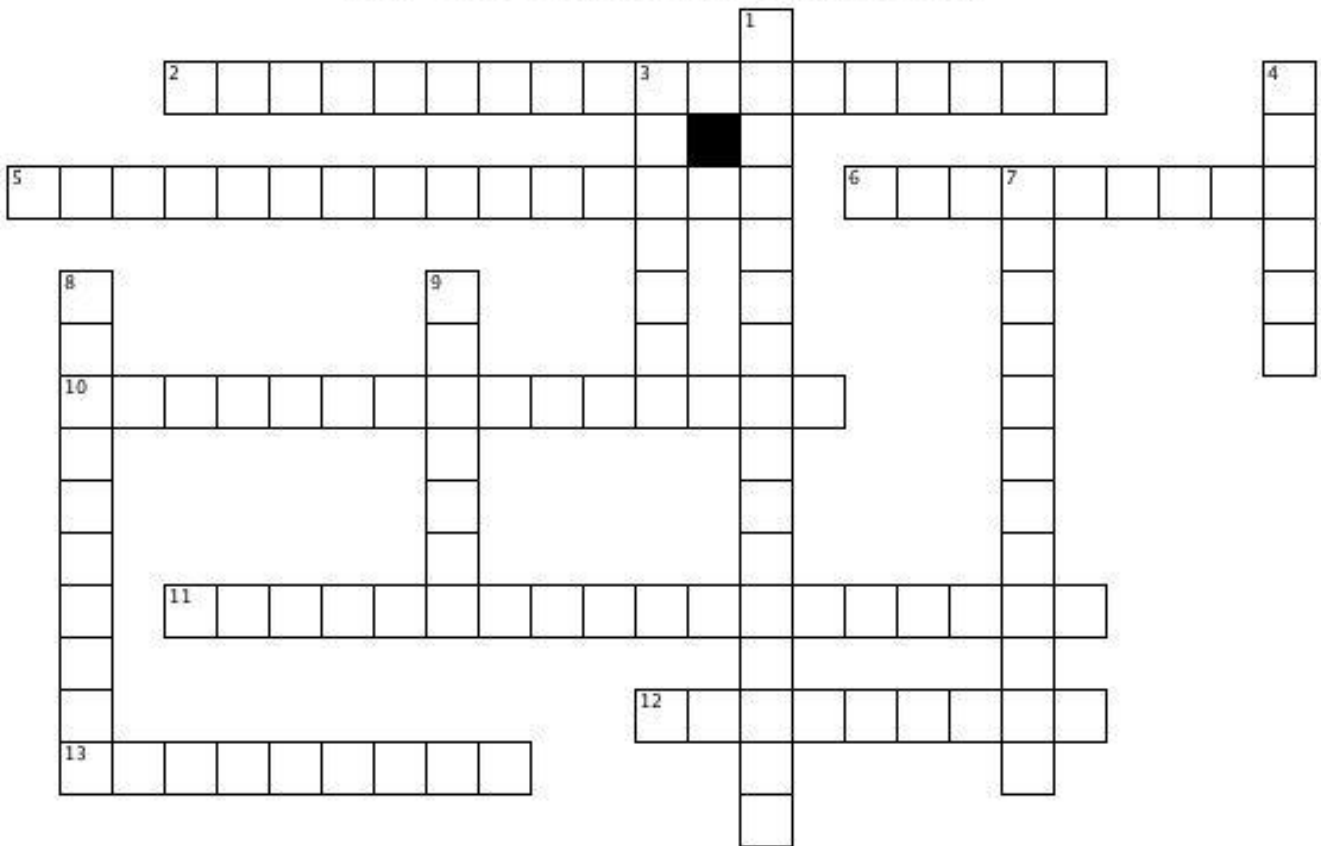
Draw a diagram showing why places near the Equator are hot and places near the Poles are cold. Annotate your diagram clearly.

Extra Challenge

Can you find out why the South Pole is colder than the North Pole?



Hot and Cold Areas: Key Words



Across

2. What do we call the bottom half of the Earth?
5. What do we call the imaginary lines that circle the Earth in an east-west direction (parallel to the Equator)?
6. What do we call the cold region around the South Pole?
10. What do we call the imaginary circle around the Earth that is 66.5 degrees south of the Equator?
11. What do we call the top half of the Earth?
12. What do we call the most southern point of the Earth?
13. What do we call the most northern point of the Earth?

Down

1. What do we call the imaginary lines that run from the top of the Earth to the bottom?
3. What do we call the imaginary line around the middle of the Earth?
4. What do we call the cold region around the North Pole?
7. What do we call the special line of latitude that forms a circle around the North Pole?
8. What is the word we use to describe how a body part, feature or behaviour helps a living thing survive better in its environment?
9. What is the word we use to describe the usual weather conditions in a particular place?

2. WHAT IS IT LIKE IN THE ARCTIC?

SUGGESTED STARTER ACTIVITIES

1. Feeling Cold

Ask the children what it feels like to be really cold. What happens to your body when it is cold? What can you do to try and warm up? Can being cold be dangerous?

2. Ice

If possible, bring some ice cubes into the classroom for the children to examine:

- What words can they think of to describe ice?
- How does it feel?
- What do we use it for?
- Where does it need to be kept to stop it melting?
- What does all this tell us about polar regions?

3. Starting Knowledge

Ask the children what they already know about the Arctic - where it is, who lives there, what animals live there (someone will usually suggest penguins!). Record correct ideas in a mindmap on the board. You could also compile a list of questions the children would like answered about the Arctic and return to this at the end of the topic to check they have been addressed.

TEACHER INPUT

Arctic Location

Slide 10: The Arctic is located at the northernmost point of our planet - the area between the **Arctic Circle** and the **North Pole**. Ask the children to find the Arctic on a globe or in their atlases - what clues are there that this is a cold area?

Arctic Landscape

Slide 11: The Arctic is a sea of ice, surrounded by cold, treeless lands called **tundra**. During the winter, the Arctic Ocean is almost entirely covered in drifting sea ice. In the summer, around 50% of the Arctic Ocean remains frozen.

The **North Pole** is in the Arctic Ocean, unlike the **South Pole**, which is on land. However, the sea around the North Pole is permanently frozen and covered in snow, which makes it look like land.

Slide 12: In the Arctic, there is at least one 24 hour period every summer during which the sun doesn't set - known as '**Midnight Sun**'. There is also at least one 24 period in the winter during which the sun doesn't rise - the '**Polar Night**'. The further north you go, the longer the periods are during which the sun either doesn't rise or doesn't set.

Arctic Climate

Slide 13: The Arctic climate is characterised by long, cold winters and short, cool summers. Temperatures only rise above freezing for between two and four months of the year. The warmest month in the Arctic is July but even then, the average daily temperature doesn't exceed 10°C. The average temperature in the winter can drop below -50 °C across large areas of the Arctic.

Arctic People

Slides 14-15: The Arctic is sparsely populated due to the hostile conditions. But it is home to 4 million people, including a number of indigenous peoples who have inhabited the Arctic for thousands of years. The proportion of indigenous people is estimated to be about 10 percent of the total population living in Arctic areas.

The **Inuit** of Alaska, Canada and Greenland have been living in the extreme conditions of the Arctic for thousands of years and have found clever ways to survive. Their staple diet is the fat and meat of seals - this is rich in iron and vitamin A which helps them withstand the cold. The Inuit's clothes, snow-shoes, dog sleds, kayaks and hunting methods are all designed for the harsh Arctic conditions.

Arctic Plants

Slide 16: The cold climate and short growing season mean that larger plants such as trees cannot grow in the Arctic. But approximately 3,000 species of flowering plants do live on the Arctic **tundra**, including flowering plants, dwarf shrubs, herbs, grasses. There are also 1,100 different species of mosses, and around 1,750 lichens.

These small, hardy plants grow in clumps and can form a thick layer on the tundra - this is to protect themselves from the wind, conserve moisture, prevent themselves being crushed by the snow and to stay close to the ground where it is comparatively warmer. Arctic flowers are specially adapted to make the most of the short summer season.

Arctic Animals

Slide 17: So life in the Arctic can be very difficult. But it is home to a rich diversity of wildlife - both on land and under the sea surface. Many animals have evolved special adaptations and behaviours to deal with the extreme cold and hostile environment, while some visit the Arctic for some of the year - often in the summer - rather than living there all year round.

SUGGESTED ACTIVITIES

Art

Create some Arctic pictures and put them together to produce an information display. It can be effective to use chalks or pastels on dark coloured paper.

Research Task

Find out about the Inuit people or another indigenous peoples from the Arctic. What ingenious ways do they have to survive in the harsh Arctic environment?

Extra Challenge

Can you find out why the Arctic has long summer days and long winter nights?

3. HOW ARE ARCTIC ANIMALS ADAPTED TO THEIR ENVIRONMENT?

SUGGESTED STARTER ACTIVITY

Starting Ideas

Ask the class to think of animals that live in the Arctic - how many can they name? Can they think of any features these animals have that help them survive in very cold conditions e.g. polar bear has thick fur to keep it warm. Record all correct ideas in a mind map on the board.

TEACHER INPUT

There is a diverse range of animals living in the Arctic, all of which are cleverly **adapted** to living in the harsh conditions. This section looks at just some of these amazing animals, but there are many more to explore:

Polar Bear (Slides 19-23)

- Classified as **marine mammals** as they spend most of their lives on the sea ice of the Arctic Ocean.
- Spend over 50% of their time hunting for food (although their hunts are rarely successful). Diet consists mainly of ringed and bearded seals.
- Can have fat reserves that account for half of their total body mass. They achieve this by feeding on the blubber of smaller marine mammals.
- White coat keeps them camouflaged (the fur is actually translucent and only appears white as it reflects visible light; beneath the thick fur their skin is jet black).
- Huge feet - each foot has 5 long claws to help grip the ice.
- They learn to shelter themselves - when there is a snowstorm they dig burrows in the snow to shelter.

For more information on the polar bear, please see this fact sheet:

<http://ypte.org.uk/factsheets/polar-bear/overview>

Whale (Slides 24-27)

- Many whales, such as the grey whale and the humpback whale, do not live all year round in the Arctic. They travel to cold waters in the Arctic to find food and then migrate to warmer waters to give birth.
- Three whale species live year-round in the Arctic - the bowhead whale, narwhal whale and the beluga whale. They are also known as 'ice whales' as they are particularly well suited for life in the Arctic. Unlike many other whales, they

do not have a large dorsal (back) fin that would make navigating through the ice more difficult.

Arctic Wolf - also known as 'polar wolf' and 'white wolf' (slide 28)

- A highly resilient animal that inhabits the Arctic regions of North America and Greenland.
- Fur on the paws to insulate them from snow and ice and also provide for a better grip on slippery surfaces.
- Thick layer of body fat for insulation and food storage to help survive the winter when food supply may be intermittent.
- As the ground is permanently frozen, this prevents the Arctic wolf from digging a den, so they usually live in rocky outcrops or caves.

For more information on the Arctic wolf, please see this fact sheet:

<http://ypte.org.uk/factsheets/wolf-arctic/overview>

Arctic Fox (slide 29)

- Arctic foxes have fur which changes colour from brown in the summer to white in the winter. Their thick coat both insulates and camouflages them from predators.
- They have furry soles, short ears, and a short muzzle - important adaptations to very low temperatures.
- Live in burrows, and in a blizzard they may tunnel into the snow to create shelter.

For more information on the Arctic fox, please see this fact sheet:

<http://ypte.org.uk/factsheets/fox-arctic/overview>

Arctic Hare (slide 30)

- Thick coat of fur to keep warm and it changes colour in different seasons - brilliant white in the winter and grey in the spring, to help it hide from predators.
- Smaller noses and ears than other hares - this prevents heat from being lost from these uninsulated areas.
- 20% of their body is fat which insulates them from the extreme cold.
- Do not hibernate but sometimes dig shelters in the snow and huddle together in groups to share warmth.

Reindeer/Caribou (slide 31)

- Very good swimmers and walkers.
- Hooves that get smaller and harder in the winter to give better grip in the ice and snow.

- For thousands of years, reindeer and caribou have provided the basis of life for many cultures. They provide meat and fat for food, skins for clothing, bedding and tents and antlers for tools.
- They are an important food source for many carnivores in the Arctic, such as wolves.

Seal (slides 32-33)

- Six seal species live in the Arctic region: ribbon seals, ringed seals, harp seals, bearded seals, hooded seals and spotted seals.
- These seals have plenty of thick fur as well as layers of blubber underneath it for insulation.
- Arctic seals are swift and graceful swimmers and do all of their hunting in the ocean. They hunt for a range of different fish, crustaceans, squid, molluscs and marine invertebrates, depending on what foods are abundant in their area.

For more information on the **harp seal**, please see this fact sheet:

<http://ypte.org.uk/factsheets/seal-harp/overview>

Walrus (slide 34)

- Walruses are easily identified by their long white tusks, grizzly whiskers, flat flippers, and bodies full of blubber.
- They are huge! An adult walrus is about 7.25 to 11.5 feet in size and can weigh up to 1.5 tons - that's the weight of a small car!
- Both males and females have large tusks that are used for defence, cutting through ice and getting out of the water.
- They are very sociable animals and often gather in large numbers.

For more information on the **walrus**, please see this fact sheet:

<http://ypte.org.uk/factsheets/walrus/overview>

Lemming (slide 35)

- Small rodents with long, soft fur. They are herbivores, eating grasses, roots, and leaves.
- Remain active during the winters rather than hibernating.

Rock Ptarmigan (slide 36)

- White plumage in winter provides camouflage against the snow.
- Feed on fruit and berries in summer, forage for food under the snow in winter.

Arctic Insects (slide 37)

According to scientific studies of insects in the Arctic tundra, around 3,000 species of insects live there including species of bumblebees, beetles, flies, mosquitoes, butterflies and moths.

Please see here for a fact sheet exploring how different plants and animals survive the harsh conditions at the North and South Poles:

<http://ypte.org.uk/factsheets/survival-at-the-poles/arctic-land-mammals>

SUGGESTED ACTIVITY

Fact File

Choose one Arctic animal (other ideas in addition to those above include the Arctic tern, bald eagle, stoat, moose/elk, musk ox, puffin, sea otter and snow goose).

Produce a fact file including the following information:

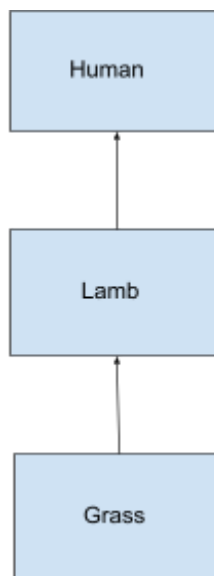
- What the animal looks like (including sketches and/or photographs)
- Where it lives
- What it eats
- How it is adapted to the Arctic environment
- Any dangers it faces

4. HOW DO ARCTIC ANIMALS DEPEND ON EACH OTHER?

SUGGESTED STARTER ACTIVITY

What Eats What?

Can the children construct very simple food chains for the UK? For example:



TEACHER INPUT

A **food chain** or web shows the order in which animals eat the other plants and animals around them. The chain usually starts with a plant, the plant gets eaten by an animal, then the animal gets eaten by a bigger animal and so on. Arrows point from the **prey** to the **predator** that will eat them.

Producers - plants get energy from the sun and use it to make their own food, so they are called producers e.g. grass.

Consumers - animals eat the plants and other animals. They do not make their own food, so are called consumers e.g. humans. A **predator** is an animal that lives by killing and eating other animals. The animal eaten is called the **prey**.

Slide 39: This slide shows an example of a very simple Arctic food chain.

Phytoplankton

Slide 40: **Phytoplankton** are microscopic plants that live in the ocean and float freely with the current. They capture the energy of the sun and turn it into food, so they are the **producers** of the ocean food chain. Phytoplankton are very important as they are the base of the marine food web and feed lots of other marine life, from microscopic organisms to huge whales.

Zooplankton

Slide 41: Zooplankton are tiny free-floating animals that live in the ocean. Most are microscopic but there are few species that can be seen by the naked eye e.g. jellyfish and krill.

Krill

Slide 42: Krill is a type of **zooplankton** - simple shrimp-like organisms that live in the ocean and feed on phytoplankton. They belong to the group of animals called crustaceans, which also includes shrimp, crabs, and lobsters. Krill are an essential part of the Arctic food chain as they are eaten by fish, birds and seals. They are also the main food source for the baleen whale.

Fish

Slide 43: The Arctic Ocean is full of fish such as salmon, mackerel, cod, trout, eel and sharks. The fish eat krill and plankton. In turn, they are eaten by seals, polar bears, other large and small mammals and birds.

Birds

Slide 44: Many birds make their home in the Arctic such as geese, swans, hawks, gulls, terns, puffins and owls. Some migrate to other parts of the world in the winter to escape the freezing cold, but others remain there all year. Birds eat insects, seeds or nuts as well as smaller birds, krill and fish. They are eaten by seals, larger birds, polar bears, other mammals and whales.

Tundra Plants

Slide 45-46: Arctic plants are an important source of food for many animals in the Arctic.

Mammals

Slide 47: A number of small mammals such as lemmings, hares, shrews and weasels live in the Arctic - some eat other small mammals or fish, others eat lichen, seeds or grasses.

Slide 48: Large mammals such as Arctic wolves and Arctic foxes feed on smaller animals, fish and birds.

Slide 49: Polar bears are at the top of the Arctic's land-based food chain and whales are at the top of the marine based food web.

All living things rely on each other in order to survive - this is called **interdependence**. So what happens to the food chain if an animal, such as the seal, is reduced by global warming?

SUGGESTED ACTIVITY

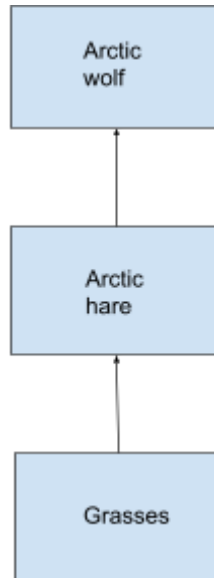
Arctic Food Chains: Worksheet (page 18)

Can the children construct very simple food chains by placing the plants and animals in the correct order? They could draw them neatly in their books and label the **producers**, **predators** and **prey**.

ARCTIC FOOD CHAINS

Can you put these Arctic animals and plants in the correct order to make a food chain? The first one has been done for you.

1. Arctic hare, grass, Arctic wolf



2. Zooplankton, harbour seal, killer whale, phytoplankton, capelin (fish)

3. Walrus, phytoplankton, polar bear, Arctic char (fish), krill

4. Squid, Arctic tern, seaweed

5. Arctic willow, snowy owl, Arctic hare

6. Lemming, Arctic wildflowers, hawk

Extension Task: Construct your own Arctic food chains.

5. HOW IS CLIMATE CHANGE AFFECTING THE ARCTIC?

SUGGESTED STARTER ACTIVITY

Climate Change Question and Answer

The children will probably already know something about climate change. A recap is useful here, before looking at how climate change is affecting the Arctic region in particular. Areas to consider:

- What is climate change?
- What is causing climate change?
- What is happening to our world because of climate change?

TEACHER INPUT

Manmade Climate Change

Slide 51: By burning fossil fuels and cutting down trees (which releases carbon dioxide), humans are contributing to a change in the Earth's atmosphere that is causing it to heat up - this is called **global warming**.

You will find lots of resources here covering global warming and climate change:

<http://ypte.org.uk/downloads/conservation-education-21-wildlife-and-climate-change>

<http://ypte.org.uk/downloads/conservation-education-29-climate-change-update>

Melting Sea Ice

Slide 52: As our planet warms, global sea temperatures are rising and this is causing Arctic sea ice to melt.

Slide 53: The Arctic ice is shrinking because the ocean under the ice is warming. Experts believe that Arctic sea ice is melting at a shocking rate - September Arctic sea ice is now declining at a rate of 12.85% per decade, relative to the 1981 to 2010 average.. Summer sea ice is an essential part of the marine ecosystem and many scientists think it will disappear by the middle of the 21st century. Some predictions say that this could happen as soon as 2030, or even sooner (however recent studies have shown that the ice cap shrinkage has slowed in recent years).

The Albedo Effect

Slide 54: Climate change is happening faster in the Arctic than it is in most of the rest of the world - it has warmed about twice as much as the global average over the last few decades. Sea ice acts as a huge white reflector at the top of our planet, bouncing some of the sun's rays back into space and helping to keep the Earth at an even temperature. But as global warming causes the sea ice to melt, less heat is

reflected and instead the bare rock and dark water absorb more of the sunlight and heat and the ocean gets a little warmer - this is called the **albedo effect**. So this accelerates the overall rate of global warming - scientists call it a 'positive feedback loop'.

Climate Change and the Arctic Food Chain

Climate change is affecting wildlife all over the world, but some species are suffering more than others. Polar animals are particularly at risk from climate change - they are specially adapted to living in the Arctic environment, and now their icy habitat is melting, their survival is endangered.

Slide 55: Polar bears depend on sea ice for their existence - as a platform from which to hunt seals, raise their young and rest after long periods of swimming. The melting ice cap is already forcing the polar bear to change its behaviour; there is now less sea ice and what is left tends to melt sooner, so the bears have to do more hunting inland and are less able to build up valuable fat reserves for the winter. Polar bears are now listed as a threatened species in the US due to the ongoing and potential loss of their sea ice habitat.

Slide 56: Some seal species, such as the ringed seal, make caves in the snow and ice to raise their pups, feed and mate. The seal is the polar bear's main prey, so loss of the sea ice affects the entire Arctic food chain.

Global Effects of Arctic Climate Change

Climate change in the Arctic is not just a local problem and the effects are likely to be felt globally:

- Some Arctic fisheries will probably disappear.
- Glaciers, sea ice and tundra will melt, contributing to global sea level rises (**slide 57**).
- A warmer Arctic could halt the Gulf Stream, which brings warmer water and weather to north-western Europe.

SUGGESTED ACTIVITIES

Research Tasks

- ❖ Choose an Arctic animal that is threatened by climate change. Find out why warmer oceans and melting sea ice is putting the survival of this animal at risk. Is anything being done to help them?
- ❖ Find out more about how climate change in the Arctic could affect us all.
- ❖ In addition to climate change, what other human threats are there to Arctic animals? (e.g. industry, ships, oil and gas exploration)

We value your feedback!

Let us know what you thought of this lesson plan by completing this Google Form <https://forms.gle/cGAwi9AWXfSZgrYa9>. **Thank you!**