COLD AREAS: ANTARCTICA

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).
- Develop contextual knowledge of the location of globally significant places - both terrestrial and marine - including their defining physical and human characteristics….. (Key stage 3).
- Understand how human and physical processes interact to influence, and change landscapes, environments and the climate ….. (Key stage 3).

KEY LEARNING OBJECTIVES

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

Note to Teachers

- These teaching notes run alongside a Powerpoint presentation and all slides are referred to in the notes.
- The notes are designed to provide key information and suggested activities to help teachers deliver the topic, whilst the presentation is full of effective images that will bring the topic to life in the classroom.
- Can be adapted to suit different ages of students by adding/deleting slides on the presentation and/or varying the level of detail used from the teacher notes.

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.

Antarctic Peninsula - the largest peninsula of Antarctica, between the Weddell Sea and the Pacific. It consists of Graham Land in the north and the Palmer Peninsula in the south (see map on slide 11).

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).

Ice sheet / continental glacier - a thick layer of ice covering a large area of land (more than 50,000km wide) for a long period of time.

Ice cap - a mass of ice and snow that permanently covers an area of land (less than 50,000km wide) and is usually centred on a highest point.

Ice shelf - a thick floating platform of ice that forms where a glacier or ice sheet flows down to a coastline and onto the ocean surface.

Iceberg - a large mass of ice that has broken away from a glacier and is floating in the ocean.

Desert - a dry land with few plants and little rainfall.

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. A **marine mammal** has the same characteristics as all other mammals, but they have adapted to living all or part of their life in the ocean.

Vertebrate - an animal with a backbone. An animal without a backbone is an **invertebrate.**

Hypothermia - a condition in which the temperature of your body is very low.

Migratory - moving from one place to another at different times of the year.

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

Food web - the whole group of interacting food chains in a habitat.

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.

1. WHERE ARE THE HOT AND COLD AREAS?

SUGGESTED STARTER ACTIVITIES

1. Hotter and Colder Experiences (Slide 4)

Ask the students 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 students 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 (**page 6**) help them 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 students 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 they 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)

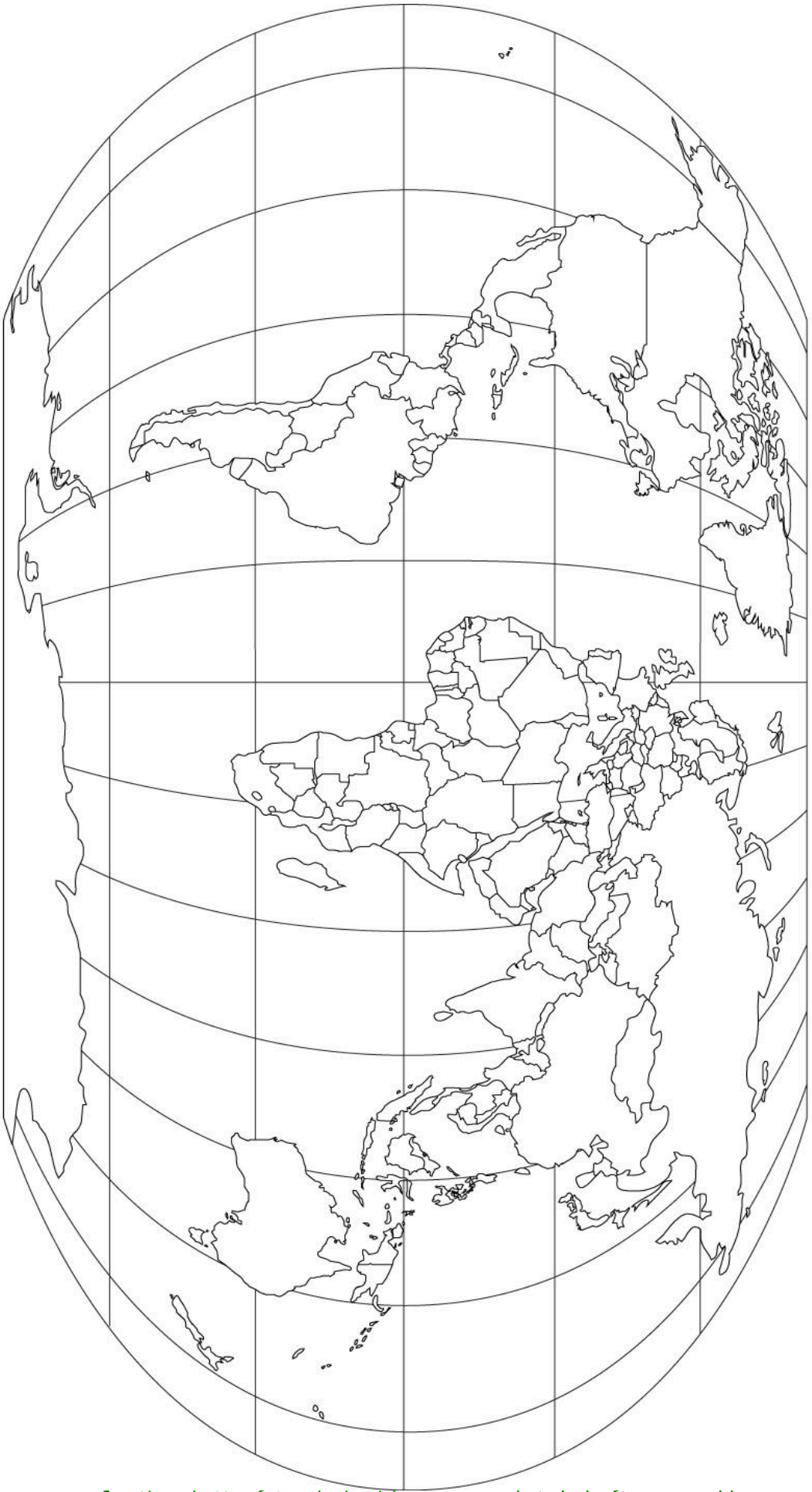
This crossword puzzle checks understanding of key terms covered in this section.

Annotated Diagram

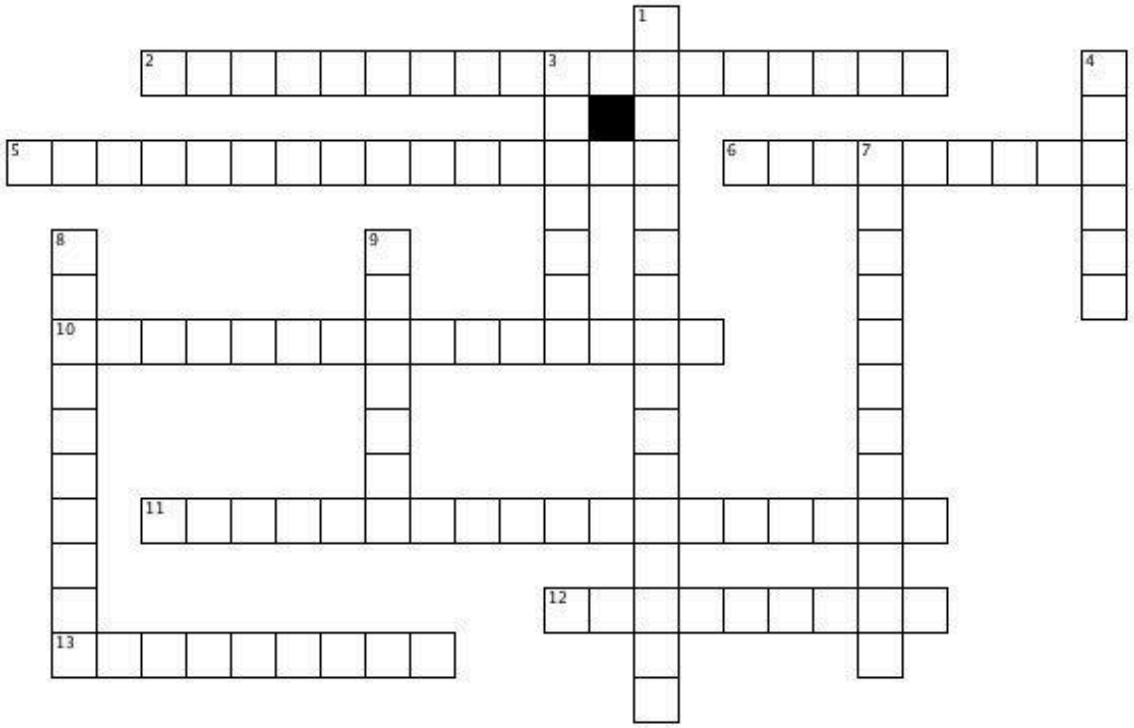
Draw a diagram showing why places near the Equator are hot and places near the Poles are cold. Annotate your diagram clearly.

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 ANTARCTICA?

SUGGESTED STARTER ACTIVITIES

1. Feeling Cold

Ask your students 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 your students 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 your students what they already know about Antarctica - where it is, what is it like there, who lives there, what animals live there etc. Record correct ideas in a mindmap on the board. You could also compile a list of questions they would like answered about Antarctica and return to this at the end of the topic to check they have been addressed.

TEACHER INPUT

Location

Slides 10-11: The continent of Antarctica is a huge frozen land mass surrounded by sea and located at the very bottom of our planet. It covers 5,400,000 square miles - much larger than Europe but less than half the size of Africa. Ask your students to find Antarctica on a globe or in their atlases. Key things to point out from the map on **slide 11** are the South Pole, Antarctic Circle, the Antarctic Peninsula and the big ice shelves (please see glossary for definitions).

Discovery

Slide 12: In 1773, Captain James Cook crossed the Antarctic Circle and sailed around Antarctica. He couldn't see land, but deposits of rock seen in icebergs showed that a southern continent existed. He predicted that an Antarctic land would be found beyond the ice barrier.

Slide 13: In 1820, a Russian naval officer called Thaddeus Bellingshausen, made the first sighting of the continent. He describes it as 'an icefield covered with small hillocks'. This was the first time that a continent had truly been 'discovered' (as there were no native people living there who had already known about it).

The Race to The South Pole

There were then a number of Antarctic expeditions to reach the South Pole. Captain Scott tried in 1901, but was forced to turn back as his men were suffering from snow blindness and scurvy.

Slide 14: In 1911, Roald Amundsen (a Norwegian explorer of polar regions) led a five man expedition that reached the South Pole for the first time.

The Antarctic Treaty

The continent of Antarctica does not belong to any nation and has no countries; instead it has areas called territories - these are claimed by 7 different countries, including the UK.

Slide 15: There are few places on Earth where there has never been war, where the environment is fully protected and where scientific research has priority. The whole of the Antarctic continent is like this - it is protected by an international Treaty made in 1959 which established the continent as a place to be used only for peace and science. It was originally signed by 12 countries (including those with a territorial claim) whose scientists had been active in and around Antarctica. Today, 53 countries are party to the Treaty.

Slide 16: Yearly meetings take place and decisions are made about the administration and management of Antarctica, such as protecting its environment.
HMS Protector is the Royal Navy's ice patrol ship and provides a reassuring presence in British Antarctic Territory. She helps deliver the UK's commitments under the Antarctic Treaty, supports science programmes and ensures that expeditions and vessels are meeting their international environmental obligations.

Landscape

Slide 17: Antarctica is considered a desert because it receives very little rain or snowfall. The small amount of snow that does fall does not melt but builds up over hundreds and thousands of years to form large, thick ice sheets. Antarctica is the only continent that is almost totally covered by ice sheets. It has 70% of all the world's freshwater frozen as ice

Slide 18: Much of Antarctica's coastline is fringed by ice shelves - the largest being the *Ross Ice Shelf* and the *Ronne Ice Shelf* (see map on **slide 11**). In the winter, Antarctica doubles in size due to the sea ice that forms around the coasts.

Slide 19: Antarctica has many high mountains and the *Transantarctic Range* has many peaks above 4000m. But it is not these mountains that make Antarctica the highest continent on Earth; it is because of the thickness of the ice sheets.

Slide 20: It may surprise students to hear that Antarctica has an active volcano - Mount Erebus.

Climate

Slide 21-24: Antarctica is the world's highest, driest, windiest and coldest continent. The coldest temperature ever recorded on Earth was minus 89.2°c (registered on July 21, 1983 at Antarctica's Vostok station).

There are three climatic regions in Antarctica:

1. The interior of the continent - extremely cold with little snowfall
2. Coastal areas - milder temperatures (though still very cold) and much higher precipitation rates
3. Antarctic Peninsula region - a warmer and wetter climate, with above-freezing temperatures common in the summer months.

Midnight Sun and Polar Nights

Slides 25-26: At latitudes greater than 66.5°S (the position of the Antarctic Circle on our globe), days of constant darkness or light can occur. As you move closer to the Poles, the periods of winter darkness and summer daylight increase. At the Poles themselves, the seasonal changes are even more pronounced: 24 hours of daylight occur for several months over summer, while there is complete darkness for several months during winter.

NB. Antarctica's seasons are opposite to the seasons that we're familiar with in the UK. Antarctic summers happen at the same time as UK winters. This is because Antarctica is in the Southern Hemisphere, which faces the sun during our winter time.

People

Slide 27: It is so cold in Antarctica that nobody lives there permanently. But scientists from all over the world visit Antarctica to study the climate, weather, geology and wildlife of this unique region. Their research has helped to highlight global problems, such as climate change. About 4,000 people live on scientific bases in the short summer and about 1,000 people spend the winter on Antarctica. About a third of these visitors are scientists and the rest are support staff (such as carpenters, electricians and chefs).

Slide 28-29: Protective clothing is essential for those living in Antarctica. The 'layer method' of dressing is most effective - several layers are built up, so that insulating air is trapped between and within layers. It is vital to be properly equipped as there are many potential hazards in this harsh environment.

Slide 30: Tourists visit to see the beautiful scenery and wildlife.

Plant Life

Slides 31: As 98% of Antarctica is permanently covered by ice and snow, plant life is very limited. Antarctica has no trees or bushes at all; vegetation is limited to about 350 species of mostly lichens, mosses and algae. These plants are specially adapted to tolerating low temperatures and dehydration.

Slide 32: Most of the ice and snow free land, where colonisation by plants is possible, is on the Antarctic Peninsula, coastal areas and the surrounding islands - here can be found two species of flowering plants. There are also banks of mosses; these have been growing for thousands of years and have formed deep banks – a splash of green amidst the surrounding ice caps, glaciers and icebergs.

Animals

There are no land-based vertebrate animals that live on Antarctica. All the vertebrates are dependent on the sea for feeding or are migratory and leave the continent when the winter arrives.

The largest Antarctic land animals are invertebrates only a few millimeters in size (mainly found on the Antarctic Peninsula). They cope with the low

temperatures in winter by becoming frozen in ice under rocks and stones. They have antifreeze in their bodies and stop all motion and bodily functions while frozen, becoming active again when the ice warms up and melts.

Slide 33: But the oceans surrounding the continent support masses of the world's sea life. Six species of seal and 19 bird species live and breed in the Antarctic. Crabeater seals are the second most numerous large mammal on the planet after humans and the population of krill has been estimated as 800,000,000,000,000 - that's 114,000 krill for every one of the seven billion humans on the planet!

SUGGESTED ACTIVITIES

Visit Antarctica Leaflet

Design and produce an illustrated leaflet encouraging tourists to visit Antarctica. Include information about how special and unique Antarctica is, the stunning landscapes that visitors will experience and the wildlife that they can see there.

Imaginative Writing

What would it be like living somewhere where there is 24 hours of darkness for several months in the winter and 24 hours of daylight for months in the summer? How would you cope with the extreme climate and living in such a remote region? Write a day in the life of a research scientist living on Antarctica.

Research Tasks

a) Imagine you are a scientist who is going to be based in Antarctica for 6 months. Find out the following:

- What will you need to wear?
- What equipment will you need?
- What dangers will there be and how can you prepare for them?

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

c) Find out how icebergs are formed.

3. HOW ARE ANIMALS ADAPTED TO THE ANTARCTIC ENVIRONMENT?

SUGGESTED STARTER ACTIVITY

Starting Knowledge

Ask students how many Antarctic animals they can name (NOT polar bears!). Why do they think there are so few terrestrial animals living in Antarctica? How do animals survive in such cold and hostile conditions?

TEACHER INPUT

Animals survive in these harsh conditions by reducing the amount of body heat lost to the environment; there are many ways in which they do this. They also have clever adaptations which enable them to move efficiently and find food.

Penguin

Slide 35: Penguins are the most common bird in Antarctica. They are flightless birds, but are extremely well adapted for life in this harsh marine environment.

Slides 36-37: Before showing these slides, ask students if they can describe (or demonstrate!) how a penguin walks! There is a good reason why penguins waddle. They can also 'toboggan' on slippery surfaces!

Slide 38: Penguins can jump out of the sea and use their strong claws to grip onto slippery ice or rocky shores.

Slide 39: Penguins are very sociable creatures and live in colonies called 'rookeries'.

Slide 40: Penguins can form large huddles to share body warmth and shelter from the wind. They take it in turns to be on the outside and exposed to the wind, so that they all share the benefit equally.

In total there are 17 penguin species, but only six of them live in the Antarctic permanently - of these there are 2 that make it their true home. The emperor and the Adélie penguin both have physical and behavioural characteristics that make them perfectly adapted to life in this cold and hostile environment:

Emperor Penguin (slides 41-42)

The largest of the penguin species at about 1.1 - 1.3 metres tall (about the height of the average 6 year old), with a very upright and regal bearing. They are highly adapted to the cold environment and are the only animal to inhabit the open ice of Antarctica during the winter.
For more information on the emperor penguin, please see this factsheet:
http://ypte.org.uk/factsheets/penguin-emperor/overview

Adélie Penguin (slides 43-44)

The smallest penguin, standing at about 71cm tall. The Adélie is the most widespread penguin in the Antarctic.

Whale

If you fell in the Antarctic Ocean, you would have around 15 minutes before hypothermia set in and rendered you unconscious. But whales can live at these low temperatures indefinitely. One of the reasons for this is the thick blanket of blubber below their skin.

Many Southern Ocean whales are migratory - they move to tropical waters during the Antarctic winter. This means their calves can be born in warmer waters, as newborn young would not survive in the cold Antarctic seas. They then return south in the spring.

There are a variety of whale species living in Antarctica, including:

The Orca ('Killer') Whale (slides 45-46)

These highly intelligent toothed whales are among the fastest swimming marine mammals. They travel in groups known as 'pods' for warmth and sharing food. Hunting requires group cooperation, so they communicate by sounds that are specific to each pod.
For more information on the killer whale, please see this factsheet:
http://ypte.org.uk/factsheets/whale-killer/overview

Humpback Whale (slide 47)

These baleen whales are slow swimmers. They have a huge heavy plate in their mouth which acts as a sieve and enables them to filter krill, plankton and crustaceans out of sea water.
A factsheet on the humpback whale can be found here:
http://ypte.org.uk/factsheets/whale-humpback/overview

Seal (slides 48-50)

Six of the 35 species of seal live in Antarctica - Antarctic fur seal, leopard seal, crabeater seal, elephant seal, Ross seal and Weddell seal. The most southerly dwelling of all mammals, seals live at the edge of pack ice wherever there is a breathing hole. They can swim large distances between breathing holes and cracks, finding the next hole using a form of sonar with high pitched sounds.

Like penguins and whales, seals have a thick blubber layer which provides insulation and is also a food reserve. They can dive more than 600 meters in search of food and remain submerged for more than an hour at a time. They have specially adapted eyes for underwater vision in low light levels.

A factsheet on the leopard seal can be found here:
http://ypte.org.uk/factsheets/seal-leopard/overview

South Polar Skua

Slide 51: These large seabirds are widespread throughout the coastal regions of Antarctica and migrate across the Equator in the Antarctic winter.

The albatross is another bird that is native to Antarctica - you can find information about it here:
http://ypte.org.uk/factsheets/albatross-wandering/overview

Antarctic Toothfish (slide 52)

The Antarctic toothfish (sometimes known as Antarctic cod) produces antifreeze that allows it to live in the sub-zero waters of the Southern Ocean surrounding Antarctica.

Antarctic Krill (slide 53)

Krill are small shrimp-like creatures (about 6cm in length). They are one of the most abundant and successful animal species on Earth - scientists estimate there are about 380 million tonnes of Antarctic krill in the Southern Ocean at any time, while up to 536 million tonnes are produced each year. The reason for the discrepancy is that so much krill is eaten by other animals. Krill are able to survive for up to 200 days without food and can shrink in length as they starve - this ability to continue growing and reducing their body size helps them to survive the cold dark winter months when food is scarce.

SUGGESTED ACTIVITY

Research Task

Choose an animal that lives in Antarctica. Produce an illustrated fact file including the following information:

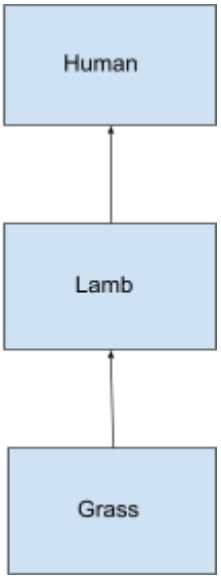
- What it looks like (include a photo or drawing)
- How it is adapted to the harsh Antarctic environment
- Whether it lives permanently in Antarctica or migrates in the winter
- What it eats and its predators

4. HOW DO ANTARCTIC ANIMALS DEPEND ON EACH OTHER?

SUGGESTED STARTER ACTIVITY

What Eats What?

Can the students 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.

Much of the ocean around Antarctica is ice-covered for half the year, and the temperature is near freezing all year. Yet the sea here is full of life, from microscopic algae to shrimplike krill, to large predators that depend on them.

On land, there are no trees or shrubs, and very few flowering plants. Mites and midges are at the top of the terrestrial food chain. But unlike the land, the waters surrounding Antarctica are rich in life.
NB Penguins, seen on land, rely on food in the sea for their energy and so are part of the *marine* ecosystem.

Slide 55: This slide shows an example of a very simple Antarctic food chain.

Phytoplankton

Slide 56: 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, including large populations of krill and huge whales.

Zooplankton

Slide 57: Zooplankton are tiny free-floating animals that live in the ocean and feed directly on the phytoplankton. Most are microscopic but there are few species that can be seen by the naked eye e.g. jellyfish and krill.

Krill

Slide 58: Krill is a type of zooplankton and an essential part of the Antarctic food chain. Rich in protein and fat, krill are food for large numbers of animals at the top of the food chain including whales, seals and penguins.

Squid

Slide 59: There are 70 different species of cephalopods (squid, octopus and cuttlefish) in Antarctic waters and they feed mostly on small fish and krill. Squid are second only to krill as a food source in the Southern Ocean, being eaten by whales, seals and seabirds.

Fish

Slide 60: Most species of fish in Antarctica feed on krill. They are eaten by penguins, seals, seabirds and squid.

Seabirds

Slide 61: South Polar skuas eat krill, fish, penguin eggs and penguin chicks. Antarctic petrels eat fish, squid and krill, while giant petrels are scavengers that will eat penguin, albatross, seal and whale carrion (decaying flesh of a dead

animal). Albatross are scavengers in the sky; they swoop down to catch fish and squid near the water's surface, as well as penguin and seal carrion.

Penguins

Slide 62: Penguins feed on fish and krill. On land, penguins have no natural predators, although their eggs and chicks are eaten by other birds such as the South Polar skua. But in the sea they are hunted by leopard seals and killer whales.

Mammals

Slide 63: With their rows of sharp teeth, **orcas** are at the top of the Antarctic food chain and have earned themselves the title of 'killer' whales. They travel in 'pods' and feed on squid, seabirds, seals, penguins and fish near the water's surface. They also occasionally hunt other types of whale. Their teeth can be 4 inches long and they are known to grab seals right of the ice.

Slide 64: The **blue whale** is the largest animal ever known to have lived on Earth - measuring up to 100 feet long and upwards of 200 tonnes. It mainly feeds on a lot of krill - sometimes up to 3.6 tonnes per day! The only potential danger to blue whales is the killer whale (orca).
For more information on the blue whale, please see this factsheet:
http://ypte.org.uk/factsheets/whale-blue/overview

Slide 65: Leopard seals are lucky as they have a very diverse diet and few predators. They feed on penguins, other seals, fish, squid and krill. Killer whales are currently the only recognized predator to leopard seals.

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 ACTIVITIES

Antarctic Food Chains: Worksheet (page 20)

Construct some very simple food chains by placing the plants and animals in the correct order. Draw them and clearly label the producers, predators and prey.

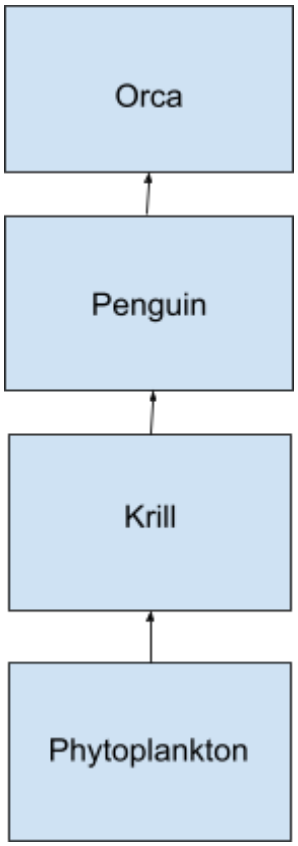
Antarctic Food Web (extra challenge)

A food chain only follows one path as animals find food. When all the food chains in a habitat are joined up together they form a food web. Can you research and draw an Antarctic food web?

ANTARCTIC FOOD CHAINS

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

1.



2. Squid, Weddell seal, phytoplankton, orca, krill

3. Leopard seal, orca, phytoplankton, fish

4. Krill, emperor penguin, phytoplankton, leopard seal, squid

5. Ross seal, phytoplankton, leopard seal, krill, fish

6. Humpback whale calf, krill, phytoplankton, orca

5. HOW ARE HUMANS AFFECTING ANTARCTICA?

SUGGESTED STARTER ACTIVITIES

Climate Change Question and Answer

The students will probably already know something about climate change. A recap is useful here, before looking at how climate change is affecting the Antarctic 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?

Destination Antarctica

Do the students know anyone who has visited Antarctica, perhaps as part of a cruise? Discuss the reasons why people want to go to Antarctica and why it is becoming a popular tourist destination. What problems could these visitors cause for this special environment?

TEACHER INPUT

a) Climate Change

This is the greatest threat to the region. Many scientists based in Antarctica are working on what might happen as our climate changes.

Manmade Climate Change

Slide 67: By burning fossil fuels and cutting down trees, 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 in detail:

http://ypte.org.uk/factsheets/climate-change/climate-change
http://ypte.org.uk/factsheets/climate-change-and-animals/introduction
http://ypte.org.uk/downloads/conservation-education-29-climate-change-update

The Antarctic Peninsula: Melting Sea Ice and Ice Shelf Collapse

Slides 68-69: Over the past 50 years, the west coast of the Antarctic Peninsula has been one of the most rapidly warming parts of the planet* and melting sea ice has caused great concern.

** The situation on the Antarctic Peninsula is actually very complex: it has been warming since at least the 1950s but recently there has been a slight cooling trend caused by a shift in the prevailing wind. Scientists predict that this will be temporary - even if the wind patterns don't change again soon, human-driven warming will overwhelm their effect in the coming decades. The slight cooling of air above the Peninsula also does not mean we can worry less about the threat of sea level rise, as the accelerating loss of ice from Antarctica is driven almost entirely by the warming seas around it.*

Warmer ocean temperatures are making ice shelves increasingly susceptible to breaks and collapses and already some have collapsed. Icebergs are created as great chunks of ice break off the edges of ice shelves.

Slides 70-71: The **Larsen Ice Shelf** is a long ice shelf in the northwest part of the Weddell Sea, extending along the east coast of the Antarctic Peninsula. In January 1995, the Larsen A ice shelf collapsed and in 2002 the majority of the Larsen B ice shelf collapsed dramatically. Just recently, in July 2017, one of the world's largest icebergs broke off from Antarctica's Larsen C ice shelf.

The Rest of Antarctica

Slide 72: There has been no significant loss of ice from the 96% of Antarctica that is not the Peninsula. It is so cold here (average surface temperature of continental Antarctic is about -37°c, compared to -5°c for the warmest places on the Peninsula), that even if temperatures were to rise by the same amount as they have on the Peninsula, there still wouldn't be any melting.

Loss of Habitats

The retreat and collapse of ice shelves leads to loss of habitat for the animals that depended on them:

Slide 73: Krill - Krill is vital to the Antarctic food web, but numbers are declining. Research shows that krill numbers have dropped by about 80% since the 1970s. Many scientists think that this long term decline in the abundance of Antarctic krill is caused by the fall in the amount of sea ice in the winter months in the Antarctic Peninsula region. This sea ice is a vital feeding ground for huge numbers of krill in the Southern Ocean, as they feed on algae underneath the surface.

Slide 74: Penguins - some species are declining in number on the Antarctic Peninsula and the distribution of penguin colonies has changed.
The **Adélie penguin** is a species that is well adapted to sea ice conditions - they need pack ice for most of the year and feed almost exclusively on krill. They

have declined in some areas due to reductions in krill populations and changing weather conditions in their traditional nesting areas. But on the other side of Antarctica (Ross Sea region and East Antarctica), colonies have remained stable or have even increased.

Emperor penguins, which breed almost exclusively on the sea ice surrounding Antarctica, are very vulnerable to climate change and have experienced a decline in numbers by up to 50% in places.

For further information on why penguins are in danger please see: http://ypte.org.uk/factsheets/penguins/penguins-disappearing-from-the-antarctic#section

Global Effects of Antarctic Climate Change

Slide 75-76: Climate change in the Antarctic is not just a local problem and the effects are likely to be felt globally. Scientists fear that the water currently stored in ice may melt and contribute to sea level rise.

It is very difficult to predict what could happen in the future as the climate system is highly complex and not enough is understood about it yet. But even small scale melting of the ice sheets would cause global sea levels to rise and cause flooding around the world. Much research is taking place on this subject, but the total contribution that Antarctica will make to global sea level rise over the next century is still unclear.

b) Tourism

Slides 77-78: Tourism can have a number of negative impacts on Antarctica:

- Breeding birds can become anxious and may abandon their nest or leave the area if regularly disturbed.
- The fragile environment becomes eroded by feet walking over the same piece of ground
- Oil spills from ships and boats are a great risk (this happened in 2007).

c) Fishing

Slide 79: Although there are regulations in place, there are illegal fishing boats that ignore them. Fishing for krill could cause a serious problem as it is at the bottom of many Antarctic food chains.

d) What Is Being Done To Protect Antarctica?

Environmental audits are now carried out to assess the impacts that people are having on Antarctica. Various measures have been introduced, such as:

- More research stations use alternative energy sources - wind and solar power.
- Protected areas are being set up where no vehicles are allowed, there are limitations to annual visitors and even no people allowed at all in some areas.
- Tour operators and expeditions are now guided by codes of conduct to minimise impacts and visitors are educated about the risks.
- The world's experts on Antarctic marine conservation have agreed to establish a marine protected area (MPA) in Antarctica's Ross Sea. It will come into force in December 2017. For further information, see: http://ypte.org.uk/factsheets/antarctica/ccamlr#section

Slide 80: Shipping in waters surrounding Antarctica has increased in recent years. The Polar Code is an international code that has been introduced for ships operating in polar waters and aims to minimise negative impacts.

Slide 81: *HMS Protector* is deployed to the Antarctic region in order to show the United Kingdom's commitment to the Antarctic Treaty. It carries out survey operations in order to understand the environment and inform future work in the Antarctic Region. It also delivers vital supplies to the British Antarctic Survey bases in the region.

SUGGESTED ACTIVITIES

Research Tasks

a) Choose an Antarctic 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?

b) Find out more about how climate change in the Antarctic could affect us all in the future.

c) There are many natural resources in Antarctica - find out what they are and the risks that exploiting them in the future could pose for this unique continent.

Visitor Code of Conduct

Devise a code of conduct for all tourists visiting Antarctica. It should explain how unique and precious the continent and its wildlife is, as well as giving information about how visitors can ensure they cause no harm when they visit.

We value your feedback!

Let us know what you thought of this lesson plan by completing this feedback form https://e.mail-2schools.org.uk/form/BPE-Lesson-Plan. Thank you!