FROZEN OCEANS

Become a polar explorer

Cross-curricular investigation for ages 7-11

bring the oceans to your classroom

[de | oceans]

CATLIN
Underwriting Ambition

CONTENTS

INTRODUCTION

Welcome to the Frozen Oceans education pack for ages 7-11.

The Frozen Oceans resources are based on the research and journeys by explorers and scientists taking part in the Catlin Arctic Surveys between 2009 and 2011.
www.catlinarcticsurvey.com

This booklet for ages 7-11 forms part of a wider education programme aimed at supporting oceans learning in schools.

oceans.digitalexplorer.com is the online home for [de] Oceans and also provides:

- an Oceans Ambassador programme to link scientists and ocean experts with schools
- multimedia resources and lesson ideas for primary and secondary schools
- teacher training opportunities

The programme will continue to develop, so do keep in touch as we work to 'Bring the oceans to your classroom'.

Thank you to the members of the Catlin Arctic Surveys 2009-2011 for their assistance in creating these resources and to Catlin Group Limited for their continued support.

About Catlin

CATLIN
Underwriting Ambition

Catlin Group Limited is a specialty insurance and reinsurance group with more than 55 offices worldwide. Catlin is proud to sponsor research and educational programmes which explore how our planet's oceans may be changing. Starting in 2009, Catlin has sponsored research into the changing Arctic environment through the Catlin Arctic Survey and is now the lead sponsor of the Catlin Seaview Survey, a study of how the world's coral reefs are changing.

About Digital Explorer

[digital explorer]

[de] Oceans is an educational programme delivered by Digital Explorer, an educational social enterprise. Digital Explorer promotes real world learning in schools through linking classrooms with researchers and expeditions.

OVERVIEW

The 2011 expedition between February and May involved a team of scientists and other staff travelling via Resolute Bay to an Ice Base off the western coast of Ellef Ringnes Island in the territory of Nunavut, Canada (78°45'N, 103°30'W). A four-strong explorer team also carried out a two-part journey across the ice, gathering data as they went.

The expedition involved a range of scientific research, which included:

- sea ice depth from transects
- background temperature / climate readings
- pH levels (the acidity of the water)
- zooplankton counts (including copepods)

Air temperatures never rose above -15°C for the duration of the expedition, and got as low as -48°C at some points during the scientists' extended stay on the ice.

This booklet is divided into lessons using the experiences from these expeditions to enable young people to explore the region. They will be able to gain an understanding of how a research expedition is conducted in such inhospitable conditions, what changes are occurring in the Arctic and how these changes can affect the rest of the world.

Each lesson is based on an aspect of polar expedition life or scientific research undertaken by the Catlin Arctic Survey teams. Pupils are encouraged to explore the Arctic Ocean through a series of hands-on activities supplemented by videos and photographs from polar expeditions.

Working in teams

The lessons and activities in this booklet have been designed to follow on from one another, building children's understanding and appreciation of the Arctic Ocean environment. We suggest splitting your class into small polar teams to work on each activity as they progress and to use the learning journey map template as described on page 4.

Each individual lesson can also be used to enliven your current curriculum offering. This could range from looking at diet and calories in a new way, to putting the insulating properties of materials in a real life context.

Together, the lessons can form a Polar Challenge Day, in a connected, fun and cross-curricular way. If you are interested in a polar scientist or explorer joining your school for the day, please see oceans.digitalexplorer.com/speakers/.

IT requirements

The multimedia resources have been designed for classrooms with access to a computer with an interactive whiteboard. Videos and slideshows can also be viewed on desktop or laptop computers or tablets. All resources can be downloaded from oceans.digitalexplorer.com/resources. The videos are in mov format and can be played using a media player such as the QuickTime player. The videos can also be played online at vimeo.com/album/2309815. Slideshows to accompany each lesson are available both in pdf format (to preserve formatting) and in PowerPoint (to offer editing flexibility).

Health & Safety

All activities should be supervised by a responsible adult. The safety of young people is the responsibility of the supervising adult.

Families and home schooling

All the lessons and activities have been designed with the non-specialist in mind. None of the activities require special equipment and can easily be done in the kitchen, garden or local park. The supporting materials (videos and presentations) are downloadable or available to view online from oceans.digitalexplorer.com/resources, and can be viewed on desktop, laptop or tablet computers. We hope you find yourself making polar sandwiches or pemmican in the kitchen, dragging tyres around the local park or experimenting with blubber gloves!

The next generation of explorers

In an article in Newsweek, February 2013, Pen Hadow, the driving force behind the Catlin Arctic Surveys and polar explorer, ends the interview with a note of caution.

> *The Arctic Ocean is like a defenseless princess who needs chaperones - a new generation of explorers - to represent her interests abroad as she arrives on the global scene. Everyone is looking to see what they can get out of her - nobody else there is coming from her perspective. That's the job of those coming up behind me. Before it's too late.*

These activities aim to light the fire for a new generation of explorers and scientists.

TEACHERS' NOTES

A learning journey

This series of lessons takes young people on a learning journey, in the same way that the explorer and science teams embarked on their own journeys of discovery to the Arctic.

To record their learning, we suggest that pupils, individually or in teams, create a map-style log before they set off on their own 'expedition'. The example above can be downloaded from oceans.digitalexplorer.com/resources; or pupils can make their own version using the instructions below.

Making a learning map

1. Use a large sheet of paper to form the base for your map
2. Find examples of maps and print them out or photocopy them (ensure you have the correct permissions to copy materials)
3. Black and white print outs or photocopies can be added to the base sheet of paper as a single sheet or as a collage
4. Colour your maps using watercolours or cold black tea to give them an authentic 'explorer' feel (allow these to dry!)
5. Stick your maps on the large sheet and make sure you give your map a title
6. After the first lesson or activity, write what you have learnt on a piece of paper and cut it out and stick it on the map, with a small flag marking where you start your journey
7. Repeat this process for each lesson or activity, marking more flags and your route line on the map, until you reach the North Pole for your final lesson and press conference

TEACHERS' NOTES

Lesson descriptions and learning objectives

1. Arctic food web mobile

A mix of creativity and science, pupils will explore the food web in the Arctic Ocean before putting their new found knowledge together to make a mobile showing the food relationships in the Arctic.

Learning Objectives

- Recognise and describe how animals obtain their food from plants (and algae) and other animals, using the idea of a food web
- Compare animals in familiar habitats with animals found in less familiar habitats, for example in the ocean

2. Train like an explorer

Nothing can prepare you properly for an expedition to the Arctic, but here are two activities that polar explorers use to train for the harsh conditions of the polar regions: tyre dragging (physical preparation) and sleeping bag relays (mental preparation).

Learning Objectives

- Identify how to keep their bodies healthy and recognise how their bodies might be damaged
- Understand that mental as well as physical preparation is needed
- Practise specific training methods matched to a particular activity

3. How many calories?!

This is a different way to look at calories, diet and food labeling. On a polar expedition, each team member needs to eat between 8,000 and 9,000 calories a day to counter the extreme cold and the exertion of dragging a 120kg sled for up to 12 hours.

Learning Objectives

- Research different food groups and understand how they keep us healthy
- Identify how different foods help the body by supplying energy and nutrition
- Explain how polar explorers design a diet suited to a specific purpose

4. Blubber or bubble wrap

A new way to look at insulation and how humans and other animals adapt to cold environments in different ways. Investigate the insulating properties of different materials and see how effective a layer of blubber can be for keeping warm in icy waters.

Learning Objectives

- Compare how some living things are adapted to survive in extreme conditions
- Identify the properties of different materials and explain why they are needed in certain environments

5. All about ice

The Arctic is defined in the popular imagination by ice, but how is the ice changing and why does it matter to those many miles from the region? A range of practicals show how the changes in the Arctic ice could affect ocean warming, climate and sea level rise.

Learning Objectives

- Describe the physical features of the Arctic environment
- Investigate how environmental change in one area can have global impacts
- Understand how people can both improve and damage the environment

6. Press conference

This final lesson brings together all previous learning as the teams reach the pole and deliver a press conference. The output from this lesson could be a written article, blog post, audio report, press release or video.

Learning Objectives

- Communicate their findings using primary and secondary sources
- Choose an appropriate format and style for a real purpose and audience
- Explain their own and others' views about environmental change

LESSON 1: ARCTIC FOOD WEB MOBILE

Summary

This activity combines science and creativity to help young people learn more about life in the Arctic and the food webs that link them. The output for this activity is to create a mobile to hang at home or in the classroom that shows some of the main types of life that live in and around the Arctic Ocean and how they are related through predator/prey relationships.

Learning Objectives

- Recognise and describe how animals obtain their food from plants (and algae) and other animals, using the idea of a food web
- Compare animals in familiar habitats with animals found in less familiar habitats, for example in the ocean

Preparation

- Download and familiarise yourself with 'Slideshow 1 – Arctic Food Web Mobile' (from oceans.digitalexplorer.com/resources)
- Print out enough copies of:
  - 'Fact Sheet 1– Arctic wildlife facts'
  - 'Activity Sheet 1 – Food webs'
  - 'Activity Sheet 2 – Arctic food web mobile'
  - 'Relevant slides from the Slideshow to use as templates'
- To make the mobiles you will need:
  - Dowelling, twigs or old wire coat hangers (make sure sharp ends are taped or covered)
  - String or fishing line
  - Card
  - Glue
  - Scissors
  - Art materials

Notes

LESSON 1: ARCTIC FOOD WEB MOBILE

Aims / Objectives	Activities	Resources	Outcomes
STARTER: WHAT LIFE IS FOUND IN THE ARCTIC?	Introduce the lesson, describing that the class is going to do a mixture of science and art to find out the types of living things found in the Arctic. To introduce the topic of Arctic wildlife, use slides 2-7 to play rounds of Arctic 'odd one out'. How can pupils tell which living thing is from the Arctic? Use slides 8-16 from the slideshow and Fact Sheet 1 to help pupils learn the names and a little information about a variety of life in the Arctic. This activity can be extended by asking pupils to research more about life in the Arctic online.	Slideshow 1 - Arctic Food Web mobile Fact Sheet 1 - Arctic wildlife facts	Know what living things can be found in the Arctic
CREATING ARCTIC LIFE CARDS	Pupils can work in small teams to create the basis for the food web mobile. In groups, pupils should draw all the living things found in the Arctic (and the sun!) on cards. NB all cards will need to be the same size If needed, slides 22-41 have outline templates of the different living things studied so far. Templates are duplicated to stick to either side of a piece of card, before being decorated. The 10 different templates will all be put together later in the lesson to form a food web.	Slideshow 1	Create a card featuring a living thing found in the Arctic
HOW DO LIVING THINGS LINK IN FOOD CHAINS?	Before putting the food web together, introduce or revise basic information about how living things are connected using Activity Sheet 1. This will help to reinforce some of the key terms. These can also be reviewed using slide 17 and a simple food chain template on slide 18.	Activity Sheet 1 - Food webs Slideshow 1	Describe food relationships using scientific vocabulary
HOW DO THE LIVING THINGS IN THE ARCTIC LINK TOGETHER?	Use the instructions on Activity Sheet 2 to guide pupils to create a food web mobile, using the living things cards. A guide template is also included on slide 19. These can then be hung in the classroom.	Activity Sheet 2 - Food web mobile Slideshow 1	Demonstrate a scientific concept using art and creativity
PLENARY HOW MIGHT THE FOOD WEB BREAK?	Use slide 20 to guide a plenary discussion about how the links can be broken and the importance of all the living things in the Arctic.	Whole class discussion	Reflect on the importance of different parts of the food web

LESSON 2: TRAIN LIKE AN EXPLORER

Summary

This activity looks at what life is like for an explorer, and how they train to survive the physical and mental hardships on a polar expedition. There are two activities: a tyre-dragging relay focusing on physical preparation and a sleeping bag relay focusing on mental preparation. Nothing can really prepare you for your first visit to the Arctic, but these activities will give a little taste of what is involved.

Learning Objectives

- Identify how to keep their bodies healthy and recognise how their bodies might be damaged
- Understand that mental as well as physical preparation is needed
- Practise specific training methods matched to a particular activity

Preparation

- Download and familiarise yourself with 'Slideshow 2 – Train like an explorer' (from oceans.digitalexplorer.com/resources)
- Have a look at 'Fact Sheet 2 – Train like an explorer' for some background information
- Print out enough copies of:
  'Activity Sheet 3 – Tyre-dragging relay'
  'Activity Sheet 4 – Sleeping bag relay'
- There are two videos ('Training in Devon' and 'Sleeping at –35˚C') to bring this activity to life, downloadable from oceans.digitalexplorer.com/resources or online at vimeo.com/album/2309815
- For the tyre dragging relay, you will need (per team):
  Car or van tyre
  Length of rope
- For the sleeping bag relay, you will need (per team):
  3 sleeping bags
  Pair of thick mitts or gloves

Notes

LESSON 2: TRAIN LIKE AN EXPLORER

Aims / Objectives	Activities	Resources	Outcomes
STARTER: HOW DO EXPLORERS PREPARE FOR AN EXPEDITION?	Using slide 2, stress the enormity of the task, pulling sleds across the Arctic. Could the pupils do this? If not, why not? Show slides 3-6 to reinforce the hardships of living and working in the Arctic. Use video 'Training in Devon' to show how the explorers trained for the expedition.	Slideshow 2 - Train like an explorer Video - Training in Devon	Discuss how explorers train for an expedition
TYRE-DRAGGING RELAY	Use the information on Activity Sheet 3 to organise a tyre dragging relay in the school grounds. Pulling tyres is one of the activities that polar explorers use to train for their expeditions. Review the activity: How hard did pupils find the tyre dragging? Why do explorers drag tyres to prepare for the Arctic? How would you find dragging 120kg for up to 12 hours a day?	Slideshow 2 Activity Sheet 3 - Tyre dragging relay	Experience what it is like to train like an explorer Match training to specific activities
SLEEPING BAG RELAY	Another aspect of training is mental preparation. Watch the video 'Sleeping at –35˚C'. It looks easy doesn't it?! Accidents happen when people are tired and frustrated. It can only take seconds for frost bite to set in, if you are not wearing gloves. Use the information on Activity Sheet 4 to organise a sleeping bag relay. Review the activity: How difficult did pupils find the activity? What emotions did they experience? Why might preparing mentally be helpful? What might it be like to have to go to bed at -35°C for 2 months?	Video - Sleeping at –35˚C Activity Sheet 4 - Sleeping bag relay	Understand the importance of mental preparation
REVIEW: WHY IS TRAINING BEFORE AN EXPEDITION SO IMPORTANT?	Compare training for a local sports match with training for an expedition: What risks are involved for each activity? How does training help to lessen risks? How does training help success? What would happen if something went wrong in the Arctic?	Slideshow 2 Whole class discussion	Discuss the importance of training for success and survival

LESSON 3: HOW MANY CALORIES?!

Summary

Living and working in the Arctic is very different to normal life and food is no different. During the expeditions, each member of the explorer teams would eat up to 9,000 calories a day to fuel their body against the cold and give them the energy needed to drag a 120kg sled. At the Ice Base, the teams needed to eat at least double the recommended amount just to stay warm at -35°C. This lesson is based around two activities that bring this reality of polar expeditions to life: designing a daily menu for a polar expedition and making pemmican a traditional expedition food stuff that has been used for over 100 years.

Learning Objectives

- Research different food groups and understand how they keep us healthy
- Identify how different foods help the body by supplying energy and nutrition
- Explain how polar explorers design a diet suited to a specific purpose

Preparation

- Download and familiarise yourself with 'Slideshow 3 – How many calories?!' (from oceans.digitalexplorer.com/resources)
- Have a look at 'Fact Sheet 3 – Arctic food plan' for some background information
- Print out enough copies of:
  'Activity Sheet 5 – Counting calories'
  'Activity Sheet 6 – Pemmican recipe'
  'Activity Sheet 7 – Planning a polar menu'
  'Activity Sheet 8 – My polar menu'
- There is also a choice of two videos ('Cooking at the Ice Base' and 'Extreme Cooking') to bring this activity to life, downloadable from oceans.digitalexplorer.com/resources or online at vimeo.com/album/2309815
- The pemmican recipe has a list of ingredients and describes the equipment needed

Notes

LESSON 3: HOW MANY CALORIES?!

Aims / Objectives	Activities	Resources	Outcomes
STARTER: WHAT DO POLAR EXPLORERS EAT?	Use slides 2-11 and the video to introduce pupils to the diet of a polar expedition. Ask pupils to guess the amount of calories they need to eat (slide 12).	Slideshow 3 - How many calories?! Video - either 'Cooking at the Ice Base' or 'Extreme cooking'	Discover more about a polar expedition diet Use the term 'calorie' correctly as a unit of energy
WHAT FOODS CONTAIN THE MOST ENERGY?	The images and information on slides 14-24 are designed to give pupils an idea of the relationship between different foods and the amount of calories per serving or weight. Polar expeditions have very different nutrition requirements from most lifestyles. Ask pupils to identify whether a particular food is good for polar expeditions or for life at home or school. Introduce the idea of portion size and a balanced diet. Pupils can then draft a menu for their daily lives or for a polar expedition using some simple examples.	Slideshow 3 Activity Sheet 5 - Counting calories	Identify the calorie content of different foods and use the relative calorie content of different foods to plan a menu
MAKING PEMMICAN ACTIVITY	Pemmican is a food that has been used on polar expeditions for over 100 years. The recipe on Activity Sheet 6 can be used with the whole class or some pemmican can be made in advance for the class to taste. Can pupils describe what makes pemmican such a good food for expeditions? Further discussion questions are listed on Activity Sheet 6.	Activity Sheet 6 - Pemmican recipe	Understand the reasons and method for making traditional polar food
HOW DO POLAR EXPLORERS PLAN THEIR DIET?	Use slide 25 to set up the activity. Calories and weight are not the only important factors. Imagine just eating pemmican for 50 days! Use Activity Sheet 7 to guide pupils through the process of designing a polar menu. More background information can be found in Fact Sheet 3. This activity can be done using the internet to find out the calories per weight of common foods. Weight loss websites, such as www.weightlossresources.co.uk/calories/calorie_counter.htm, are a great resource for this. Pupils could also find out the calories per weight information as a homework task. Activity Sheet 8 provides an example template for planning the menu.	Slideshow 4 Activity Sheet 7 - Planning a polar menu Activity Sheet 8 - My polar menu Fact Sheet 3 - Arctic food plan	Design a daily menu fit for a polar expedition
PLENARY	Pupil teams present their polar menu and give reasons for their selection, using the factors on slide 25 as guidance. If pupils are completing the task for homework, a follow-up discussion can take place in the next lesson.	Team presentations Whole class discussion	Present ideas as a team Justify choices using reasons

LESSON 4: BLUBBER OR BUBBLE WRAP?

Summary

Animals and humans use different techniques to keep warm in polar conditions. Humans have developed a different diet as well as clothes suited for the cold climate. Animals have adapted in other ways. Penguins used a two layer feather system and mammals in the Arctic such as the polar bear and seal have large amounts of fat to keep them warm. This lesson looks at the insulating properties of different fabrics and substances.

Learning objectives

- Compare how some living things are adapted to survive in extreme conditions
- Identify the properties of different materials and explain why they are needed in certain environments

Preparation

- Download and familiarise yourself with 'Slideshow 4 – Blubber or bubble wrap?' (from oceans.digitalexplorer.com/resources)
- Have a look at 'Fact Sheet 4 – Polar kit and clothing' for background knowledge
- Print out enough copies of:
  'Activity Sheet 9 – Polar clothing'
  'Activity Sheet 10 – Blubber gloves'
- There is also a video ('Keeping warm experiment') that looks at polar clothing and the insulating properties of different fabrics, downloadable from oceans.digitalexplorer.com/resources or online at vimeo.com/album/2309815

Notes

LESSON 4: BLUBBER OR BUBBLE WRAP?

Aims / Objectives	Activities	Resources	Outcomes
STARTER: ADAPTING TO THE COLD	Use slide 2 to ask pupils to identify which animal is best adapted to the cold. They should think of reasons to justify their choice. The rest of the lesson examines how humans and other animals have adapted to living in the cold of the Arctic.	Slideshow 4 – Blubber or blubber wrap?	Identify adaptations to extreme environments
HOW MANY CLOTHES DO YOU NEED AT –50°C?	Use slide 3 as a prompt to ask pupils to guess the number of items of clothing worn on an Arctic expedition. The total number on slide 4 is 24! Can pupils name the items shown?	Slideshow 4	Discuss the number and types of clothing needed to stay warm
WHAT'S THE BEST MATERIAL FOR THE ARCTIC?	Introduce pupils to the polar clothing activity through the video, Activity Sheet 9 and slide 5. The investigation requires that pupils wait for 20-30 minutes to see which material is the best insulator.	Video – Keeping warm experiment Activity Sheet 9 – Polar clothing	Discover the best material for insulation through a science investigation
HOW DO ANIMALS KEEP WARM?	Use slide 6 to focus pupils on thinking about how other animals adapt to the cold. Can they identify specific adaptations used by the animals shown? Introduce pupils to the blubber gloves activity and discuss how well fat works as an insulator.	Activity Sheet 10 – blubber gloves	Identify and examine specific adaptations to extreme environments
PLENARY HOW CAN SCIENCE HELP US KEEP WARM?	Pupils to check their polar clothing experiment to identify the best insulating material. Discussion points: Which fabric was the best insulator? Were you surprised by the insulating properties of any of the materials you used? What clothes should polar explorers use to stay warm? How has science helped you learn how to stay warm in the Arctic?	Slideshow 5 Whole class discussion	Understand how science has helped explorers to keep warm in the Arctic

LESSON 5: ALL ABOUT ICE

Summary

The Arctic is defined by ice in the popular imagination. Now, some estimates state that the Arctic Ocean may be ice free in the summer by 2040. This has impacts on the Arctic ecosystem and inhabitants, but also further afield. This lesson looks at how the changes in ice cover in the Arctic have implications far beyond the region.

Learning objectives

- Describe the physical features of the Arctic environment
- Investigate how environmental change in one area can have global impacts
- Understand how people can both improve and damage the environment

Preparation

- Download and familiarise yourself with 'Slideshow 5 – All about ice' (from oceans.digitalexplorer.com/resources)
- Have a look at 'Fact Sheet 5 – Arctic Sea Ice' and 'Fact Sheet 6 – Thermohaline Circulation' for background knowledge, as well as the video 'Ocean circulation', downloadable from oceans.digitalexplorer.com/resources or online at vimeo.com/album/2309815
- Print out enough copies of:
  'Activity Sheet 11 – Albedo effect'
  'Activity Sheet 12 – Sea level rise'
  'Activity Sheet 13 – Ocean circulation demonstration'
- When the Digital Explorer team were in Antarctica they made a video, 'Sea level rise experiment', that can be used as an introduction to this activity, downloadable from oceans.digitalexplorer.com/resources or online at vimeo.com/album/2309815
- Each experiment included in this lesson has a number of items to organise, all of which are listed on the individual activity sheets (you may need more than one lesson to go through all experiments)

Notes

LESSON 5: ALL ABOUT ICE

Aims / Objectives	Activities	Resources	Outcomes
STARTER: WHAT IS SEA ICE LIKE?	The Catlin Arctic Surveys took place on the frozen surface of the Arctic Ocean. The ice varied in thickness and shape. Use slide 2 to introduce your class to the different names for ice in Inuktitut, the language spoken by the Inuit, the indigenous people in the Canadian Arctic. We have also included the word for polar bear as sometimes the explorers had to move across thin ice like a polar bear to spread their weight. Then ask pupils to use this new vocabulary to identify the different types of ice in slides 3-12, and the explorer using the 'polar bear crawl'.	Slideshow 5 - All about ice	Learn the different types of words for ice in Inuktitut and learn that the ice in the Arctic is not all the same
WHAT IS HAPPENING TO THE AREA OF SEA ICE IN THE ARCTIC?	Use slide 13 to show pupils the trends for sea ice coverage in the Arctic. Ask pupils to use their data skills to interpret the graph and answer the questions.	Slideshow 5	Use data skills to interpret trends in sea ice coverage in the Arctic
ARCTIC SEA ICE AND THE WIDER WORLD	There is a choice of three experiments that demonstrate some of the impacts that the reduction in sea ice is having. These can be set up for pupils to do themselves, or as demonstrations by the teacher. It is also possible to mix this up and demonstrate two of them and have pupils do one for themselves. Slides 14-18 give an introduction to these issues. Slide 16 relates to the albedo effect. Slide 17 relates to sea level rise. Slide 18 relates to ocean circulation.	Slideshow 5 Activity Sheet 11 - Albedo effect Activity Sheet 12 - Sea level rise Activity Sheet 13 - Ocean circulation demonstration Video - 'Sea level rise experiment' can be used to introduce and model Activity Sheet 13	Use practical demonstrations, so that pupils can understand science concepts relating to changes in Arctic ice
PLENARY WHY DOES ARCTIC ICE MATTER TO EVERYONE?	As part of an open discussion or small group work, pupils should present reasons why the state of the ice in the polar regions matters to everyone	Slideshow 5 Whole class discussion	Relate changes in one place to wider changes in the environment

LESSON 6: POLAR PRESS CONFERENCE

Summary

This final lesson brings together all the previous learning as the classroom expedition reaches the North Pole, and the team deliver a press conference. The output from this lesson could be a written article, a blog post, audio report, press release or video. These outputs can be shared at an assembly, parents' evening, or with the local press. You can also send a selection through to Digital Explorer (info@digitalexplorer.co.uk) so that we can post them on our website.

Learning Objectives

- Communicate their findings using primary and secondary sources
- Choose an appropriate format and style for a real purpose and audience
- Explain their own and others' views about environmental change

Preparation

- Download and familiarise yourself with 'Slideshow 6 – Polar Press Conference' (from oceans.digitalexplorer.com/resources)
- Have a look at an example blog post from the expedition - 'Fact Sheet 7 - Heading home'
- Templates for some of the outputs are available:
  'Activity Sheet 14 - Storyboard template'
  'Activity Sheet 15 - Article template'

Notes

LESSON 6: POLAR PRESS CONFERENCE

Aims / Objectives	Activities	Resources	Outcomes
STARTER: WHY DO WE NEED TO SHARE OUR FINDINGS?	Explain that expeditions need to share their findings for two main reasons. The science research needs to be shared with a wider audience. Not everyone can go to the Arctic and so the team needed to communicate what they found out. The other reason is that expeditions are sponsored. The Catlin Arctic Surveys were sponsored by an insurance company, Catlin. It helps sponsorship to show their support on TV and in the news.	Slideshow 6 - Polar press conference	Identify the reasons for communicating the findings of an expedition
WHAT WERE YOUR MAIN FINDINGS?	The class teams need to review their learning over the past lessons. They should choose their main findings and experiences, as well as selecting some secondary sources such as information from Fact Sheets or photos they have used. These will form the basis of the story that they are going to share. The teams should select five points in total.	Learning journey maps	Summarise previous learning and select appropriate secondary sources
POLAR COMMUNICATIONS	Pupils are free to use the format that suits them and the resources at school. Pupils could use ICT to create a video or complete their article or press release.	Learning journey maps	Communicate findings in a range of formats
PLENARY POLAR PRESS CONFERENCE	Class teams share their articles, videos, etc. with the rest of the class. These can also be shared with local news and websites such as digitalexplorer.com. Set this up as a press conference from the North Pole. Some pupils may want to create a suitable backdrop in the classroom. There is an opportunity to discuss technology at the North Pole. Teams would have to rely on a satellite phone connection or use specialist satellite and film equipment flown in. There are no plug sockets and you would have to rely on battery power or use solar panels.	Whole class presentations	Present findings to peers and real audiences

ACTIVITY SHEET 01

Food webs

Information

Plants and animals are called different things depending on what they eat to survive.
Carnivores are animals and plants that eat animals.
Herbivores are animals that eat plants.
Omnivores are animals that eat both plants and animals.

Question 1

Complete the sentences using the words below.

Plants are _ _ _ _ _ _ _ _ _ because they make their own food using _ _ _ _ _ _ _ _ _.
_ _ _ _ _ _ _ _ _ _ are animals that _ _ _ other animals. Animals that are _ _ _ _ _ _
and _ _ _ _ _ by other animals are called _ _ _ _ .

prey	sunlight	eat
predators	moonlight	producers
plants	animals	farmed
hunted	eaten	lunch

Question 2

In pairs decide whether the animals in the Arctic are carnivores, herbivores or omnivores and whether they are predators or prey or both.

About food chains

Living things in their environments are dependent on each other for food. Food chains show which animals eat other animals or plants. A food chain starts with what gets eaten and the arrows point towards the animal or plant that is doing the eating.

ACTIVITY SHEET 02

Arctic food web mobile

Summary

In this activity, pupils use the Arctic life cards that they have made as part of Lesson 1 to create a food web mobile.

Preparation

Each group will need:

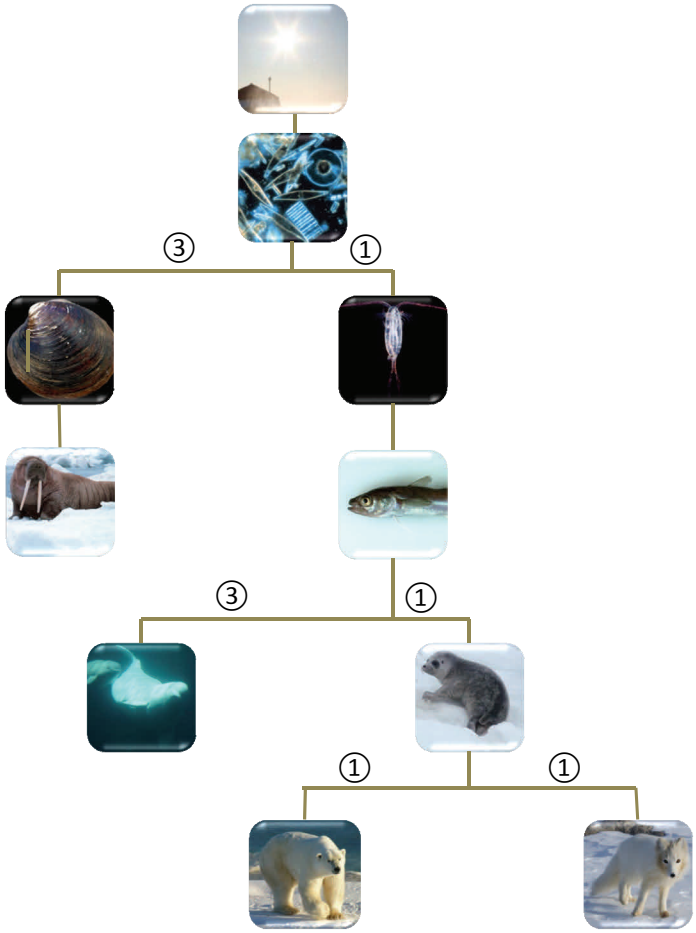
- Dowelling, twigs or old wire coat hangers (make sure sharp ends are taped or covered)
- String or fishing line
- Glue or sticking tape
- Scissors

You may also want to make a demonstration food web mobile beforehand.

Activity

Pupils should start by trying to lay the living things cards in order to show the predator–prey relationships between them.

Once pupils have laid the cards out in the right order, they can start to hang them together using string, tape and sticks. Each group will need three twigs, sections of dowelling, wire hanger or similar.



Design extension notes

The numbers on the diagram opposite show the relative distance along the sticks to hang the cards, so that the mobile balances. You may wish to let pupils work out how best to balance the varying numbers of cards as a Design & Technology extension activity.

ACTIVITY SHEET 03

Tyre dragging relay

Expedition filmmaker Phil Coates on Dartmoor before the 2011 Catlin Arctic Survey

Summary

This activity follows part of the training completed by the expedition team before they left for the Arctic. During the preparation for the 2011 Catlin Arctic Survey, the explorers would drag tyres for up to five hours a day across Dartmoor. We don't suggest that pupils do this activity for five hours in a row, but they should get a taste for the training during this relay activity.

The emphasis during the actual training is on stamina and teamwork. Try to encourage and focus on these during the activity.

Preparation

Decide how you want to set up the relay, depending on the number of pupils taking part. For each relay team, you will need:

– Car or van tyre (this can be varied according to the age of your pupils)

– Length of rope

Tie the rope around the tyre. Old rope can be found for free from outdoor activity centres and climbing walls. You will probably need to tie loops in the end of the rope for pupils to hold on to.

Ensure that you brief pupils on the health and safety aspects of the activity, following the procedures you have at school, including conducting a risk assessment for the activity.

Activity

1. Divide pupils into their groups.
2. Brief teams that the aim of the activity is to work as a team to drag the tyre across the playground or playing field as many times as there are members of the team.
3. Ask pupils to spend 3 minutes deciding how they will do this, e.g. all team members pulling the tyre or taking it in turns individually or in pairs.
4. Start the relay!

ACTIVITY SHEET 04

Sleeping bag relay

Communications manager, Marjan Shirzad practises the sleeping bag system before the expedition

Summary

Getting into one sleeping bag seems simple enough, but it is a lot harder when you have to get in to 3 or 4 sleeping bags and the temperature in your tent is -40°C. It is easy to get frostbite in your fingers, zipping up the sleeping bag at night, when you are tired after a long day. It can also be very frustrating to try to do up fiddly zips with gloves on. Equipment can get broken when you get tired and irritated and there isn't a nearby camping shop to pop down to for repairs or a new sleeping bag. This exercise teaches pupils how to develop mental resilience.

Preparation

Decide how you want to set up the relay, depending on the number of pupils taking part. For each relay team, you will need:

– 3 sleeping bags

– Pair of thick gloves or mitts

Ensure that you brief pupils on the health and safety aspects of the activity, following the procedures you have at school, including conducting a risk assessment for the activity.

Activity

1. Divide pupils into equal teams.
2. Brief teams that the aim of the activity is to show how patience and practice can help to make simple tasks in harsh environments that little bit easier.
3. Each member of the team will need to get into and out of the three sleeping bags (one inside the other) wearing mitts or gloves. If they take the gloves off at any point, they could get frostbite and the team will be disqualified.
4. The fastest team to complete the sleeping bag relay wins.
5. Start the relay!

ACTIVITY SHEET 05

Counting calories

Pepperoni Pizza (large slice)

Energy 181 calories
Weight 71 g

Peanut butter (serving)

Energy 184 calories
Weight 30 g

Porridge (serving)

Energy 166 calories
Weight 45 g

Chocolate (bar)

Energy 520 calories
Weight 100 g

Bread (slice)

Energy 116 calories
Weight 56 g

Lettuce (serving)

Energy 3 calories
Weight 25 g

Chicken (fillet)

Energy 162 calories
Weight 140 g

Pancakes & syrup (3 pancakes)

Energy 530 calories
Weight 120 g

Banana (single)

Energy 95 calories
Weight 100 g

Create a daily menu to make sure that you have enough energy for the day. Give reasons for your choices.

ACTIVITY SHEET 06

Pemmican recipe

About pemmican

Pemmican is a food stuff that has been used on polar expeditions for over 100 years. The name 'pemmican' originally comes from a Cree (a Native American people) word for rendered fat.

It is a high-energy, and highly nutritious food, and also very easy to carry. It has been the ideal food for Native American scouts, 18th Century traders and polar explorers. Scott and Amundsen took pemmican with them on their expeditions to the South Pole.

Traditionally, pemmican is a combination of dried meat, dried fruit and fat (typically from a cow or bison). In recent years, vegetarian and non-fat based variations have been developed.

Ingredients

The quantities have been listed in proportions, so you can make the amount you need, depending on whether you are heading out into the wilds or just want the class to have a small taste.

- **2 portions** jerky / dried meat (beef, bison, caribou, tofu for example)
- **1.5 portions** dried fruit (raisins, cranberries, cherries)
- **1 portion** rendered fat (tallow, suet, vegetarian suet) or use molasses* to bind the mixture

Method

1. Put the jerky in a blender until it is a coarse powder. You could also use a pestle and mortar. If the jerky is not dry enough, place it in an oven at 80°C / 180°F for an hour or more to dry it out further.
2. Render the fat by melting it in a pan over a very low heat. When the fat stops bubbling, it is ready.
3. Strain the rendered fat into an oven dish and add the powdered jerky and chopped or powdered berries. Mix all the ingredients thoroughly.
4. Leave the mixture to firm up, and then cut into bars or roll into small balls.
5. Wrap in greaseproof paper and keep dry. Nibble at will for an energy boost.

* If using molasses, there is no need to heat it. Just add enough to the jerky/berry mix to bind it together.

Discussion

- Why do you think that pemmican was developed as a food stuff?
- Why do you think it was adopted by polar explorers?
- Does pemmican taste nice?
- What are the nutritional benefits of pemmican?
- Can you see any problems for someone eating pemmican if they are not taking a lot of outdoor exercise?

Alternative - polar sandwich

If you don't have time for the pemmican recipe, try this polar sandwich:

1. Take a hard biscuit
2. Put a 2cm thick layer of peanut butter
3. Add an equal amount of butter
4. Enjoy!

ACTIVITY SHEET 07

Planning a polar menu

Packing the shopping - the explorers organise their food in the morning before setting off.

Summary

How would you plan your shopping trip to go to the North Pole? How much food would you take and what items would you choose?

Activity

1. Put the factors in order of importance in the diagram opposite with the most important at the top
2. Complete 'My polar menu' template (Activity Sheet 8) with foods that you would use on your expedition to the North Pole. Don't fill in the calorie column yet.
3. For homework check the food labels in your local shop, supermarket or online to find out the calorie value for your menu. Complete this column.

Review

- Do you need to change the amount of any foods to increase the calories?
- Do you need to change the amount of any foods to decrease the weight?
- Would you like to eat this on a polar expedition?

Factors

- Taste
- Weight
- Energy
- Easy to cook
- Vitamins & minerals
- Balanced diet

My menu factors

ACTIVITY SHEET 08

My polar menu

	Weight	Calories
Breakfast		
Lunch		
Dinner		
Totals		

ACTIVITY SHEET 09

Polar clothing

Communications Manager, Marjan Shirzad, wears a face mask that helps to protect the airways from freezing air.

Summary

Which fabrics help to keep you warm or insulate you the best? In this activity, you will choose three fabrics and investigate how well they insulate some warm water. Using this information, you will be able to advise what type of clothing polar explorers need to keep warm, when the temperature is -40°C.

Preparation

For this experiment, you will need:

- 3 heat resistant cups or beakers
- Warm or hot water
- 3 different types of material or fabric (e.g. fleece, cotton, paper, bubble wrap, etc.)
- A thermometer
- Tape

Activity

1. Fill the 3 containers/cups/beakers with warm water
2. Note the temperature of each container in the table below
3. Wrap each container with one of your chosen fabrics/materials, using tape to create a tight seal
4. Place the wrapped containers in a cool place (inside or outside or even in the fridge)
5. Leave for 20-30 minutes
6. Unwrap the containers and measure the temperature, noting this new temperature in the table below

Measurements

Fabric	Temp. before (°C)	Temp. after (°C)

Discussion

- Which fabric was the best insulator?
- Were you surprised by the insulating properties of any of the fabrics/materials you used?
- What fabrics/clothes should polar explorers use to stay warm?

ACTIVITY SHEET 10

Blubber gloves

Walrus on sea ice (image credit: NOAA)

Summary

This activity looks at how animals have adapted to cold environments by having a layer of fat to insulate themselves. There are two methods to complete this activity. The first is messier and perhaps more fun. The second might be more suitable to performing the activity with a whole class.

Preparation

For this experiment, you will need:

- 1 large container
- Lots of ice
- 2 freezer / self-seal bags or over-large rubber gloves (method 2 only)
- Gaffer or parcel tape (method 2 only)
- Fat such as margarine (or animal equivalent suet, butter, lard)
- Stopwatch

Method 1

1. Fill a large container with lots of ice and water
2. Place one hand in the cold water and time how long you can keep it there before the cold becomes unbearable
3. Record the time
4. Cover your hand with large amounts of fat and repeat the experiment, timing how long you can keep your fat-covered hand in the water before the cold becomes unbearable
5. Compare the two times

Method 2

1. Fill one of the bags or gloves 2/3 full with fat
2. Placing your hand in the other push it into the fat-filled bag or glove, creating a blubber glove
3. Roll the ends of the bag together and seal with tape to stop any fat escaping
4. Follow the guidance in Method 1 to see how fat helps animals keep warm in cold environments

ACTIVITY SHEET 11

Albedo effect

A 'lead' opens up in the Arctic sea ice, exposing the dark ocean beneath the ice

Summary

Albedo is the term used to describe surface reflectivity. The greater the albedo of a surface, the more light it reflects and the less it absorbs. This activity looks at how decreasing sea ice in the Arctic Ocean contributes to a lowering of the albedo and an increase in the amount of solar energy absorbed in the region.

Light, white sea ice has a high albedo, reflecting more of the sun's heat back into the atmosphere. Conversely, the dark surface of the open ocean absorbs more solar energy, contributing to warmer oceans and a reduction in sea ice coverage.

This is an example of a positive feedback loop. A reduction in sea ice coverage results in more solar energy being absorbed by the Arctic Ocean. This leads to further sea ice loss, and so on.

Preparation

To demonstrate the albedo effect, you will need:

- 1 piece of white material, such as felt
- 1 piece of black material, such as felt
- 2 thermometers
- A heat source, e.g. a lamp (an incandescent bulb will work much better than an energy-saving one as these emit more waste heat – the higher the wattage the better!)

Activity

1. Make sure that both thermometers are at room temperature
2. Note the temperature of each thermometer
3. Place one thermometer under the white material and the other under the black one
4. Put the thermometers covered by the material under the light source, making sure they are the same distance away (approx. 20 cm)
5. Keep the thermometers there for 15 minutes
6. Note the new temperature of each thermometer

Review

- Which colour absorbed more light energy?
- Which colour reflected more light energy?
- How can this activity be related to what is happening in the Arctic?

ACTIVITY SHEET 12

Sea level rise

Exploring the ice on the Arctic Ocean, during the Catlin Arctic Survey

Summary

How might the melting of ice in the Polar Regions affect sea level rise around the world? The melting of different bodies of ice has different impacts on sea level rise.

A study published in November 2012* states that 4 trillion tonnes of ice from Greenland and Antarctica has melted between 1992 and 2011. This has resulted in a 11mm rise in sea level, contributing about 40% of the total sea level rise today. For sea ice, there has been a marked reduction in sea ice coverage in the Arctic and an increase in the Antarctic.

This activity demonstrates how sea level rise is affected differently by melting sea ice and melting ice caps in Greenland and Antarctica.

Preparation

For this experiment, you will need:

– 2 full cans of food

– 2 plastic containers

– Some ice

– A marker pen

Activity

1. Place the two cans of food in the plastic containers (the height of the containers should be higher than the cans).
2. Into one container put a mixture of ice and water, until it comes up to about 1cm below the top of the can. This is the Arctic Ocean model.
3. In the other container pour water (again until it comes up to about 1cm below the top of the can). Then place the same amount of ice used for the Arctic on top of the can. This is the Greenland or Antarctica model.
4. Label each container and mark a line at the water level.
5. Ask pupils to guess what will happen to the water (sea) level as the ice melts.
6. Leave the cans for a time (up to 2 hours). The melt rate will of course vary with the warmth of the room and the amount of ice used.
7. Mark the level of the water after all the ice has melted.

Review

– Ask pupils if there is a difference in impact from sea ice and ice on land.

– How could this affect people living in e.g. the UK or USA?

*A Reconciled Estimate of Ice-Sheet Mass Balance, Andrew Shepherd et al., Science 30 November 2012: Vol. 338 no. 6111 pp. 1183-1189

ACTIVITY SHEET 13

Ocean circulation demonstration

Summary

Ocean circulation relies on different densities of water falling and rising. The density of water is affected by salinity and temperature. This demonstration will help pupils understand that the ocean is not like a swimming pool where the water is stationary, but more like a river with deep currents.

You may need the help of your school's science technicians with some of the equipment.

Equipment needed per group:

- 1 clear container to act as a mini-ocean
- Salt
- Water
- Food dye

Preparation:

You will need to create the following water samples in advance of the lesson:

- 8 litres of 'Standard seawater' at room temperature (create the brine by dissolving 32 grams of salt per litre of tap water)
- 0.5 litres of 'Standard seawater' at room temperature (20°C) with food dye (create the brine by dissolving 32 grams of salt per litre of tap water)
- 0.5 litres of 'North Atlantic seawater' with food dye (create the brine by dissolving 32 grams of salt per litre of tap water) and kept in the fridge (5°C)
- 0.5 litres of 'Arctic seawater' with food dye (create the brine by dissolving 64 grams of salt per litre of tap water) and kept in the fridge (5°C)
- 0.5 litres of 'Ice cap melt water' with food dye (add no salt) and kept in the fridge (5°C)

Demonstration 1 – Control

1. Fill the container halfway with up to 2 litres of the undyed 'Standard seawater'
2. Fill a beaker with some of the dyed 'Standard seawater'.
3. Carefully pour the dyed water down the side at one end of the container.
4. Observe what happens.

Demonstration 2 – North Atlantic

1. Explain that as the water moves north it becomes cooler. Use the 'North Atlantic seawater' to demonstrate how cooler surface-water behaves.
2. Repeat the demonstration for the control and use the dyed 'North Atlantic seawater' instead of the dyed 'Standard seawater'.

Demonstration 3 – Arctic Ocean

1. As sea ice forms it exudes salt, making the surface waters in the Arctic brinier. Use the 'Arctic seawater' to demonstrate how cooler and saltier water behaves. It is the sinking of this cold, salty water in the Arctic that drives the Gulf Stream and other ocean currents.
2. Repeat the demonstration for the control and use the dyed 'Arctic seawater' instead of the dyed 'Standard seawater'.

Demonstration 4 – Ice cap melt

1. If the Greenland Ice Cap melts, more freshwater will enter the Arctic Ocean. In addition, there may be increased river output in Canada and Siberia, again decreasing the salinity of the Arctic Ocean.
2. Repeat the demonstration for the control and use the dyed 'Ice cap melt water' instead of the dyed 'Standard seawater'.
3. What impact might this have for the ocean current system?

ACTIVITY SHEET 14

Storyboard template

CAPTION:

CAPTION:

CAPTION:

CAPTION:

CAPTION:

CAPTION:

ACTIVITY SHEET 15

Article template

Tips:

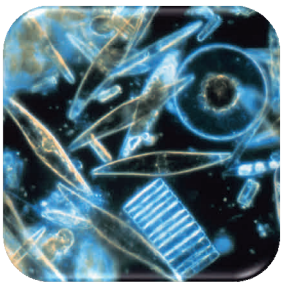
- Have a great title
- Use an exciting image
- Use facts that you have learnt
- Use persuasive writing techniques

North Pole News

By:

FACT SHEET 01

Arctic wildlife facts



Algae is the Latin name for seaweed. Algae range from tiny individual organisms all the way to examples like the giant kelp which can grow over 65 metres long. They get their energy from the sun like plants.

Copepods are small crustaceans that live in the sea. They are related to animals like lobsters and shrimps. They feed on algae and are eaten by larger animals such as whales and fish.

Clams are a type of shellfish. They filter algae from the sea for food. The shells are about 5cm high.

Arctic cod is a fish that lives in the cold waters of the Arctic and around Greenland. It feeds on small crustaceans and is eaten by animals such as seals and beluga whales. It grows to about 30cm long.

Ringed seals are one of the types of seal that live in the Arctic Ocean. They are a marine mammal and can grow up to 1.8 metres in length and weigh over 140kg. They give birth on small ice floes and eat fish to survive.

FACT SHEET 01 (continued)

Arctic wildlife investigation

The **walrus** is a large marine mammal that is easily recognised from its tusks. They can weigh more than 1,700kg, and spend a lot of time diving into the cold Arctic waters to find shellfish to eat.

The **arctic fox** is a small fox which has thick fur that changes from white in the winter to brown in the summer. They eat small mammals like lemmings and also seal pups.

The **beluga** is a small whale that hunts for fish in the Arctic waters. It has a bump on its head which contains an organ known as the melon. This is used for 'echolocation' to find holes in the sea ice to come up for air. Male belugas can grow up to 6 metres long.

The **polar bear** is the largest land carnivore. Polar bears spend more of their time at sea and their Latin name (*Ursus maritimus*) means 'sea bear'. They hunt seals and sometimes arctic foxes. Standing on their back legs, they can be over 2.5 metres tall.

Useful websites

www.arkive.com

www.bbc.co.uk/nature/places/Arctic4

www.worldwildlife.org/places/arctic

FACT SHEET 02

Train like an explorer

Ann Daniels and Tyler Fish train before the 2011 expedition

Apsley Cherry-Garrard (one of the survivors from Captain Scott's Terra Nova expedition) famously said "Polar exploration is at once the cleanest and most isolated way of having a bad time which has been devised."

Dragging 120kg sledges for up to 12 hours a day, over smashed up ice in the intense cold and on limited rations makes a long polar expedition a unique physical and mental challenge. The suffering endured on a 3-month journey across the Arctic Ocean is unimaginable to most of us.

The physical training for the Catlin Arctic Survey Explorer Team was masterminded by Jon Stratford. Jon spent 14 years as a Royal Marine Commando, working as a physical training instructor in his latter years.

Months of intense physical training are imperative before stepping out onto the ice. Jon works closely with each explorer to target specific areas, but the overall aim remains the same – to build endurance, strength and speed.

Given that the majority of the physical exertion comes from dragging a heavy sled, a lot of the training exercises mimic this action. Tyre-dragging is therefore the polar explorers' training staple.

As the expedition departure date draws closer, the explorer's training programme increases in intensity. The number of circuit repetitions and towing weights are increased. With this increase in intensity comes the need for the explorers to mimic conditions on the ice as much as possible.

This includes training with a hood on, which reduces communication and vision (both of which are extremely important when working as a team on the ice), and wearing mittens to prepare for the frustrations of trying to operate and manhandle kit and sleds with impaired dexterity.

Such a physically demanding expedition requires pre-departure training to be conducted in small, managed steps to reduce the risk of injury. Their training programme also needs to ensure the team is able to withstand extreme fatigue and weight loss as the expedition progresses.

This text has been adapted from an original blog post from the expedition website - www.catlinarcticsurvey.com/2011/08/15/train-like-an-explorer/

FACT SHEET 03

Arctic food plan

A selection of food for a polar expedition (image credit: Weber Arctic)

The diet while on a polar expedition must be high in calories but light to carry. A polar diet is generally high in fat, as fat is high in calories. If you are going to eat the same food for 50 or 60 days, you had better like it! A phenomenon of polar travel is that after a couple of weeks food starts to taste bland, so strong tasting food is important, and should contain as little water as possible. The best way to gauge this, is to freeze the food and try to eat it.

Food with a high water content will freeze and will not be very tasty. The best foods for polar travel are strong tasting, high in fat and low in water content.

Polar Pâté

Polar Pâté, made from meat, suet, vegetable fats and grains, is a good base for a polar diet. It is high in calories, about 700 per 100 grams. When mixed with noodles or rice it makes a thick gravy, and can be a morning or evening staple.

Chocolate Truffles

These are special high-calorie truffles made with chocolate, butter and macadamia nuts. They come in milk chocolate, dark chocolate and white chocolate flavours. These provide long-lasting energy as they contain about 700 calories per 100 grams.

Expedition Cake

This cake is made mostly from dry fruit and nuts, and contains very little water, so it tastes good at low temperatures, and does not freeze. Expedition cake is a bit contrary to most polar food, as it is not as high in calories. However, we find it is a very effective trail food, because it provides a lot of energy very quickly.

Freeze Dried Cheese

Freeze-dried cheddar cheese makes a good snack. It is made from old cheddar and contains 637 calories per 100 grams.

Zero bars

The Zero bar is a high-calorie commercial chocolate bar. Each 50 gram bars contains 320 calories.

Deep Fried Double Smoked Bacon

Bacon contains more calories than any other type of pork meat. This is old-fashioned 'farmer's type' smoked bacon. Unlike commercially processed bacon, the result is a product that is more flavourful and contains less water. We have experimented with many different ways to prepare the bacon for expeditions, and have found that deep frying removes most of the water, without losing too much fat.

Nutrition

Although there are a lot of calories in our polar diet, there is very little nutrition. Therefore, it is imperative to your health that you use a good supplement. We recommend the 7Systems Vitamin Mix, which includes some sixty different ingredients, and comes perfectly packaged in daily rations. We highly recommend use of these vitamins for any long, physically demanding expedition.

This information has been reproduced with the kind permission of Richard Weber of Weber Arctic. Weber Arctic were one of the food suppliers for the Catlin Arctic Survey.

Further information can be found at their website:
www.weberarctic.com

FACT SHEET 04

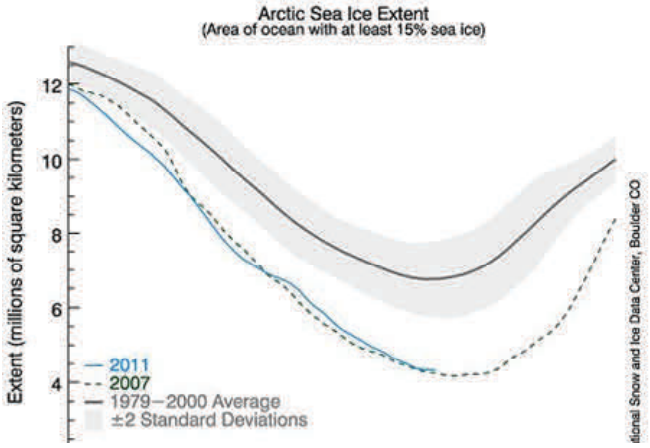
Polar kit and clothing

Tyler Fish examines designs for the clothes to be worn by the team on the 2010 expedition

- The three key factors for suitable clothing are: moisture-management, durability and wind-resistance.
- The material that makes up the Explorer Team's sledging suits is a combination of natural and synthetic fabrics: a PERTEX© Classic 6 outer, reinforced with POLARDRI© and insulated with a DRYACTIV© deep pile lining.
- The suits are custom designed for vigorous and daily use for 3 months.
- The temperature range the suits can withstand is -5°C to -50°C.
- Clothing worn against the skin should be made of synthetic material in order to absorb sweat from the body and dry as soon as possible.
- Frostbite is most common at the extremities of the human body: toes, fingers and nose. These are the areas which need most protection while working in a cold environment.
- Three layers of gloves are worn: an outer mitt, a mid-layer glove and a pair of thin base-layer gloves.
- It is critical to keep feet warm and insulated, as well as making sure there is enough room for the feet to move inside the boots. This is so circulation is not cut off and the risk of frostbite minimised.
- To protect the neck and head, scientists and explorers wear woolly hats, neck-overs and facemasks.
- If the team are not doing a physical activity and therefore not generating much heat of their own, a down jacket full of feathers is worn.

FACT SHEET 05

Arctic sea ice



The National Snow and Ice Data Center (NSIDC) publishes regular updates on the state of polar ice (www.nsidc.org)

Current estimates are that the Arctic will be ice-free in the summer by 2036. After centuries of trying to navigate the fabled North West Passage, this geographical shortcut connecting Europe and Asia may become a forgotten obsession. Instead ships will ply their trade across the entirety of the Arctic Ocean, rather than hugging the edges of land.

2007 marked the lowest extent of Arctic sea ice on record and the years since have shown little evidence of bucking the trend. This change has ramifications not just for international trade but also in terms of climate, habitat loss, natural resource exploitation and geopolitics, as well as the livelihood and culture of indigenous peoples who have long made the Arctic their home.

A loss of sea ice will create a positive feedback loop in the climate system. The white ice of the Polar Regions reflects solar warmth better than the dark waters of the seas. This solar reflection is known as the albedo effect. The phenomenon can be replicated in the classroom by placing a piece of black card and a piece of white card in direct sunlight or under a lamp. Attach a thermometer to the back of each piece of card and observe the changes in temperature for each over time.

The sea ice also provides important habitats to Arctic animals and plants, all the way from the microscopic life that inhabits the brine channels, to larger animals such as polar bears and ringed seals. The plight of the polar bear is well-documented and can provide an emotive 'way in' for some pupils. The WWF have produced some good background information and resources on this topic.

Reduced sea ice not only represents opportunities for shipping, which could provide a lower carbon transport infrastructure between Europe and Asia, but also opens up new areas for natural resource exploration. The Guardian has produced an interactive map of current endeavours and Shell has developed a website describing its attitudes and plans for the region. One current issue is whether the chemicals used to mitigate environmental damage from oil spills will work in such cold temperatures.

In terms of geopolitics, the Russian claims to the North Pole are well-documented. Many countries bordering the Arctic are surveying the continental shelves, used as a marker for delineating territorial waters. There was also evidence of increased military build-up in Resolute Bay in the Canadian Arctic, when I passed through last year and the Danish Army patrols in Greenland were featured in episode 6 of the excellent BBC 'Frozen Planet' series.

This move to bring the Arctic hinterland of Canada and Russia under further control and to increase commercial activity in the

As the ice breaks up, cracks appear - these stretches of open water are known as leads (image credit: © Martin Hartley)

region has had a negative impact on the indigenous peoples living there. Survival International write:

Many of the Innu are still fighting to retain much of their traditional lifestyle, increasingly difficult as the government hands out their land in mining concessions, floods the heart of their territory for hydro power schemes, and builds roads which cut up the remainder. In April 1999, the UN Human Rights Committee described the situation of tribal peoples as 'the most pressing issue facing Canadians', and condemned Canada for 'extinguishing' aboriginal peoples' rights.

FACT SHEET 06

Thermohaline circulation

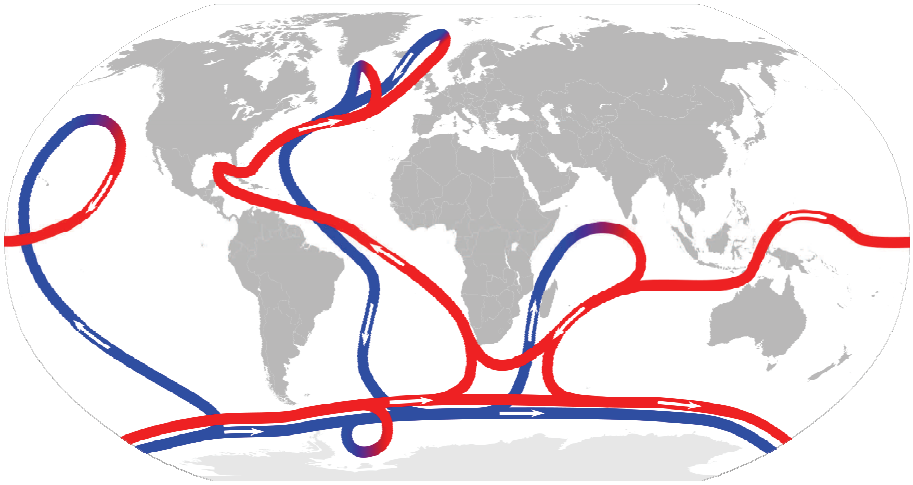


Image credit: Robert Simmon, NASA

– If you look at a map of the world and draw a line through London (a latitude of about 50 degrees North) and follow this line across the world, you'll see that it passes through southern Siberia and skims the southern shores of Hudson Bay in Canada. The week before I came out to the Catlin Arctic Survey Ice Base, the temperature in Hudson Bay was lurking between -20°C and -15°C, whilst London was starting to nudge a balmy 8°C.

– In general we think about temperatures becoming colder as you move further north, but England, for example, enjoys a relatively mild climate compared to Northern America.

– The reason for this is the global ocean currents, and specifically for the British Isles and North Western Europe, the current known as the Gulf Stream which brings warm waters from the Caribbean. The ocean currents around the world have a huge impact on our climate.

– The movement of the ocean current in the North Atlantic is a bit like a swimmer doing a tumble turn. The warm salty water from the tropics moves northward releasing its heat close to the English coast. This current continues to move further north until it enters the Arctic Ocean. When Arctic sea ice is formed in the autumn and winter, cold brine (salt water) is rejected from the ice and the surface water becomes denser, sinking down towards the seabed. This water then flows out of the Arctic back towards the equator, creating a dragging effect that sustains global ocean currents.

– This mechanism is known as thermohaline circulation (thermo = temperature and haline = salt). Both salt and temperature play a big role in this process as these two factors affect the water's density. Cold water is heavier than warm water. We know this if we have been swimming in a lake on a summer's day and enjoyed the warmth of the upper layers and shivered as our feet reach down into the depths. Salt water is heavier than fresh water, as it is not just water, but also contains dissolved salts.

– In the North Atlantic the warm salt water cools as it moves north, and then sinks. Cold brine is the heaviest type of water and so this process is relatively rapid, speeding the flow of the current. However, the speed at which the water sinks in the North Atlantic could be affected by changes in the Arctic Ocean. Because of increased sea ice and glacier melting (ice is all fresh water), as well as more riverine input, there is an increased flow of freshwater from the Arctic that is mixing with the cold salt water from the Atlantic. By adding more buoyant fresh water to the mix, the Atlantic water does not sink as rapidly.

– Scientists have put forward scenarios that show thermohaline circulation slowing abruptly over a variety of timeframes. This slowing of the ocean conveyor (the global system of ocean currents) could have dramatic climatic effects around the world. A Met Office Technical Note 'Global climatic impacts of a collapse of the Atlantic thermohaline circulation' predicts the impact if the ocean conveyor were to stop completely: "In the first five decades after the collapse, surface air temperature response is dominated by cooling of much of the Northern Hemisphere (locally up to 8°C, 1-2°C on average) and weak warming of the Southern Hemisphere (locally up to 1°C, 0.2°C on average)."

– More research is needed to understand better sea ice formation, movement and melt rate in the Arctic Ocean. If the sea ice melt-rate increases rapidly, then we could see a resulting slowing of the ocean currents that warm North Western Europe. A significant slowing 8,200 years ago heralded a mini Ice Age.

Edited from an original blog on the Catlin Arctic Survey website by Dr. Victoria Hill

FACT SHEET 07

Heading home

Explorer co-leader, Ann Daniels, talks about what it's like to return to civilisation

"It's strange coming back to a city after being away for so long. For many days you don't smell anything except clean Arctic air, your own body odour and freeze-dried food each evening. Your only sights are your companions and thousands of miles of snow and ice. Once you're back there are suddenly smells everywhere and so many things to see. You notice perfume or aftershave as people walk past. The warm smell of the city changes constantly and your eyes are aware of the many colours, with cars passing, people walking, music blaring and billboards. It's difficult to get used to.

The first thing I did after being picked up off the ice was to have three baths, one after the other. I shaved my legs and got rid of the dead skin that hadn't seen the light of day for weeks. Because you don't take your clothes off during the expedition, dead skin builds up.

My first drink was a cup of tea made with water out of a kettle, and my first meal was steak, potatoes and vegetables. Each item lay separately on a plate, and I ate it with a knife and fork at a table sitting on a chair.

I always find the end of an expedition difficult. I don't miss anything at all, apart from my family of course. I have everything I need on the ice for what I'm doing and as long as you've got the food right, there's nothing you crave.

It's amazing how great it is to go back to simple life. I hate leaving the ice as much as I love coming home, if that makes any sense. The most difficult part of an expedition is the first two weeks. The weather is cold, the sledges are heavy, and you have so many days stretching ahead of you, it seems forever.

The highlight of this year's Survey was the way the team worked together. Tyler (the other co-team leader) and I helped people who hadn't travelled to the Arctic Ocean before to do their jobs. Watching them as they coped with the hardships and enjoyed the magnificence of the environment we were travelling in was a pleasure.

Although it's only been a few months I'm already planning my next expedition. A woman has yet to walk solo to the North Pole - I just need funding and am trying to raise sponsorship at the moment."

You can follow Ann on Twitter @AnnDanielsGB or visit:
www.anndaniels.com

This booklet and further ideas about bringing the Frozen Oceans to your classroom are downloadable from oceans.digitalexplorer.com

These resources for ages 7-11 are based on journeys undertaken by explorers and scientists taking part in the Catlin Arctic Surveys between 2009 and 2011. The activity ideas and accompanying resources are designed to introduce pupils to what life is like in the High Arctic and the importance of learning about this extreme environment.

The activities are designed for use across the curriculum and can be combined to create a 'Polar Day' at your school.

Themes covered include:

- **Create a mobile that shows the arctic food web (Art & Science)**
- **Learn how polar explorers train and survive (Physical Education)**
- **Devise a menu for a polar expedition (Food Technology)**
- **Investigate how people and animals stay warm in the Arctic (Science)**
- **Understand the impacts of the melting ice (Geography)**
- **Report findings at a polar press conference (English and ICT)**

These activities are designed to be used with further multimedia resources available online. A selection of videos and photo slideshows from the expeditions are available for free download from oceans.digitalexplorer.com.

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