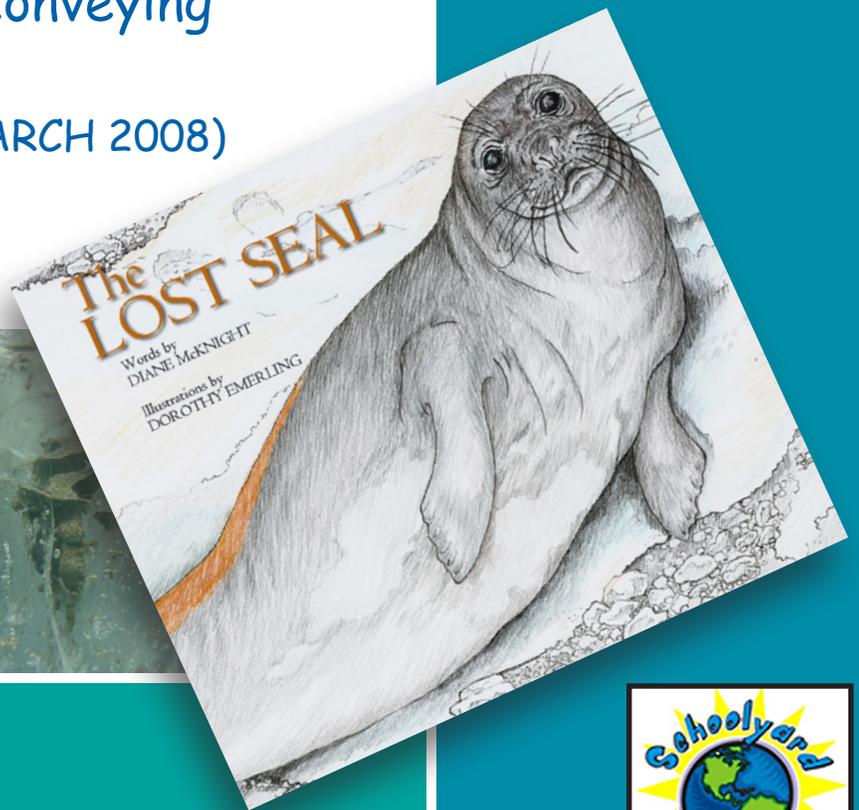


# The Lost Seal



"a book like this, with an engaging story line and beautiful images, goes a long way toward conveying science to the public."

(Nature Geoscience, VOL 1, MARCH 2008)





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# TO THE TEACHER

## To the Teacher:

As part of the LTER Schoolyard Children's Book Series, *The Lost Seal* was written by Antarctic scientist Diane McKnight. This true story of one seal's travels in an Antarctic desert provides an engaging framework to convey how different Antarctica and the Dry Valleys are from the environments with which children are familiar. It contains original artwork from children in grades 2-4 from 19 different elementary schools throughout the world. *The Lost Seal* website contains over 400 pieces of original artwork, photos of the Dry Valleys, and real-life video of the lost seal.



*The Lost Seal—Teacher's Guide* for Grades 3-5 was developed by the University of Colorado-Boulder. This guide is geared towards using the storybook, *The Lost Seal* by Diane McKnight, as a springboard for learning. Cross-curricular lesson plans have been developed as an addition to the storybook. Our goal is to integrate science, math, social studies, and language arts. The lesson plans are topic-specific activities based on subject matter discussed in the book and are geared towards grades 3-5, although activities may be adapted for lower grades. We hope that after students read the book and participate in the activities, they will have a greater understanding of wildlife and the natural world.

## English Language Learners:

We have provided differentiation strategies with each lesson for working with English Language Learners (ELL). These strategies are aimed at providing curriculum access for all students regardless of their native language. We have included this section to provide a meaningful experience for all students. Many of the lessons are well suited for ELL because of their inquiry-based, experiential nature.

## Standards:

All of the lessons have been mapped to the Boulder Valley School District (BVSD) science standards for third through fifth grades as well as the general BVSD Language Arts, English Language Acquisition, Social Studies, Math and Fine Art standards. The BVSD standards are aligned with the Colorado State Standards in all of these areas. In addition we have mapped the lessons to the National Science Content Standards. You will find the list of applicable standard numbers at the top of each lesson. To read the standard in further detail, please refer to the lists in the appendix.

## TEACHER'S EDITION COMPANION CD

### Interactive Educational CD:

A set of interactive CDs has been developed to illustrate the research and ecology of the Dry Valleys region of Antarctica. The interactive CD for learners is designed for grades 8-10 and the accompanying Teacher's Guide CD has supplemental information and videos.

### Explore and Learn More about Antarctica and the Dry Valleys:

The website for the McMurdo Dry Valleys Long Term Ecological Research project (MCMLTER) provides additional educational resources for *The Lost Seal*. The website provides links to the field blogs of past team members, which can help students imagine what it would be like to conduct field research in the Dry Valleys.

## GOALS OF THE LOST SEAL ANTARCTICA UNIT

After students have read *The Lost Seal*, by Diane McKnight, they will explore the natural history of Antarctica and learn about the important connections in the ecosystem.

## OBJECTIVES

After completing these activities, students will be able to...

1. Retell the story of the lost seal.
2. Find Antarctica on a map or globe.
3. Identify animals and other organisms that make up the Antarctic ecosystem.
4. Understand why research and the ecosystems of Antarctica are important.
5. Understand how human activities may impact the environment and why laws exist to protect animals that live in Antarctica.

# VOCABULARY

**Algae:** Plants that grow in water and do not have stems, roots or leaves; many are single-celled organisms and are too small to be seen without a microscope.

**Alpine glaciers:** Glaciers located in mountains.

**Antarctic Conservation Act:** A federal law that protects animals and plants in Antarctica.

**Bacteria:** Single-celled organisms that do not have a true nucleus and are too small to be seen without a microscope.

**Cargo net:** A net made of three-inch-wide cloth strips used for packing supplies.

**Colonies:** Places where penguins hatch their eggs.

**Cryoconite hole:** A shallow hole in the ice on the surface of a glacier containing water and sediment.

**Diatoms:** A type of algae that have glass shells.

**Dormant:** Alive, but not growing; like sleeping for a long time.

**Flipper tag:** A piece of plastic attached to an animal for identification.

**Flow rate:** The amount of water moving past a point in a stream over a period of time.

**Gauging stations:** Places in a stream where instruments are set up to measure flow rate.

**Glaciers:** Large masses of ice that last for many years.

**Hut:** A small building used as shelter from harsh conditions.

**Ice sheets:** Very large glaciers that cover a continent.

**Instrument:** Device designed for a special use, such as measuring flow rate.

**Katabatic winds:** Strong warm winds that come down from ice sheets.

**Killer whales:** Small whales with white patches on their backs; these whales are also known as Orcas.

**Leopard seals:** Large predatory seals that have a spotted coat.

**Limnologist:** A scientist who studies lakes and streams.

**Microscope:** A magnifying instrument that allows extremely small things to be seen.

## VOCABULARY (CONT.)

**Mosses:** Tiny-leaved flowerless plants that grow in moist places.

**Mummified:** Preserved by being dried out.

**Nematodes:** Small worms that mainly live in soil.

**Outlet glaciers:** Glaciers that come from an ice sheet.

**Pup:** A baby seal.

**Pendant:** A thick rope with a loop on one end.

**Sledge:** A large sled used for hauling gear.

**Sling load:** Cargo wrapped up in a net carried underneath a helicopter.

**Ventifacts:** Rocks that have been smoothed and polished over many years by sand blown in the wind.



# 1

## THE LOST SEAL: INTRODUCTION TO THE BOOK

**Content Area:** Science,  
Language Arts

**Grade:** 3-5

**Duration:** 1 hour

**Standards and Benchmarks:**

Science: 3S4, 4S4, 5S4

Language Arts: 1, 6

English Language Development:  
1, 3

National Science Content  
Standards: G

**Objectives:** To introduce students to the story of *The Lost Seal* and introduce them to Antarctica.

**Pages in the Book:** Entire book

**Resources & Materials:**

- *The Lost Seal* book,
- Chart Paper
- Markers

## Teaching the Lesson:

*This lesson may be taught two ways; as a classroom-wide read-aloud or independent/guided reading lesson.*

1. Begin the lesson with the class gathered and explain to them that they are going to read a book entitled *The Lost Seal*. Ask students to make predictions based on the front cover of the book. Then explain to the students that this is a nonfiction book that was written about a seal and a research team in Antarctica.
2. Next, begin with a KWL (Know, Want to know, Learned) chart. Jot down what students know about Antarctica and research. Students can also use their journals to create their own KWL chart.
3. As students begin to read the book, independently or with the teacher, use sticky notes to take notes about questions or predictions that come up as the book is read.
4. When the book is finished, encourage student to discuss the book. This may be done as a class or in small groups. If working in small groups you can have students create a poster of the book and list key vocabulary words that were used in the story.
5. Finally, explain to the students that they are about to embark on a month-long study of Antarctica and the research that is being done there. They will become Limnologists and learn how to study streams and relate their experiences back to the book, *The Lost Seal*.

**Assessments:** If the lesson was used as an independent or guided reading lesson, this would be a good time to evaluate fluency and student comprehension. Short answer questions or journal entries may be assessed for comprehension skills. A vocabulary-matching quiz may also be given before or at the end of the lesson. Giving the matching quiz beforehand would be a great way to assess what the students already knew about Antarctica.

**Differentiation for ELLs:**

- If possible, read a leveled book about Antarctica a week before starting this unit with ELLs during guided reading time. Use this time to pre-teach relevant vocabulary and information and to activate prior knowledge for these students.
- Before reading the book aloud, do a “picture walk” showing the students each page. Encourage them to ask questions and discuss their observations. Use this to illustrate the important concepts you want them to understand before beginning the read-aloud.
- If possible, re-read the book in a small group with ELLs, taking time to talk about key vocabulary and grammar.
- Start a word wall for vocabulary relevant to this unit, making sure to use pictures when possible.

# The Lost Seal Vocabulary Quiz

Name \_\_\_\_\_

- \_\_\_\_\_ **Algae**
- \_\_\_\_\_ **Dormant**
- \_\_\_\_\_ **Alpine glaciers**
- \_\_\_\_\_ **Flow rate**
- \_\_\_\_\_ **Antarctic Conservation Act**
- \_\_\_\_\_ **Gauging station**
- \_\_\_\_\_ **Bacteria**
- \_\_\_\_\_ **Glaciers**
- \_\_\_\_\_ **Colonies**
- \_\_\_\_\_ **Cryoconite hole**
- \_\_\_\_\_ **Ice sheets**
- \_\_\_\_\_ **Diatoms**
- \_\_\_\_\_ **Katabatic winds**
- \_\_\_\_\_ **Instrument**
- \_\_\_\_\_ **Ventifacts**
- \_\_\_\_\_ **Leopard seals**
- \_\_\_\_\_ **Limnologist**
- \_\_\_\_\_ **Microscope**
- \_\_\_\_\_ **Mosses**
- \_\_\_\_\_ **Mummified**
- \_\_\_\_\_ **Nematodes**
- \_\_\_\_\_ **Outlet glaciers**
- \_\_\_\_\_ **Killer whales**
- \_\_\_\_\_ **Cargo net**
- \_\_\_\_\_ **Flipper tag**
- \_\_\_\_\_ **Pup**

- A.** The amount of water moving past a point in a stream over a period of time.
- B.** Single-celled organisms that do not have a true nucleus and are too small to be seen without a microscope.
- C.** Place in a stream where instruments are set up to measure flow rate.
- D.** Places where penguins hatch their eggs.
- E.** A shallow hole in the ice on the surface of a glacier containing water and sediment.
- F.** Large masses of ice that last for many years.
- G.** A net made of three-inch-wide cloth strips used for packing supplies.
- H.** A federal law that protects animals and plants in Antarctica.
- I.** A type of algae that have glass shells.
- J.** Plants that grow in water and do not have stems, roots or leaves; many are single-celled organisms and are too small to be seen without a microscope.
- K.** Alive, but not growing; like sleeping for a long time.
- L.** A scientist who studies lakes and streams.
- M.** Small whales with white patches on their backs; these whales are also known as Orcas.
- N.** A piece of plastic attached to an animal for identification.
- O.** Glaciers located in mountains.
- P.** A baby seal.
- Q.** Rocks that have been smoothed and polished over many years by sand blown in the wind.
- R.** Tiny-leaved flowerless plants that grow in moist places.
- S.** Very large glaciers that cover a continent.
- T.** A magnifying instrument that allows extremely small things to be seen.
- U.** Device designed for a special use, such as measuring flow rate.
- V.** Strong warm winds that come down from ice sheets.
- W.** Preserved by being dried out.
- X.** Large predatory seals that have a spotted coat.
- Y.** Small worms that mainly live in soil.
- Z.** Glaciers that come from an ice sheet.



## 2

# THE LOST SEAL PANTOMIME

**Content Area:** Science

**Grade:** 3-5

**Duration:** 45-minute class period

**Standards and Benchmarks:**

Science: 5S7

Language Arts: 1, 2, 4, 6

English Language Development:  
1, 2, 3

National Science Content  
Standards: G

**Objectives:** Students will become familiar with the story and contents of the book, *The Lost Seal*.

**Resources & Materials:**

- *The Lost Seal* book
- Paper
- Pencils

## Teaching the Lesson:

*This lesson can be taught as a classroom-wide activity, or by grouping students into story-telling teams to present a portion of the story.*

1. Introduce this lesson after the class has learned about the McMurdo Dry Valleys, discussed the book and watched the video of the seal. Begin the lesson with the class gathered and explain that stories can be told by movement and by using sign language, and that they can tell the story as a pantomime.
2. First have the class do a warm-up activity and explain about the approach used in sign language.
3. Divide the students in fourteen groups of 2-3 children and give each group a phrase or sentence, such as "They found a trail in the snow, but there were no footprints."
4. Instruct the groups to devise a way to use sign language or movement to show the events or ideas in their sentence.
5. After the students have decided on their plan, form a large circle arranged in order of the sentences of the story. Have each group take their turn doing their movements while someone reads the sentence out loud in the order of the story.
6. For the second time around, have the groups do the movements in sequence without reading the sentence aloud.

1. A hundred years ago in Antarctica
2. Explorers found a valley of death.
3. No sign of life, but the skeleton of a seal
4. In our time, scientists go to this valley to study streams.
5. They found a trail in the snow, but there were no footprints.
6. They found a lost seal. He was starving.
7. He could not get home to the ocean.
8. The rules said that they could not help him.
9. But he smelled their cheeseburgers; so he came to their camp and looked at them.
10. They called for help. A helicopter came with a net and a sling.
11. They herded the seal onto the net and strapped him safely in.
12. He flew home, hanging from the helicopter in the sling. He was safe.
13. The scientists named the stream "Lost Seal Stream."
14. You can find it on a map forever.



Early Antarctic explorers resting in Taylor Valley

**Assessments:** Did the students put effort into planning their movement to tell their part of the story? Did the students understand the movements of the other small groups when the movements were done without the story being read?

# 3

## Antarctica Journal

**Content Area:** Science, Language Arts

**Grade:** 3-5

**Duration:** 30-minute class period

**Standards and Benchmarks:**

Science: 3S2, 4S2, 5S2

Language Arts: 2, 3

English Language Development: 4

National Science Content Standards: A

### Teaching the Lesson:

1. Introduce this lesson after the class has learned about the McMurdo Dry Valleys, discussed the book and watched the video of the seal. Begin the lesson with the class gathered and explain that many explorers of the polar regions wrote in their journals every day to record their observations and activities.
2. Provide a notebook to each student and explain that they can use this notebook to record their experiences and observations as they learn about the McMurdo Dry Valleys and Antarctica.
3. Allow the students to personalize their notebook as they choose.
4. Encourage the students to write their first journal entry about what most interests them about Antarctica.
5. Read aloud the quote from Scott's journal from the book and discuss the students' reactions to Scott's comments.

**Objectives:** Students will create a journal to record data, observations, and research to use during the Antarctica unit. Students will also investigate why journals are important to science research.

**Pages in the Book:** 6, 7

**Resources & Materials:**

- Notebook (one per child)
- Pencils
- Markers
- Crayons
- Any other materials wanted to use to decorate the journals
- Computer access with printer

**Assessments:** Did the students put effort into personalizing their notebooks? Did the students react to Scott's description of the Dry Valleys?

**Differentiation for ELLs:**

- Encourage the students to draw pictures in their notebooks to express what they already know about Antarctica.



## 4

## Creating 3-D Map of Antarctica

**Content Area:** Science, Language Arts, Social Studies, Visual Arts

**Grade:** 3-5

**Duration:** 2 class periods, Day 1: Creating the Clay Map, Day 2: Painting and Labeling (*day 2 may come a few days after the maps are created to allow for drying time of the clay*).

**Standards and Benchmarks:**

BVSD Science: 3S4, 4S4, 5S4, 5S8  
 BVSD other content area standards —  
 Language Arts: 5; English Language Development: 3; Geography: 1, 3;  
 Visual Arts: 2, 3, 4;  
 National Science Content Standards: B, D

**Objectives:** To allow students to understand the geography of Antarctica, including the continent's location on a globe, land formations, and research stations.

**Pages in the Book:** 2, 3, and 31

**Resources & Materials:**

- *The Lost Seal* book
- Maps of Antarctica (books or computer)
- One piece of cardboard for each student (12 in. X 12in.)
- Salt dough (one recipe per child, send home for homework before the project)
- Copies of a map of Antarctica
- Paint
- Markers
- Paper

## Teaching the Lesson:

### Day 1:

1. Begin the lesson by looking at the map in the book, *The Lost Seal*, on pages 2 and 3. Ask students what they notice about the map.
2. Next, discuss the geological features of the continent of Antarctica. You may use additional maps from books, paper handouts, or the internet to give students other visuals. Here are a few online resources:

- <http://pubs.usgs.gov/fs/fs50-98/>
- <http://www.nationalgeographic.com/xpeditions/atlas/antarctic/antarctic-dwl.gif>

3. Hand out cardboard and salt dough to each student. Allow students to draw a rough draft of the Antarctic continent on their cardboard square. Make sure to discuss the Transantarctic Mountains and explain that glaciers usually cover them.

4. Allow students to create their map of Antarctica using their salt dough. Once students have created the map, place the map in a safe place to allow the dough to dry (this may take a few days).

### Day 2:

5. Once the clay maps are dry, allow students to begin to paint and label their maps. Make sure students include the surrounding oceans as well, just like the map in the book.

6. When students are finished with their maps, explain to them that for the next few lessons they will be exploring the geography of Antarctica in depth.

7. To conclude the activities, presentations of the maps may be made in the classroom.

**Assessments:** Check to see if students created a 3-D map of Antarctica. Did the students create and label the geography correctly?

### Differentiation for ELLs:

- Pre-teach any unknown vocabulary related to cartography and geography.
- If possible, allow extra time for them to explore maps and research geological features of Antarctica.
- Add the names (with pictures) of the geological features to the word wall.
- Pair students up for this activity and give ELLs a language partner, who will be a good model for the language. Make sure that they have equal roles, so that both are participating and communicating with one another.



### Salt Dough Recipe

#### Ingredients:

- 2 cups flour
- 1-cup salt
- 1-cup cold water
- 1 large zip-lock bag

**Directions:** In a large bowl, mix table salt and flour together. Gradually add 1/2 cup of water and mix to desired consistency. Knead the dough on a flat surface, adding a few more drops of water as needed (but not making it too moist). Place in a large zip-lock container and bring to school.

## 5

## As the Temperature Goes Down

**Content Area:** Science, Math

**Grade:** 3-5

**Duration:** 45 min to set up the experiment, temperature needs to be measured every 15 minutes and then after 24 hours.

**Standards and Benchmarks:**

Science: 3S2, 3S3, 3S4, 4S2, 4S3, 4S4, 5S2, 5S3, 5S4, 5S5

Math: 3, 5

National Science Content

Standards: A, B, E

**Objectives:** Students will investigate how low the temperature can go in salt water. Can the temperature go below freezing (32 degrees F)?

**Pages in the Book:** 22-23

**Resources & Materials:**

- Temperature recording sheet
- Two plastic bowls
- Two thermometers (use plastic to withstand freezing)
- Water and salt
- Measuring cup
- Freezer

## Teaching the Lesson:

1. Discuss with students what they already know about the temperature at which water freezes. Explain that pure water freezes at 0 degrees C (32 degrees F). What about salt water? (When salt dissolves in water, the water molecules have difficulty locking together to freeze into a solid. Salt water freezes at about  $-2.2$  degrees C (28 degrees F). When the water does freeze, the salt is pushed out and the solid ice is fresh water. The water below the ice becomes saltier.
2. Divide the students into groups; the number of groups will depend on available freezer space. Hand out the supplies to each group.
3. Next, have students fill the two bowls with the same amount of water. Record the amount of water used.
4. Use the thermometers to measure the temperature of the water in each bowl and record the results.
5. In one bowl, mix one tablespoon of salt per cup of water used and stir until it is dissolved. Label the bowl "salt water."
6. Record the temperature again (it should be the same).
7. Place the bowls in the freezer next to each other.
8. Every 15 minutes, observe the bowls and note if any ice has formed across the top. Also, record the temperature for each bowl. Make sure to place the thermometer in the same place in each bowl. As the water freezes, use a pencil or similar object to make a small hole for the thermometer to go through.
9. Continue to record the temperature every 15 minutes until 120 minutes have gone by.

10. Next have students make predictions of what will happen if the bowls are left in the freezer overnight. Record their predictions on the lab sheet.
11. Leave the bowls overnight and check the bowls in the morning. Were the predictions correct? Did both bowls freeze? Why or why not?
12. Discuss what the students have learned, and go over the properties of pure water freezing and salt-water freezing.

**Assessments:** Did students fill in the worksheet correctly and record the data?

**Journal Topic:** Compare pure and salt water when it freezes.

**Notes & Reflections:** For further investigation repeat steps 1-6 using sugar, cornstarch, and baking soda. Where the results the same? Why or why not?

**Differentiation for ELLs:**

- Provide either a data collection and prediction making worksheet with necessary grammar structures or have them copy this information into their own notebooks.
- Before the group discussion, allow the students to work with a language partner to write down their conclusions and discoveries to share with the group.

### As the Temperature Goes Down

	Pure Water	Salt Water
<b>Amount of water</b>		
<b>Initial temperature</b>		
<b>Temperature after mixing</b>		
<b>After 15 minutes</b>		
<b>30 minutes</b>		
<b>45 minutes</b>		
<b>60 minutes</b>		
<b>75 minutes</b>		
<b>90 minutes</b>		
<b>105 minutes</b>		
<b>120 minutes</b>		
<b>Temperature after 24 hours</b>		



## 6

## Make Your Own Glacier

**Content Area:** Science, Social Studies

**Grade:** 3-5

**Duration:** 45 min.

**Standards and Benchmarks:**

Science: 4S9, 5S8

Geography: 1, 3

National Science Content

Standards: D

**Objectives:** To introduce students to the terms: Alpine glaciers, Cryoconite hole, Glaciers, Ice sheets, and Outlet glaciers. Students will learn how glaciers form and how they impact Antarctica.

**Pages in the Book:** 6, 7

**Resources & Materials:**

- *The Lost Seal* book
- Disposable paper or styrofoam bowls
- Mixture of gravel, sand, and silt-sized sediments (2-3 cups)
- Pepper
- Clear plastic wrap
- Corrugated cardboard (3-4 pieces, each 18" x 10")
- Clear packaging tape
- Scissors
- Snow, shaved ice, or crushed ice.
- Ice chest or cooler for storing ice
- Freezer
- Large sheets of poster board or construction paper
- Towels (for cleanup)

## Teaching the Lesson:

1. Introduce students to the concept of glaciers. Define glaciers, alpine glaciers, ice sheets and outlet glaciers. Write the definitions on the board and discuss how glaciers are formed. Students are to explore how temperature affects the formation and preservation of glaciers. Define cryoconite hole and write the definition on the board. Explain how cryoconite holes play a vital role for microbial communities.
2. Next, prepare the students to make their own glaciers. Make sure to discuss the process of how glaciers are formed while they are making their own.
3. Model each step as you begin to build your own glacier.
4. Pass out supplies to each student. Place a spoonful of sediments in the bowl. Next add one spoonful of snow, crushed ice, or shaved ice and one spoonful of water to the bowl; then carefully stir the solution and flatten into the bottom of the bowl.
5. Add another 2-3 spoonfuls of snow or ice to the mixture and flatten again. This will allow your glacier to melt just a little. Next add a dusting of pepper.
6. Continue to repeat step 5 until the bowl is full.

**Optional Activity:**

1. Explain that if snow continues to accumulate, a glacier can get so thick that it will fill an entire valley with ice. Then the ice can merge from other valleys to form an ice sheet.

2. Next, form mountains by folding the cardboard pieces in half the long way, forming a mountaintop. Tape three mountaintops together. These are the models of the mountains.
3. Cover the mountain range with plastic wrap and begin to pack snow or crushed ice into the valleys of the mountain range. Continue to fill the valleys until all of the valleys are full and the ice has begun to spill over to the next valley, forming an ice sheet.
4. These models may be covered with plastic wrap and used for a later exhibit if needed.
5. Finally, review with students how glaciers and ice sheets are formed.

**Assessments:** Do students understand new vocabulary words? Are students able to make a connection of why glaciers are important in Antarctica?

**Differentiation for ELLs:**

- Before the activity, read a leveled book related to glaciers and/or ice sheets in a small group.
- Add new vocabulary to the word wall, along with pictures if possible.

## 7

## Rocks of Antarctica

**Content Area:** Science

**Grade:** 3-5

**Duration:** 45 min.

**Standards and Benchmarks:**

Science: 5S5, 5S8

National Science Content

Standards: A, B, D

**Objectives:** Students will be able to discuss katabatic winds, ventifacts, velocity, and understand the way the rocks of Antarctica are formed. Students will also create a 3-D model of a ventifact.

**Pages in the Book:** 20, 21

**Resources & Materials:**

- Information and pictures of ventifacts
- Grey modeling clay
- Small rocks for each student
- Sand paper
- Cotton
- Cloth
- Paper towel

## Teaching the Lesson:

1. Begin the lesson by asking the students what they know about Antarctica and the geology of Antarctica.
2. Next, introduce the terms katabatic winds, ventifacts, and velocity.

**Katabatic winds:** Define katabatic winds.

Write the definition on the board. Illustrate the temperature of katabatic winds by comparing it to the temperature of a freezer or outside on a cold winter day. Illustrate the speed of katabatic winds by comparing it to that of a racecar.

**Ventifacts:** Define ventifacts. Explain the relationship between ventifacts and katabatic winds.

**Known velocities:** Allow the students to understand the concept of 140 miles per hour by comparing it to known velocities: A person walks at an estimated 2 miles/hour, a car driving in the city has a speed limit of 25 miles/hour, and an airplane flies at an estimated 550 miles/hour, which is why in a short time people can travel very long distances.

3. Allow students to create their own ventifacts with the modeling clay. Hand out clay to students and allow them to shape their own ventifacts.
4. Next, hand out a small rock to each student and explain that they are going to use different materials to try to change the shape of the rock. Ask students to predict which material will have the most and least effect on shaping the small rock.
5. Have the students test their predications by rubbing each individual material on the rock for 30 seconds to 1 minute and recording their observations in their science notebook.

6. Provide enough time at the end for all the students to explain their findings to the class.
7. Encourage a final class discussion on what they have learned. Reinforce how katabatic winds play a major role in the formation of ventifacts. Allow the students to make a tie between the most successful material (sand paper) and the sand blown by the katabatic winds.

**Assessments:** Discuss the definition of ventifacts and katabatic winds. Did each student understand the relationship between katabatic winds and ventifacts? Did the students formulate predictions? Once tested, were the students able to understand why their predictions were/were not met?

**Differentiation for ELLs:**

- Re-read pages 20-21 of *The Lost Seal* ahead of the lesson to pre-teach vocabulary.
- Add new vocabulary to the word wall, along with pictures if possible.
- Show a video of katabatic winds to the students.
- Provide a worksheet to record either data or predictions with necessary grammar structures, or have the students copy this information into their own notebooks.
- Before the group discussion, allow students to work with a language partner to write down their conclusions and discoveries to share with the group.



A scientist stands next to a ventifact shaped by the very strong winds in Taylor Valley (photo: Karen Cozzetto)

## 8

## Stream Flow

**Content Area:** Science, Math

**Grade:** 3-5

**Duration:** 1.5 hours  
\*\*field trip option

**Standards and Benchmarks:**

Science: 3S1, 3S2, 3S3, 3S4,  
3S9, 4S1, 4S2, 4S3, 4S4, 4S11,  
5S1, 5S2, 5S3, 5S4, 5S10

Math: 2, 3, 5, 6

National Science Content  
Standards: A, B, E

**Objectives:** Students will learn how to measure stream flow and why it is useful in Antarctica.

**Pages in the Book:** 28, 29

**Resources & Materials:**

- Oranges (or object to float down the stream)
- Two marking sticks
- Tape measure or string
- Timing device
- Paper
- Pencil
- Calculator

## Teaching the Lesson:

1. Arrange a field trip to a nearby stream with the students.
2. Select and mark two points within the stream.
3. Measure the distance between these two points.
4. Drop the orange (or other object) at the marker furthest upstream and allow it to float to the second marker. Record the time it takes for the object to float between the two points (seconds).
5. Repeat step 4 three times and average the time (seconds).
6. Measure the width of the stream at three different locations along the designated stretch of the stream and find the average (meters).
7. Measure the depth of the stream for three different locations along the designated stretch of the stream and find the average (meters). Make sure all measurements are done in the consistent units.
8. Calculate the flow rate using the following equation:
 
$$\frac{\text{Length} \times \text{Width} \times \text{Depth}}{\text{Time}}$$

The answer should be given in meters<sup>3</sup>/second (alternatively, velocity can be determined by disregarding steps 6 and 7 and calculating distance/time).
9. Encourage a final class discussion on what they have learned.

**Vocabulary Terms:**

- **Flow rate:** The amount of water moving past a point in a stream over a period of time.
- **Gauging station:** A place in a stream where instruments are set up to measure flow rate.
- **Instrument:** Device designed for a special use, such as measuring flow rate.
- **Limnologist:** A scientist who studies lakes and streams.

**Assessments:** As a class and individually, were the students able to recognize the main vocabulary terms?

Part 1: Did each student participate in the demonstration?

Part 2: Did each team of students successfully complete their measurements?

Did the students understand the flow rate formula?

Were the students able to use the formula correctly?

**Differentiation for ELLs:**

- Before the field trip read a leveled book related to flow rate in a small group.
- Add new vocabulary to the word wall, along with pictures if possible.
- Partner the students with language partners for the independent work.

## 9

## Staying Warm

**Content Area:** Science

**Grade:** 3-5

**Duration:** 45 min.

**Standards and Benchmarks:**

Science: 3S2, 3S3, 3S4, 4S2, 4S3, 4S4, 4S7, 5S2, 5S3, 5S4, 5S5

National Science Content Standards: A, B, C

**Objectives:** Students will study insulators and waterproofing for animals. Students will be able to determine the best design for staying warm.

**Pages in the Book:** 16, 17

**Resources & Materials:**

- Containers with leak-proof lids
- Water
- Thermometers
- Insulating materials such as newspaper, foam noodles, plastic bubble wrap, fake fur, air filled plastic bags, etc.
- Masking tape or duct tape (make duplicates available)
- Paper (science journals)
- Pencil
- Refrigerator or freezer

## Teaching the Lesson:

1. First, distribute a container filled with water, a leak proof lid, and tape.
2. Next, have students measure the temperature of the water and record the data in their science journals.
3. Students will then fasten the lid onto the container tightly and choose an insulating material.
4. Allow students to insulate the container with the material of their choice. Make sure the lid is able to come off easily.
5. Once the container is insulated, place the container in a particular condition for a set amount of time (room temperature, refrigerator, freezer).
6. When the set time is up, students are then to record the temperature and determine the temperature change.
7. Begin to take class averages of all the jars wrapped in paper, etc., to determine an average temperature change.
8. Finally conclude with a classroom discussion: Which insulators worked the best? What affected the results? Why is the data different from duplicate insulators? How can this be related to animals that live in Antarctica?

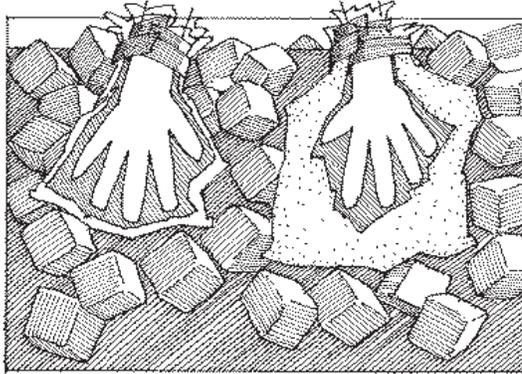
**Assessments:** Students may write a journal reflection piece on the experiment. During the classroom discussion at the end of the lesson, make sure to stress the importance of how this experiment is related to animals in Antarctica. How can this be related to everyday life?

### **Differentiation for ELLs:**

- Before the lesson, brainstorm with the students on how they (or other animals) stay warm and use this to introduce the concept of an insulator.
- Partner the students with language partners for the independent work.
- Add new vocabulary to the word wall, along with pictures if possible.
- Allow time for students to discuss and write conclusions with their language partner before sharing as a class.

### **Extension Activity:**

#### **Blubber Glove**



#### **How do penguins and other arctic animals stay warm in ice-cold water?**

**Materials:** Four large zip-lock plastic bags, one pound of solid vegetable shortening (such as Crisco), duct tape, a bucket of cold water with ice cubes.

1. Discuss how we stay warm in the water.
2. Ask students to list ways that animals stay warm in cold water.
3. Have the students cover one hand with a plastic bag.
4. In another bag, add a generous amount of shortening. Have the students place the plastic covered hand into the shortening so that their hand is surrounded completely by shortening. Wrap duct tape around the bags covering their wrist.
5. Cover the other hand with two plastic bags, without “blubber” shortening. This is the control.
6. Place both hands into ice-cold water.

**Discuss how the solid shortening acts as blubber that penguins and other animals have.**

**Discuss what advantages blubber gives to marine animals besides warmth. (Buoyancy) Also discuss how blubber acts as a food reserve. (Especially when the penguin parents take turns sitting on the eggs.)**

## Food Web Connection

**Content Area:** Science, Language Arts

**Grade:** 3-5

**Duration:** 45 min.

**Standards and Benchmarks:**

Science: 3S4, 4S4, 4S8, 5S4, 5S7

Language Arts: 1, 2, 3, 5

English Language Development: 3

National Science Content

Standards: A, C

**Objectives:** Students will become familiar with the food chain and know what life forms are found in Antarctica.

**Pages in the Book:** 10, 11, 12, 13, 14, 15, 16

**Resources & Materials:**

- Research material on life forms in Antarctica
- Pictures of various Antarctic animals (phytoplankton, diatoms, krill, shrimp, small fish, squid, whales, seals, penguins, killer whales)
- Poster board for each student
- Chart Paper
- Pencils
- Paper
- Markers
- Paint, watercolors

## Teaching the Lesson:

1. Begin the lesson by asking students which life forms live in Antarctica and make a list.
2. Next, hand out research materials and pictures of the Antarctic animals. Instruct students to cut apart the pictures with the names still attached to the pictures.
3. Ask students to then put the animals in groups and then describe how the groups are similar and different.
4. Students should now use the Internet and research materials to discover what these animals eat.
5. After students have a good understanding of who eats who, hand out a poster board to each student and have them place the phytoplankton at the bottom of the poster and the krill above the phytoplankton.
6. Students can then place on top of the krill all the animals that eat krill and use arrows to indicate that energy is going from the krill to the animal that eats the krill. Students can eventually turn their food web into a mini mural with markers and paint.
7. Ask students to find which animal has the most arrows (krill) and introduce the concept of **keystone species**: an organism that most of the others depend on in some way.
8. Finish the lesson by going over the food web posters and reviewing who eats who.

**Food Web Resource:** <http://www.vtaide.com/png/oceanchain.htm>

**Assessments:** Did students understand the concept of a food web? Did their poster have details of all the life forms that are involved in the web? How was their level of creativity?

**Differentiation for ELLs:**

- Provide a worksheet or format for information gathering from the internet.
- Add new vocabulary to the word wall, along with pictures if possible.

11

## Seal Dress Up

**Content Area:** Science

**Grade:** 3-5

**Duration:** 45 minutes

**Standards and Benchmarks:**

Science: 4S7

National Science Content

Standards: C

**Objectives:** Students will become familiar with adaptations seals have.

**Pages in the Book:** 16, 17, 18, 19

**Resources & Materials:**

- Swim fins
- Toy plastic teeth or create a row of teeth that can be tied on
- Whiskers (made out of pipe cleaners, with string as ties)
- Down vest
- Coat
- Hat
- Two oven mittens (attach claws on mits)
- Clear plastic rain poncho
- Pillowcase

## Teaching the Lesson:

1. Prepare for this lesson by putting all the "parts" of the seal into a pillowcase.
2. Next, discuss with students what an adaptation is and how humans can stay warm using clothing and gear. Then ask students which adaptations a seal has to stay warm and live in the ocean.
3. Ask for a volunteer from the class to "dress up."
4. As students begin to say each seal adaptation, pull them out of the bag, and begin to dress up like a seal. Here is a list of adaptations:

Hind Flippers (swim fins): Seals use their back flippers for steering through the water.

Front Flippers (oven mitts): These are called the pectoral flippers and can be moved in an up and down motion to swim. Seals also have claws on their front flippers.

Blubber (down vest): Blubber helps keep seals warm and it is also used as reserved food. The lost seal probably used some blubber for fuel when he was lost.

Fur (coat and rain coat): Seals have fur that covers their body and it is very sleek. The fur is also waterproof (add the rain coat on).

Ears (hat): Use a hat to show that seals is covered in fur, but do not have earflaps like sea lions do. This is one way to tell the difference between seals and sea lions.

Whiskers: Similar to a cat's whiskers, seals use whiskers to help find their food in dark and murky waters.

Teeth: Used to catch its prey and then swallow it whole

5. Once the student is completely dressed, go over the adaptations again with the students.

**Assessments:** As a follow up activity, have students draw a diagram of a seal and label each adaptation. Make sure they also give a definition of what an adaptation is. A Venn diagram may also be used to compare and contrast seals and humans.

**Differentiation for ELLs:**

- Add new vocabulary to the word wall, along with pictures if possible.

## The Science of Mummification

**Content Area:** Science, Social Studies

**Grade:** 3-5

**Duration:** 45-minutes to set up experiment, one week to observe and discuss at the end.

**Standards and Benchmarks:**  
 Science: 3S1, 3S2, 3S3, 3S4, 4S1, 4S2, 4S3, 4S4, 5S1, 5S2, 5S3, 5S4, 5S7  
 History: 2  
 Geography: 1  
 National Science Content Standards: A, C

**Objectives:** Students will be introduced to the process of mummification and relate the conditions necessary to the conditions in McMurdo Dry Valleys. Students will be able to recognize the conditions in Antarctica as being conducive to the process of mummification, comprehend key vocabulary terms, and conduct controlled experiments in which only one variable is changed at a time.

**Pages in the Book:** 4, 5

**Resources & Materials:**

- Apples (one for every 2-3 students)
- Plastic cups
- Baking soda
- Salt
- Measuring cups and bowls
- A scale capable of precise measurement (for weighing apple slices before and after)

## Teaching the Lesson:

After reading the parts of *The Lost Seal* that discuss how scientists sometimes find mummified seals in the McMurdo Dry Valleys, discuss the process of mummification and where else the students might have heard of this process (e.g. they may have read about Egyptian mummies in social studies). Discuss which climatic conditions in the Dry Valleys may be conducive to mummification.

1. Divide students into groups of 2-3. Give each group a quartered apple.
2. Explain to students that we can mimic the conditions in the Dry Valleys by treating our apple slices with baking soda and salt ("mummy salts"). What changes do they think will occur? How can we measure these changes?
3. Discuss ways that we might be able to test the effects of our "mummy salts" on the apples. Remind students that we want to conduct a controlled experiment, so we need to have a group that we treat with "mummy salts" and a group that we treat in exactly the same way but without the salts.
4. Develop a procedure with the students and write it out on the board. At a minimum, make sure the procedure includes the steps that follow below, but if students want to measure other variables these can be included as well (e.g. they could measure the length of the apple slices, etc.).
5. Instruct the students to precisely weigh each of the four quarters of the apples using the scales. Once the apple slices are weighed, place each one in a labeled cup so it is easy to keep track of which is which.

6. Have each group mix 1/2-cup baking soda and 1/2-cup salt in a small bowl.
7. Pour the mixture over two of the apple slices in paper cups so that they are completely covered. Leave the other two apple slices uncovered in their cups.
8. Place the set of four cups from each group in a dark and dry location for one week.
9. After the week is up, retrieve the cups and have students examine the apple slices. Do the slices that were covered look different than the ones that were uncovered? Why? Have students record their observations and make drawings of the “mummified” and control apples. Re-weigh each of the apple slices. Which apples have lost the most of their weight? Why?
10. Discuss how conditions in the “mummy salt” cup were similar to conditions in McMurdo Dry Valleys.

**Assessments:** As a class and individually, were the students able to recognize the main vocabulary terms? Did students accurately weigh their apple slices, correctly record the information, and make detailed observations? Did the students work together to develop a procedure for a controlled experiment?

**Differentiation for ELLs:**

- Before the activity, read a leveled book related to mummies in a small group.
- Add new vocabulary to the word wall, along with pictures if possible.
- Allow students to work with a language partner and write conclusions and observations before sharing with the class.

## 13

## Antarctic Animal Research Project

**Content Area:** Science, Language Arts

**Grade:** 3-5

**Duration:** two 45 minutes class periods

**Standards and Benchmarks:**

Science: 3S4, 4S4, 4S7, 5S4

Language Arts: 1, 2, 3, 5

English Language Development: 1, 2, 3, 4

National Science

Content Standards:

C, G

### Teaching the Lesson:

1. Discuss with students how a scientist gains new information. Make a list of everything the students suggest.
2. Next, tell the students that they are going to be researchers studying Antarctic animals and explain the directions for their reports.
3. Each student should then choose an Antarctic animal to research. Encourage students to choose an animal that has not already been chosen.
4. Allow students to research the topic for at least 2 class periods. The rest of the research and project will be completed at home.
5. Students should then complete their report on a poster board and bring back to school by a certain date.

**Objectives:** Students will locate and research life forms in Antarctica, including insects.

**Pages in the Book:** 10, 11, 13, 14, 15, 16, 17

**Resources & Materials:**

- My Animal of Antarctica Directions Report form
- Internet access
- Books and magazine

6. Have each student present their report to the class. Use the rubric as a guide for grading.

7. Conclude the lesson with a discussion on the reports and review what the students have learned.

**Sea World: Penguins**

<http://www.seaworld.org/infobooks/Penguins/home.html>

**Enchanted Learning: Antarctic Animals**

<http://www.EnchantedLearning.com/school/Antarctica/Animalprintouts.shtml>

**Assessments:** Students will present their research to the class and a rubric will be used for grading. Students will be aware of what they are being graded on.

**Notes & Reflections — Books:**

- *Nanu, Penguin Chick*, by John Butler
- *Tacky the Penguin*, by Helen Lester
- *Penguin Chick*, by Betty Tatham
- *Penguins*, by Gail Gibbons
- *A Penguin Pup for Pinkerton*, by Steven Kellogg
- *Antarctic Antics: A Book of Penguin Poems*, by Judy Sierra
- *Arctic & Antarctic*, by Barbara Taylor
- *The Complete Guide to Antarctic Wildlife: Birds and Marine Mammals of the Antarctic Continent and Southern Ocean*, by Hadoram Shirihai
- *Antarctic Journal: Four Months at the Bottom of the World*, by Jennifer Owings Dewey

**Differentiation for ELLs:**

- Work in a small group to help clarify expectations and help them locate internet resources.
- Provide extra time for them to do research in class under the supervision of the teacher.

## Directions for Antarctic Report

Name \_\_\_\_\_

Date \_\_\_\_\_

Dear Family,

We are working like scientists to study animals (including insects) in Antarctica. Your child has already picked his or her research topic and has begun research in class. Student will have 2 days in the classroom to research and the rest of the project is to be completed at home as homework. Students are to write their report using the guide below and then create a poster board of the topic. Included is a rubric of the grading scale for the project. Each student will present his or her report to the class.

### **Project Directions:**

- Pick an animal or other life form that lives near Antarctica.
- Do research on the topic.
- Complete the report forms attached to this letter and create a poster of the researched animal.
- Present report to the class

# My Antarctic Animal Report

Name \_\_\_\_\_

Date Due \_\_\_\_\_

Name of Animal \_\_\_\_\_

Height & Length \_\_\_\_\_

Weight \_\_\_\_\_

Habitat Name \_\_\_\_\_

What predators do your animal have?

---

---

What Prey does your animal eat?

---

---

Describe the habitat where your animal lives.

---

---

Describe special adaptations your animal has.

---

---

What are some interesting facts about your animal?

---

---

\*Be sure to include drawings of your animal and use more paper if necessary.

### Teaching the Lesson

	4 <b>WOW!</b>	3 <b>You Did It!</b>	2 <b>Still Trying</b>	2 <b>Do Over!</b>
<b>Research Information</b>	Information clearly relates to the main topic. It includes several supporting details and/or examples.	Information clearly relates to the main topic. It provides 1-2 supporting details and/or examples.	Information clearly relates to the main topic. No details and/or examples are given.	Information has little or nothing to do with the main topic.
<b>Sources</b>	All sources (information and graphics) are accurately documented in the desired format.	All sources (information and graphics) are accurately documented, but are not in the desired format.	All sources (information and graphics) are accurately documented, but not in the desired format.	Some sources are not accurately documented.
<b>Diagrams &amp; Illustrations</b>	Diagrams and illustrations are neat, accurate and add to the reader's understanding of the topic.	Diagrams and illustrations are accurate and add to the reader's understanding of the topic.	Diagrams and illustrations are not accurate OR do not add to the reader's understanding of the topic.	Diagrams and illustrations are not accurate OR did not add to the reader's understanding of the topic.
<b>Time</b>	Students turned in report early or on time with the report form completed & pictures	Student turned report for 1 day late with report form complete & pictures.	Student turned report form 2 days late with report form complete & pictures.	Student turned report form in 3 days late with report form completed & picture
<b>Oral Presentation</b>	Student presented verbal information to the classmates with little to no assistance and provided pictures	Student presented verbal information with more assistance and provided a picture.	Student presented verbal information with complete assistance and provided a picture.	Student did not present verbal information but included a picture.



## Microscope Mania

**Content Area:** Science

**Grade:** 3-5

**Duration:** 45 minutes

**Standards and Benchmarks:**

Science: 3S2, 4S2, 5S2  
National Science Content  
Standards: A, E

**Objectives:** To familiarize students with studying small organisms by using a microscope.

**Pages in the Book:** 10, 11

**Resources & Materials:**

- Microscopes
- Multiple slides with covers (plastic preferred)
- Assorted pre-made slides
- Teacher-prepared microscope worksheets

## Teaching the Lesson:

1. The teacher will need to prepare a worksheet showing the parts of a microscope. Here is a list of parts:
  - Eyepiece 10x
  - Body tube
  - Revolving nosepiece
  - Objective lens 4x (low); 10x (medium); 40x (high)
  - Stage
  - Stage clips
  - Carrying arm
  - Base
  - Mirror or light source (lamp)
2. Begin the lesson by asking students what they know about a microscope. Make a list of their answers. Then explain to the students how a microscope works. Explain the parts and the different lenses. Make sure to explain how to properly care for a microscope.
3. Distribute microscopes to each student. Review microscope structure while students locate each part on their own.
4. Next, distribute pre-made slides for the students. Make sure the pre-made slides are things students are familiar with (insects, plants, other types of fiber). Students can work individually or in groups to get their slides focused. Allow students to move from station to station to see the different slides.
5. Hand out the microscope vocabulary sheets and allow students to quiz each other on the different the parts of the microscope. Allow students to cut out the vocabulary words and label the microscope.
6. Conclude this lesson by reviewing the parts of the microscope and allowing the students to discuss why microscopes are important for the story presented in the book.

**Assessments:** Do students know and understand the parts of a microscope?  
A quiz could be used to test knowledge.

**Differentiation for ELLs:**

- Before the activity, read in a small group a leveled book related to microscopes.
- Add new vocabulary to the word wall, along with pictures if possible.
- Partner the students with language partners for the independent work.

## Microscope Vocabulary

EYEPIECE	Allows you to view the image on the stage and contains the ocular lens.
NOSEPIECE	Holds the objective lenses and can be rotated to change the magnification.
OBJECTIVE LENSES	These are found on the nosepiece and range from low to high power.
STAGE CLIPS	These are used to hold a slide in place on the stage.
LIGHT SOURCE	Projects light upwards through the diaphragm to allow you to see the specimen.
ARM	This part on the side of the microscope is used to support it when it is carried.
COARSE ADJUSTMENT KNOB	Moves the stage up and down to help you get the specimen into view.
BASE	The bottom part of the microscope.
STAGE	Part of the microscope that supports the slide that is being viewed.
COVER SLIP	A small plastic or glass piece that is used to cover a water drop on a slide.
SLIDE	A small glass plate on which specimens are placed for viewing.
POWER	The degree of magnification for a lens.

## Surviving Extremes: Anhydrobiosis

**Content Area:** Science

**Grade:** 3-5

**Duration:** Two 1-hour  
classroom sessions

**Standards and Benchmarks:**

Science: 3S1, 3S2, 3S3, 3S4,  
4S1, 4S2, 4S3, 4S4, 4S8, 5S1,  
5S2, 5S3, 5S4

National Science Content  
Standards: A, C

## Teaching the Lesson:

What are the small creatures of Antarctica?

1. Introduction to microscopic organisms: Explain that there are hundreds of living things that are around us but that we can't see because they are too small.
2. Define microscope. Explain how this is a very useful tool in science. Describe the basic parts of a microscope (i.e. eyepiece, lens, stage, focus knobs, slides and coverslips) and discuss procedures for using the microscopes.
3. Inquiry: How do tiny invertebrates survive the extreme conditions of Antarctica?

Students will design and conduct investigations to answer the above question.

### Part 1 Procedure:

1. Split students into groups of 2-3 for this part of the investigation. Each group should have a microscope. Demonstrate how to create a slide from the cultures of tardigrades by adding 1-2 drops to the center of the slide with a pipette. You do not need a coverslip to view the tardigrades at low or medium power, but explain that if they want to view the tardigrades at high power they will need to add a coverslip. To do this they should place four small drops of Vaseline on the four corners of the coverslip, then gently place this over the slide. The Vaseline will keep the coverslip suspended a little higher so the pressure from the coverslip doesn't crush the tardigrades.
2. Make observations. Give students 15-20 minutes to observe their organisms under the microscopes. This may take longer if students are unfamiliar with using a microscope. Move between

**Objectives:** Students will investigate how microscopic organisms survive the extremely cold and dry conditions of the McMurdo Dry Valleys.

**Pages in the Book:** 10, 11

### Resources & Materials:

- Microscopes
- Glass slides and coverslips
- Living tardigrades, rotifers, and/or nematodes
- Pipettes
- Vaseline
- Notebooks
- Pencils
- Freezers

groups to help with preparing slides, focusing the microscope, etc. Ask them to take notes about size, color, shape, and movement patterns. They should also draw each type of organism available — e.g. tardigrades, rotifers, and nematodes.

3. Once students have had time to make observations, introduce the use of stain to measure metabolism if available.
4. Class discussion: How can we measure the activity level of invertebrates? What are some of the conditions that you think might affect the activity level? Keep a list of student ideas.

## **Part 2 Procedure:**

1. Remind students that we want to conduct a controlled experiment to help understand how extreme conditions can affect the activity patterns of invertebrates. In a controlled experiment we can only change ONE variable at a time, and in this case we will change temperature. So we need to have two groups that are exactly the same except for the difference in temperature. Have students brainstorm about some of the other variables that could affect the outcome that we need to hold constant. Work together to develop a procedure for preparing slides.
2. Have each group prepare two identical sets of slides — one for the freezer group and one for the control group.
3. Leave slides in the freezer for several hours or overnight.
4. Remove the slides from the freezer and have each group record the activity level of their two sets of slides using the microscopes. They should also make drawings and take notes on any other observations of the organisms.
5. Set up a chart on the board so each group can record their data. Once all the groups have filled in their data, have each student record the complete data set.
6. Discuss patterns. What happened? Was there a difference between the two groups? Which was more active? How can slowing down metabolism help invertebrates survive extreme conditions?
7. Review vocabulary.

**Assessments:** As a class and individually, were the students able to recognize the main vocabulary terms? Did the groups successfully conduct a controlled experiment? Did they keep everything but temperature the same between the two groups?

## **Differentiation for ELLs:**

- Add new vocabulary to the word wall, along with pictures if possible.
- Allow students to work with a language partner and write conclusions and observations before sharing with the class.

## 16

## Small Creatures: Diatoms

**Content Area:** Science, Art

**Grade:** 3-5

**Duration:** 45 minutes

**Standards and Benchmarks:**

Science: 3S2, 4S2, 4S7, 5S2

Visual Arts: 2, 3, 4

National Science Content

Standards: A, C, E

**Objectives:** Students will be able to recognize the microscopic living things of Antarctica and understand why research is important.

**Pages in the Book:** 10, 11

**Resources & Materials:**

- Access to computers and the Internet
- Pictures of diatoms
- Paint or crayons
- Glue
- Tape
- Scissors
- Paper

### Teaching the Lesson:

1. Introduce the students to microscopic organisms. Explain that there are hundreds of living things that are around us but that we can't see because they are too small. Define microscope. Explain how this is a very useful tool in science. Define bacteria, algae, mosses, nematodes, and diatoms. Write the definitions on the board. Define dormant. Show the students images of the organisms.
2. Next introduce diatoms. Have students research diatoms by visiting the Antarctic Freshwater Diatom website at <http://huey.colorado.edu/diatoms>. Images of diatoms can be found by clicking on the blue "Taxa" button on the top left of the page (<http://huey.colorado.edu/diatoms/taxa/index.php>) and then clicking on the scientific name of the diatom.
3. Have students go to the website: <http://huey.colorado.edu/diatoms>. Allow students to choose a diatom or diatoms that they like and have them print them out.
4. Next have students discuss the shape and patterns of their diatoms and cut them out with scissors. Have the students then glue or tape their diatoms on the paper to create a work of art. Students may want to use more than one diatom to create a collage.
5. Encourage a final class discussion on what they have learned and allow students to present their finished project.

**Assessments:** Where students able to discuss what microscopic small creatures live in Antarctica and explain the definition of diatoms? Did each student successfully complete a finished project of the diatom collage?

**Differentiation for ELLs:**

- Before the activity read a leveled book related to diatoms in a small group.
- Add new vocabulary to the word wall, along with pictures if possible.
- Partner the students with language partners for the independent work.
- Work in a small group to help clarify expectations and help them locate internet resources.
- Provide extra time for them to do research in class under the supervision of the teacher.

## Algae and Moss Study

**Content Area:** Science

**Grade:** 3-5

**Duration:** Two 45-minute classroom sessions

**Standards and Benchmarks:**

Science: 3S1, 3S2, 3S3, 3S4, 4S1, 4S2, 4S3, 4S4, 4S8, 5S1, 5S2, 5S3, 5S4

National Science Content Standards: A, C

**Objectives:** Students will be able to recognize the microscopic living things of Antarctica and comprehend key vocabulary terms. Students will also design and conduct scientific investigations and recognize the basic parts of a microscope and know how to use them properly.

**Pages in the Book:** 10, 11

**Resources & Materials:**

- Microscopes glass or plastic slides and coverslips
- Different varieties of algae (available from Carolina Biological Supply)
- Freezers
- Vaseline
- Paper
- Pipettes
- Pencils
- Science Journals

\* This same lesson may be repeated with mosses (available from Carolina Biological Supply)

## Teaching the Lesson:

1. Introduction to Antarctica: Locate the continent of Antarctica on a globe or map. Ask the students what they already know about Antarctica.
2. Introduce algae: What are algae and why are algae important? Ask the students what they already know about algae.
3. Define microscope. Explain how this is a very useful tool in science. Describe the basic parts of a microscope (i.e. eyepiece, lens, stage, focus knobs, slides and coverslips) and discuss procedures for using the microscopes.
4. Next, ask students- How do algae survive the extreme conditions of Antarctica? Students will design and conduct investigations to answer this question.

**Part 1:**

5. Split students into groups of 2-3 for this part of the investigation. Each group should have a microscope. Demonstrate how to create a slide from the cultures of algae by adding 1-2 drops to the center of the slide with a pipette. You do not need a coverslip to view the algae at low or medium power, but explain that if they want to view the algae at high power they will need to add a coverslip. To do this they should place four small drops of Vaseline on the four corners of the coverslip, and then gently place this over the slide. The Vaseline will keep the coverslip suspended a little higher so the pressure from the coverslip doesn't crush the algae.

6. Make observations. Give students 15-20 minutes to observe the algae under the microscopes. This may take longer

if students are unfamiliar with using a microscope. Move between groups to help with preparing slides, focusing the microscope, etc. Ask them to take notes about size, color, shape, and movement patterns. They should also draw each type of algae.

7. Allow students to observe and compare the different types of algae in the microscope. Make sure they are taking notes, comparing, and drawing their observations.

## **Part 2:**

Remind students that we want to conduct a controlled experiment to help understand how extreme conditions can affect algae. In a controlled experiment we can only change ONE variable at a time, and in this case we will change temperature. So we need to have two groups that are exactly the same except for the difference in temperature. Have students brainstorm about some of the other variables that could affect the outcome that we need to hold constant. Work together to develop a procedure for preparing slides.

1. Have each group prepare two identical sets of slides—one for the freezer group and one for the control group.
2. Leave slides in the freezer for several hours or overnight.
3. Remove the slides from the freezer and have each group record the activity level of their two sets of slides using the microscopes. They should also make drawings and take notes on any other observations of the organisms.
4. Set up a chart on the board so each group can record their data. Once all the groups have filled in their data, have each student record the complete data set.
5. Discuss patterns. What happened? Was there a difference between the two groups? How can the algae survive extreme conditions?
6. Review vocabulary and discuss the results of the experiments.

**Assessments:** Were the students able to locate Antarctica on a globe or map? As a class and individually, were the students able to recognize the main vocabulary terms? Did the groups successfully conduct a controlled experiment? Did they keep everything but temperature the same between the two groups?

## **Differentiation for ELLs:**

- Add new vocabulary to the word wall, along with pictures if possible.
- Allow students to work with a language partner for the microscope work and write conclusions and observations before sharing with the class.

## 18

## Equipment for the McMurdo Dry Valleys

**Content Area:** Science, Social Studies, Language Arts

**Grade:** 3-5

**Duration:** 1-hour classroom session

**Standards and Benchmarks:**

Science: 3S2, 4S2, 5S2

Language Arts: 1, 2, 3, 6

English Language

Development: 1,

2, 3, 4

Geography: 1

National

Science

Content

Standards:

E, G

**Objectives:** Students will be introduced to some of the equipment used by researchers in the McMurdo Dry Valleys of Antarctica. Students will also be able to recognize that research is being done in the McMurdo Dry Valleys in Antarctica and write a short story on research in Antarctica using key vocabulary words.

**Pages in the Book:** 4, 6, 25

**Resources & Materials:**

- *The Lost Seal* book
- Paper
- Pencils

**Vocabulary Terms:**

- **Cargo net:** a net made of three-inch-wide cloth strips used for packing supplies.
- **Flipper tag:** a piece of plastic attached to an animal for identification.
- **Hut:** a small building used as shelter from harsh conditions.
- **Pendant:** a thick rope with a loop on one end.
- **Sledge:** a large sled used for hauling gear.
- **Sling load:** cargo wrapped up in a net carried underneath a helicopter.

## Teaching the Lesson:

*Which tools do people use in Antarctica?*

**1. Equipment for Research in Antarctica:**

Students are introduced to some of the equipment used by researchers in the McMurdo Dry Valleys of Antarctica. Ask the students guiding questions from the book *The Lost Seal*. Some questions may include:

- What did Captain Robert Scott and his crew use to carry their gear and supplies?
- How did Captain Scott and other researchers protect themselves from harsh conditions?
- What was attached to the seal that helped the scientists identify it?

- How was the seal carried back to safety?

Define cargo net, flipper tag, hut, pendant, sledge and sling load. Write the definitions on the board.

2. Encourage the students to close their eyes and imagine they are in Antarctica with Dr. Diane McKnight and the rest of the crew. In the same way as they saved the seal, ask the students to write their own short story using at least four of the main vocabulary terms discussed in class. Allow them to be inventive; perhaps they are saving another animal, they are part of the team of scientists that study the seals, or maybe they are the seal itself.

3. Provide enough time at the end to have each student tell their classmates what their short story was about.
4. Encourage a final class discussion on what they have learned.
5. Have the students turn in their short story to you for reading comprehension and vocabulary review.

**Differentiation for ELLs:**

- Add new vocabulary to the word wall, along with pictures if possible.
- Work with each student to facilitate the story-writing process.
- Give the students an option to write a "children's book," so that they can utilize more basic vocabulary and grammatical structures.

## 19

## Design Your Own Antarctic Research Project

**Content Area:** Science, Language Arts

**Grade:** 3-5

**Duration:** 3-5 45-minute class periods

**Standards and Benchmarks:**

Science: 3S4, 4S4, 5S4

Language Arts: 1, 2, 3, 4, 5

English Language Development: 1, 2, 3, 4

National Science Content Standards: A, G

**Objectives:** Students will be exposed to grant writing and creating a research project with their background information of Antarctica. Students will also participate in the writing process as they design the research project.

**Pages in the Book:** Entire book

**Resources & Materials:**

- Paper
- Pencils
- Research Materials
- Computers with internet access
- Poster Board
- Other various art supplies for the final project

## Teaching the Lesson:

This would be best done towards the end of a unit lesson on *The Lost Seal*, once students already have some background knowledge about Antarctica.

1. Discuss with students that an important task for scientists is to obtain funds for their research. Scientists must prepare a grant proposal in which they carefully describe the questions they would like to answer and explain why these questions are important. For this reason, writing is an important skill for successful scientists. Several agencies of the US government fund research and these funding agencies receive more proposals than can be funded.
2. Tell students that their task today is to write their own mini grant proposal for research they would like to do if they had the opportunity to go to Antarctica.

**Part 1 — Background Research:**

1. Divide students into groups of 2-4.
2. Provide students with materials they can look through for ideas about what they would like to study. This could include books, maps, and printouts that describe some of the animals that are found in Antarctica.
3. In addition, have several books and maps available at the front of the room for the entire class to share.
4. Encourage students to decide as a group on their study topic, and write out several "research questions" that they have about that topic.

## **Part 2 — Making a Poster:**

1. Explain to students that their poster should have at least three parts: 1) a written description about what they would like to study, 2) an illustrated map of Antarctica showing the regions of the continent where they will conduct their study (e.g. if they plan to study whales, they should highlight the oceans around Antarctica), and 3) drawings of their study organisms or topics. They can also fill in the map with other drawings, cutouts, or whatever they like.
2. Pass out a large sheet of blue construction paper or poster board and a copy of a map of Antarctica to each group. The construction paper should be large enough that students have room to paste the map, their written description, and any other drawings or materials they want to include.
3. Students should divide up tasks within their group for the poster — some can draw, some can write, etc.
4. Provide an example proposal or outline to follow that contains background information, research questions, methods, and expected results.

## **Part 3 — Peer Review:**

1. Explain to students that other scientists who are experts in a particular area of study generally make the recommendations about which grant proposals are interesting and well-designed. This process is called “peer review.” It is an important part of the scientific process. Explain to students that they will now assume the role of a reviewer.
2. All the final posters should be displayed around the room. Give students at least 10 minutes to walk around the room and look at each one. Once everyone has had a chance to look at all the posters, have them each write a 2-3 sentence paragraph that states which was their favorite proposal and why. Their answers should remain anonymous.
3. Collect all the votes from different students and tally them up to determine which grant proposal will receive funding. You could give a prize for the top proposal if desired.

**Assessments:** Assessments should be made on the final poster of the project, participation in the project with the group, the presentation, and the peer review. A rubric may be created to assess students of these topics.

## **Differentiation for ELLs:**

- Work in a small group to help clarify expectations and help them locate resources.
- Allow students to work with a language partner.
- Allow students to work on tasks that are less language intensive in creating the poster.

## Antarctic Expedition Guide

**Content Area:** Science, Social Studies, Language Arts

**Grade:** 3-5

**Duration:** One 45-minute class period

**Standards and Benchmarks:**

Science: 4S8, 5S7

Language Arts: 1, 2, 3, 5

English Language Development: 1, 3

Geography: 5

National Science Content Standards: G

**Objectives:** Students will understand that researchers visiting Antarctica need to be prepared to stay for long periods of time isolated from the rest of the world. Students will also understand that researchers need to pack everything they will need for personal and scientific use for several months.

### Pages in the Book:

### Resources & Materials:

- Paper
- Pencils
- Journals
- Internet access

<http://www.yourexpedition.com>  
<http://www.rei.com>

## Teaching the Lesson:

1. Begin the lesson with a discussion on what we need to survive (shelter, clothing, food, and water). Have students brainstorm on what they think they will need to pack for a 4-month research trip to Antarctica.
2. Divide the students into groups, explain that each group is a research team that will be going to Antarctica for 4 months in the austral summer. They need to create a packing list for their expedition. Remind students of the expected weather conditions and necessities for survival.
3. Allow students to work on computers with internet connections to begin to make a list for their trip.
4. Once students have created their list, conclude the lesson with sharing the list. You may want to create a master class list.

### Extensions:

1. Give students a budget to work with and incorporate math skills in this lesson.
2. Have students design special gear, such as a backpack or a coat.
3. Groups could be divided into different expeditions (rainforest, prairie, desert, South Pole). Students could then compare and contrast the requirements for expeditions to the different regions. How would the packing lists be different?
4. Compare and contrast winter weather where the students live.

**Assessments:** Do students understand what is needed for survival? Were they able to create a packing list for their trip?

Did they work well with other members of the group? Did they contribute to the classroom presentation?

**Notes & Reflections — Other Web Sites:**

- <http://www.nationalgeographic.com/sealab/antarctica>
- <http://www.nationalgeographic.com/xpeditions/activities/05/circles.html>
- <http://www.amnh.org/exhibitions/shackleton>

**Differentiation for ELLs:**

- Allow students to work with a language partner.

## Laws, Treaties, and Acts...

**Content Area:** Science, Social Studies, Language Arts

**Grade:** 3-5

**Duration:** 2 45-minute class periods

**Standards and Benchmarks:**

Science: 5S7, 5S9

Language Arts: 1, 2, 3, 5

English Language Development: 1, 2, 3

Civics: 2, 4

National Science Content

Standards: G

**Objectives:** Students will research and become familiar with the Antarctic Treaty and the Antarctic Conservation Act.

**Pages in the Book:** 8, 9, 15, 24

**Resources & Materials:**

- Paper
- Pencils
- Journals
- Computers with Internet access

## Teaching the Lesson:

1. Begin the lesson by asking students what they know about laws that govern Antarctica (students can write their answers in their journals).
2. Next, explain that there are two laws that are important, the Antarctic Treaty and Antarctic Conservation Act.
3. Divide the student into pairs and allow them to begin research on the Antarctic Treaty. Questions students may want to answer are: When was it signed? What countries were involved? Why was it necessary? What's the importance?
4. Once the groups have finished researching the treaty allow them to share with the class their findings.
5. After completing the research on the Antarctic Treaty, next have students research the Antarctic Conservation Act. Proceed the same way as above with the research. Allow the students to share what they have discovered.
6. Conclude the lesson with reviewing the two laws and why they are important.

**Assessments:** Why are the laws that governs Antarctica important? Why do these laws matter in the book, *The Lost Seal* by Diane McKnight?

**Differentiation for ELLs:**

- Before the activity, read a leveled book related to laws/government in a small group.
- Add new vocabulary to the word wall, along with pictures if possible.
- Allow students to work with a language partner.

## Antarctica's Future

**Content Area:** Science, Language Arts, Social Studies

**Grade:** 3-5

**Duration:** 2 45-minute class periods

**Standards and Benchmarks:**

Science: 5S7, 5S8, 5S9

Language Arts: 1, 2, 3, 4, 5

English Language Development: 1, 2, 3, 4

Geography: 5, 6

National Science Content

Standards: G

**Objectives:** Students will understand the debates that involve the future of Antarctica. Students will also practice research and public speaking skills.

**Pages in the Book:** 30, 31

**Resources & Materials:**

- Paper
- Pencils
- Antarctica Journal
- Access to computers
- Poster board

**Possible Websites for Research:**

<http://www.classroom.antarctica.gov.au/>

<http://www.sln.org.uk/geography/enquiry/we8.htm>

## Teaching the Lesson:

1. Begin the lesson by discussing what the future may look like for Antarctica. Show some of the pictures from various Antarctic websites.
2. Next explain to students that they will be researching a group that values Antarctica. They will then prepare a debate to present to the class about their group and what the future of Antarctica should look like.
3. Discuss with students which groups may influence the future of Antarctica.
4. Divide students into different groups and allow each group to choose a role-play group; fishermen, scientists, environmentalists, mining engineers, tour group leaders.
5. Give each group an ample amount of time to research their debate topic. If students are struggling with researching the topics, you may want to create research worksheets for the students.
6. Once students have researched their topic, allow them to create a poster of why Antarctica is important to that particular group.
7. After the research and debate posters are made, hold a classroom debate of the future of Antarctica. Allow each group to express the importance of Antarctica to them and allow students to ask questions. Explain that at the end of the debate the class will be voting on the best conclusions.

**Assessments:** Did each student participate in the research on the topic? Did each poster accurately support their opinion in a clear way? Did each student share information at the debate?

**Differentiation for ELLs:**

- Allow students to work with a language partner.
- Work in a small group to help clarify expectations and help them locate internet resources.
- Provide extra time for them to do research in class under the supervision of the teacher.

## References

### Geography of Anarctica:

- <http://www2.umaine.edu/USITASE/teachers/pdf/tortillaMapLesson.pdf>
- <http://www.andrill.org/flexhibit/flexhibit/materials/activities/Activity2A-BuildAModelGlacier.pdf>
- [http://www.windows2universe.org/teacher\\_resources/teach\\_flubber.html](http://www.windows2universe.org/teacher_resources/teach_flubber.html)

### Animals of Antartica:

- <http://www.vtaide.com/png/oceanchain.htm>
- <http://www.marine.usf.edu/pjocean/packets/sp01/sp01u1p3.pdf>

### Small Creatures:

- <http://www.daviddarling.info/encyclopedia/A/anhydrobiosis.html>
- <http://www.marine.usf.edu/pjocean/packets/sp01/sp01u1p2.pdf>
- <http://www.marine.usf.edu/pjocean/packets/sp01/sp01u1p3.pdf>
- <http://www.math.mtu.edu/gk-12/microscopes.html>
- <http://www.antarctica.gov.au/about-antarctica/fact-files/plants/mosses-and-liverworts>
- [http://www.nsf.gov/discoveries/disc\\_summ.jsp?cntn\\_id=100705](http://www.nsf.gov/discoveries/disc_summ.jsp?cntn_id=100705)
- <http://sciencespot.net/Pages/classbio.html>
- [http://eduref.org/cgi-bin/printlessons.cgi/Virtual/Lessons/Science/Process\\_Skills/SPS0064.html](http://eduref.org/cgi-bin/printlessons.cgi/Virtual/Lessons/Science/Process_Skills/SPS0064.html)

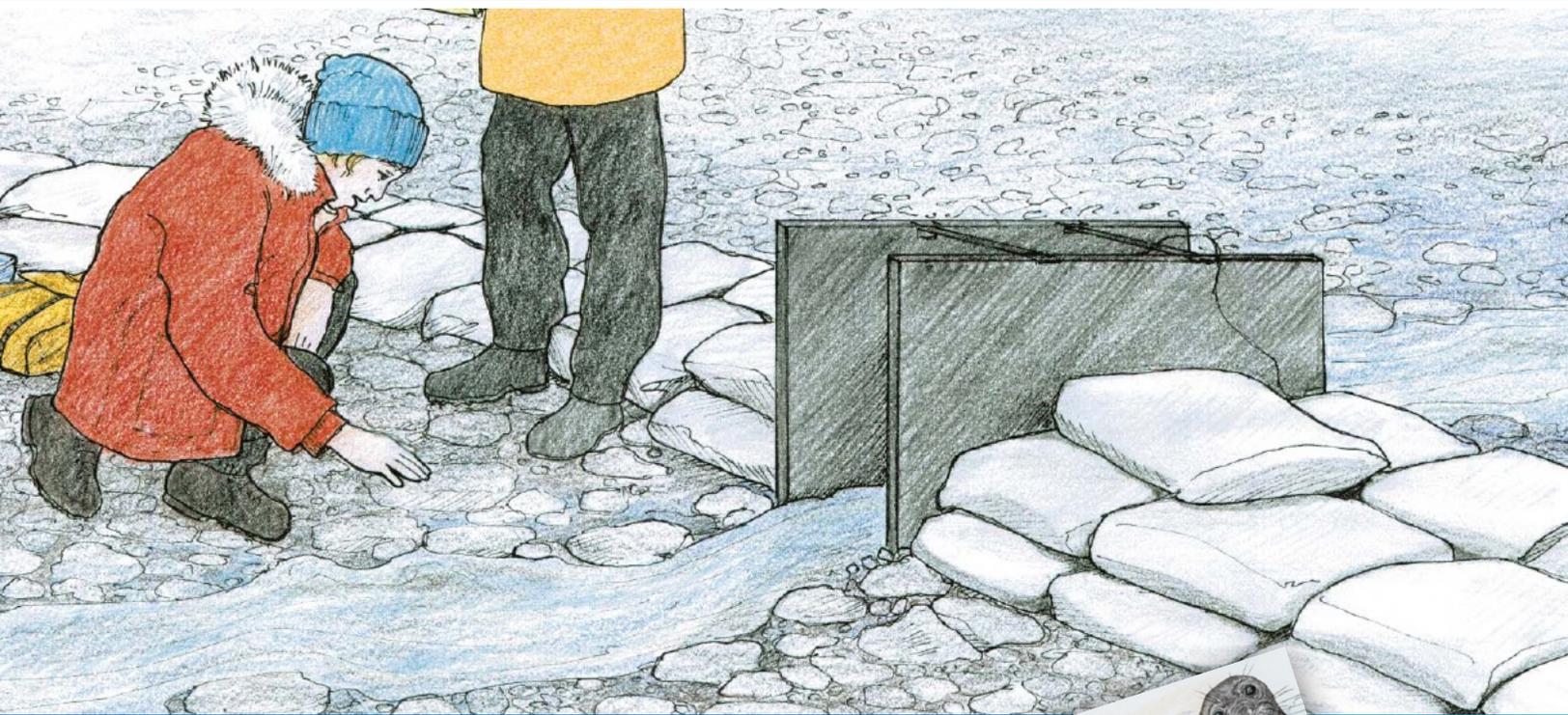
### Research and Conservation:

- <http://www.globalclassroom.org/antarct8.html>
- [http://www.educationworld.com/a\\_lesson/newsforyou/pdfs/newsforyou085-download.pdf](http://www.educationworld.com/a_lesson/newsforyou/pdfs/newsforyou085-download.pdf)
- <http://www.marine.usf.edu/pjocean/packets/sp01/sp01u1p2.pdf>
- <http://www.nsf.gov/pubs/1995/nsf95154/nsf95154.pdf>
- <http://www.sln.org.uk/geography/roleplay.htm>
- <http://www.reachoutmichigan.org/funexperiments/agesubject/lessons/newton/AntarcticII.html>

## Books for Young Readers

- ***Animals in the Wild*** by Vincent Serventy
- ***Antarctic Journal: Four Months at the Bottom of the World*** by Jennifer Owings Dewey and Barbara Taylor
- ***Antarctic Antics, Book of Penguin Poems*** by Judy Sierra
- ***Antarctica*** by Helen Cowcher
- ***Arctic Son*** by Wendell Minor
- ***The Complete Guide to Antarctic Wildlife: Birds and Marine Mammals of the Antarctic Continent and Southern Ocean*** by Hadoram Shirihai
- ***Cinderella Penguin or The Little Glass Flipper*** by Janet Perlman
- ***Cuddly Dudley*** by Jez Alborough
- ***Life in the Polar Regions*** by Melvin Berger
- ***Little Penguin's Tale*** by Audrey Wood
- ***Mr. Popper's Penguins*** by Richard and Florence Atwater
- ***Nanu, Penguin Chick*** by John Butler
- ***Penguins*** by Gail Gibbons
- ***Penguin*** by Claire Robinson
- ***Penguin Chick*** by Betty Tatham
- ***A Penguin Pup for Pinkerton*** by Steven Kellogg
- ***Penguin Small*** by Mick Inkpen
- ***Penguins at Home: Gentos of Antarctica*** by Bruce Macmillan
- ***Penguins*** by Sylvia Johnson
- ***Playing with Penguins and Other Adventures in Antarctica*** by Ann McGovern
- ***Polar Wildlife*** by Kamini Khanduri
- ***Tacky the Penguin*** by Helen Lester
- ***The Emperor Penguins*** by Kazue Mizumura
- ***The Important Book*** by Margaret Wise Brown





*The Lost Seal* describes an encounter of researchers with a live Weddell seal in the McMurdo Dry Valleys. The story uses the seal's travels in a polar desert and its helicopter-assisted return to McMurdo Sound to convey how different the Dry Valleys are from other environments. The narrative describes both the historical context of the exploration of the Dry Valleys and current field activities, such as measuring stream flow, in an engaging manner.



Long Term Ecological Research