Arctic Animals

4–8 Teacher's Guide

A SEAWORLD EDUCATION DEPARTMENT PUBLICATION

CONTENTS

To the Teacher

The ***Arctic Animals*** Teacher's Guide for grades 4–8 was developed at SeaWorld to help you teach your students—in an active, hands-on way—about the natural history of the Arctic and how people form an important part of this ecosystem. Our goal is to integrate science, mathematics, art, social studies, and language arts. SeaWorld curriculum supports the *National Science Education Standards*.

The brief background information in this Guide was written for you, the teacher. It will help you do these activities with your students. We suggest you also refer to some of the materials listed on page 24 for more in-depth information. SeaWorld strives to provide teachers with up-to-date information and activities that motivate students to appreciate and conserve wildlife, the oceans, and the natural world.

Goals of the Arctic Animals Unit

Students will explore the natural history of the Arctic and recognize that humans are an interconnected part of this ecosystem.

Objectives

After completing the SeaWorld Arctic Animals unit, the student will be able to…

1. Trace the Arctic Circle on a map or globe and identify the latitude that defines this circle.
2. Identify the countries, ocean, seas, and bays that lie within the Arctic Circle.
3. Describe four physical characteristics of the arctic environment.
4. Place five arctic animals in their habitat.
5. List ways arctic animals keep warm during the arctic winter.
6. Explore the cultural diversity of Native Americans that make the Arctic their home.
7. Express a concern for how human activities may impact the arctic environment and the future survival of animals that live there.
8. Share their learning experience with friends and family.

Vocabulary

Arctic Circle — the imaginary line that encircles the globe at 66° 33" north latitude. Arctic lands and oceans lie within this circle. "Arctic" comes from the Greek word *arktos*, meaning bear.

blubber — an insulating layer of fat just below the skin of most marine mammals.

conservation — taking care of our environment by wisely managing its resources.

food chain — a simple straight-line diagram that shows "who eats whom" in an ecosystem.

food web — a diagram that shows the many complex interconnections of "who eats whom" in an ecosystem.

ecosystem — a unit of plants, animals, and nonliving components of an environment that interact.

hypothermia — a medical condition that happens when a person's or an animal's body temperature falls below normal.

ice floe — a flat expanse of floating ice.

IAP — International Arctic Project. This expedition crossed 3,218 km (2,000 mi.) of arctic land on dogsled in the summer of 1995. Team members conducted research and collected data about the arctic region.

lair — the shelter of some animals; used for birth and protection. May also be called a den.

microscopic — very small; only visible to humans through a microscope.

North Pole — the geographic top of the earth. Longitude lines converge here.

permafrost — permanently frozen soil found only in very high latitudes.

pollution — harmful elements that alter or affect an environment in a negative way, such as chemicals that poison water supplies or trash that clutters the ocean.

prey — an animal eaten by another animal.

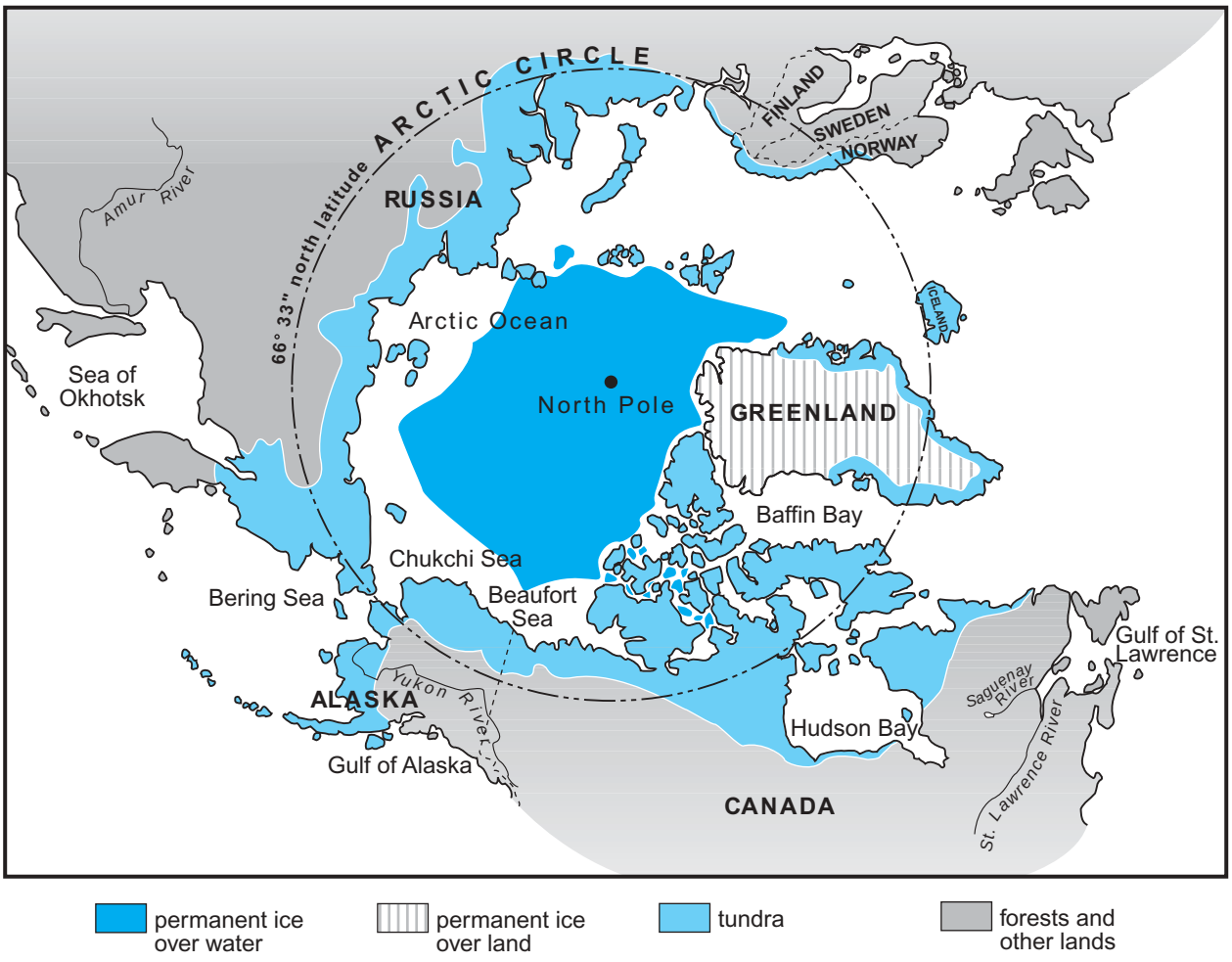
predator — an animal that eats another animal.

scrimshaw — a form of Native American art that uses animal bones and ivory. Artists carve pictures into the bones and ivory, then stain the surfaces to highlight etchings.

sled — a low-running vehicle drawn by dogs, horses, or reindeer. Humans use sleds for transporting loads across snow and ice.

tundra — a treeless area between the ice cap and tree line of arctic regions, with a permanently frozen subsoil.

The Arctic Circle rings the globe at 66° 33" north latitude. North of this imaginary line lie the frozen lands of the Arctic.



The Arctic—Sitting at the Top of the World

The Arctic is the northernmost part of the earth.

The *Arctic Circle* rings the globe at 66° 33" north latitude. North of this imaginary line lie the frozen lands of the Arctic. Seven countries share the Arctic—Canada, Finland, Greenland, Norway, Sweden, Russia, and the United States.

The Arctic is not a continent.

The *North Pole* sits on permanently frozen ocean water, not on land. Overall, more than half of the Arctic is frozen ice moving across the surface of the Arctic Ocean. No one can put a marker at the North Pole; ice constantly shifts and drifts in a clockwise direction, so markers soon become inaccurate.

Much of the soil in the Arctic remains permanently frozen, too. Called *permafrost*, the top layer of the frozen soil sometimes thaws during the spring and summer. The resulting cold, soggy, soil allows plants to grow and animals to graze.

It's cold in the Arctic.

Ocean water temperatures often stay below the freezing point of fresh water (0°C or 32°F). Dissolved salts and constant movement of the water keep it from freezing solid.

On land, air temperatures average only 15.5°C (60°F) during the warmest months. During the winter, weather can be severe, with the temperatures falling to -70°C (-94°F). Strong winds can drop temperatures more. The annual snowfall compares to the snowfall of Chicago; about 30 to 60 cm (12–24 in.). Trees are rare, and plants grow low to the ground.

Because the Arctic is at the "top" of the world, the sun may never rise above the horizon on some winter days and may never set below the horizon on some summer days. For example, in December, some days may be 24 hours dark, but in June some days may be 24 hours light.

Portage Glacier in the Kenai Peninsula slowly moves down the mountainside, releasing ice and snow decades old to the sea.

Life in the Deep Freeze

Plants cling to ice and frozen ground.

Microscopic plants called diatoms live under the ice in the Arctic Ocean. Other algae grow on permanent ice. Lichens (algae and fungi growing together) cover barren rocks. Mosses, grasses, flowers, and shrubs carpet the *tundra*.

Most plants on the tundra grow only ankle high, hugging the ground to avoid the cold blasts of arctic winds. Short summers compress growing seasons that sometimes last less than two months. Mosses and lichens grow in spongy cushions, soaking up available moisture.

Animals cope with cold.

Shrimps, fishes, seals, walruses, and whales thrive in the cold, nutrient-rich waters of the Arctic Ocean. Caribou, moose, and musk oxen roam the tundra. Polar bears prowl the ice. Birds such as ptarmigans and snowy owls live year-round in the cold weather. Many other animals visit arctic lands to feast on summer plants and insects.

Warm-blooded marine animals, like these walruses, have a think layer of blubber that helps retain body heat in cold ocean water.

The red fox and other land predators use keen senses of smell and hearing to find lemmings and other prey.

Some birds, seals, and whales migrate south during the coldest arctic months. Others stay year-round, protected by thick layers of *blubber* or dense coats of fur. The arctic fox and grouse change colors; they are brown in summer, white in winter.

For thousands of years, people have made the Arctic home.

Today, they include the North American Inuits and Aleuts and the Siberian Yupiks. These people hunt, trap, and fish to survive.

Native people often follow animal behavior for successful hunting and fishing. Like polar bears, hunters wait beside the breathing holes of seals to catch prey.

Animal hides and fur protect human skin from the cold. Meals include high-energy blubber and fatty meat for the extra calories required to survive in the cold. On average, the diets of people living in cold climates has twice as many calories as the diets of people in warm climates.

A Frontier That Could Disappear

The Arctic plays a critical role in global health.

Some ecologists describe the Arctic as a mirror that reflects the health of the rest of our planet. The land plays a crucial role in worldwide weather and climate patterns. Rich habitats support a wide variety of plants and animals.

Until the mid-1800s, the Arctic remained unspoiled, isolated from human exploration by its extreme weather conditions. But today's technology gives people easier access to this fragile habitat. Natural resources like gas, oil, and coal attract developers.

Future success depends on wise use of resources.

Development during the last 40 years has left paved roads crisscrossing the tundra, oil drill rigs dotting the coastline, and underground mines marking the frozen earth. Cities and construction sites have sprouted where people could never live or work before. The survival of both people and animals depends on the intelligent *conservation* of land and ocean resources today.

The Arctic needs you.

As one of the last frontiers on earth, the Arctic needs protection. You can help. Here's how:

q Learn all you can about the Arctic. The more you know, the better you can help.

q Support other people who work to protect the Arctic. These are two organizations to consider supporting:
- American Zoo and Aquarium Assoc. 7970–D Old Georgetown Road, Bethseda, MD 20814
- Hubbs-SeaWorld Research Institute (H-SWRI) 2595 Ingraham, San Diego, CA 92109

q Do what you can to help the Arctic right where you live.
- Recycle everything you can to help reduce your energy needs.
- Conserve your use of fuel.
- Support legislation that helps the environment locally and globally.
- Don't buy products that are made from endangered animals.
- Properly dispose of trash and household chemicals.

Arctic Animal Shuffle

Use the cards on pages 7, 8, and 9 to help your students get started exploring arctic animals. Here are some ideas for ways to use these cards in your classroom:

- Use the facts on the cards to help you prepare lesson plans and lead discussions in class.
- Copy and cut apart the cards. Distribute a different card to each cooperative learning group. Visit the school library to learn more about the animals. Groups may even adopt that animal as their "mascot" while working on the Arctic Animals unit.
- Copy and cut apart the cards. Distribute a complete set to each student or group of students. Students compare similarities and differences among various animals.

collared lemming

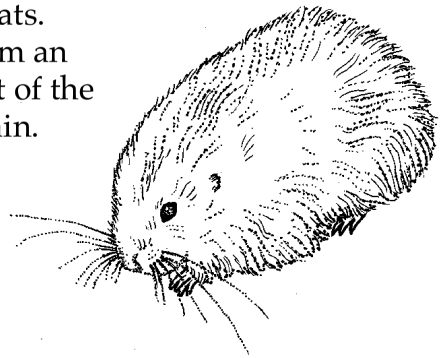
Dicrostonyx torquatus

size: 10 to 11 cm (3.9–4.4 in.), 17 to 20 g (0.6–0.7 oz.)

distribution: tundra regions of the northern hemisphere

diet: green parts of plants, occasionally bulbs, roots, and mosses

predators: arctic foxes, snowy owls, arctic skuas, and stoats. Lemmings form an important part of the arctic food chain.



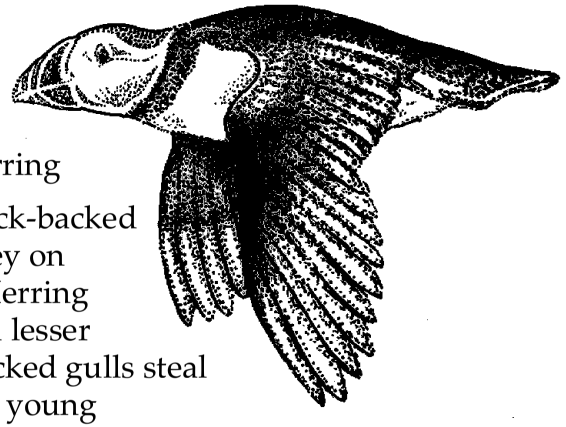
Atlantic puffin

Fratercula arctica

size: 28 to 30 cm (11–11.8 in.) standing, wingspan 53 to 58 cm (20.9–22.8 in.)

distribution: North Atlantic Ocean

diet: small fishes; including sandeels, sprats, capelin, and small herring



predators: great black-backed gulls prey on adults. Herring gulls and lesser black-backed gulls steal eggs and young

arctic tern

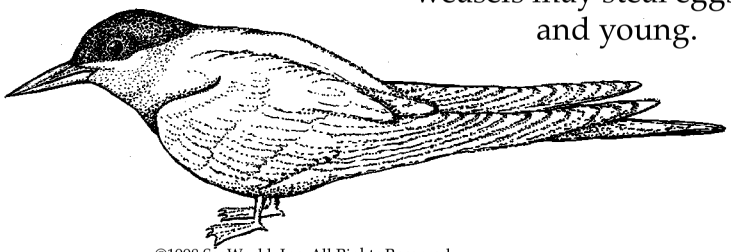
Sterna paradisaea

size: to 38 cm (15 in.) standing, wingspan to 81 cm (31.9 in.)

distribution: circumpolar at high northern hemisphere latitudes during the summer. Flies south to winter along the shores of Antarctica. Travels as far as 36,000 km (22,370 mi.) round trip.

diet: small fishes, molluscs, and pelagic crustaceans

predators: Snowy owls, arctic skuas, stoats, foxes, and weasels may steal eggs and young.



greenland shark

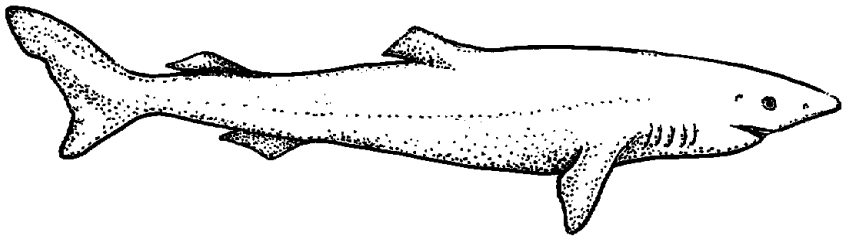
Somniosus microcephalus

size: more than 4 m (13.1 ft.)

distribution: North Atlantic and Arctic Oceans

diet: various fish species such as herring, spiny eels, salmon, char, smelt, cods, and flatfish in addition to marine mammals, most commonly seals

predators: none



bowhead whale

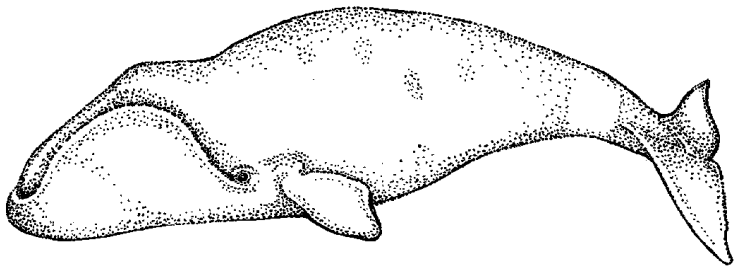
Balaenea mysticetus

size: 18.5 m (60.7 ft.) and 100 metric tons (220,400 lb.), females generally larger than males

distribution: circumpolar in the Arctic but usually in the Bering, Chukchi, and Beaufort Seas

diet: mostly planktonic swarms of krill and other small crustaceans

predators: none, but hunted by humans



harp seal

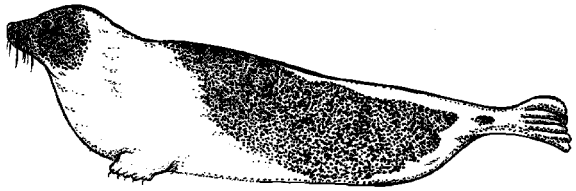
Phoca groenlandica

size: to 1.7 m (5.6 ft.) and 130 kg (287 lb.), males somewhat larger than females

distribution: population centers in the northwest Atlantic Ocean around Newfoundland

diet: pelagic crustaceans and fishes such as capelin and herring. During the summer they also feed on arctic cod and polar cod found at high latitudes.

predators: polar bears and killer whales



beluga whale

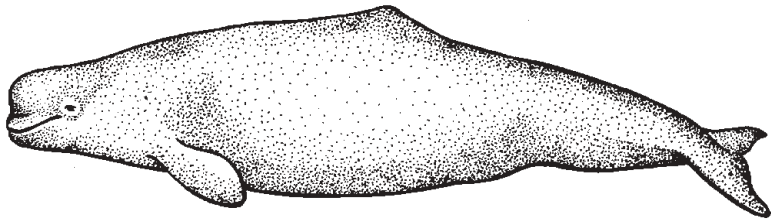
Delphinapterus leucas

size: males to 4.6 m (15.1 ft.), 1,500 kg (3,307 lb.) females to 4 m (13.1 ft.), 1,360 kg (2,998 lb.)

distribution: Arctic Ocean and adjoining seas

diet: primarily bottom-dwelling animals such as flounder, octopuses, crabs, shrimps, clams, snails, and sandworms

predators: killer whales and polar bears



ringed seal

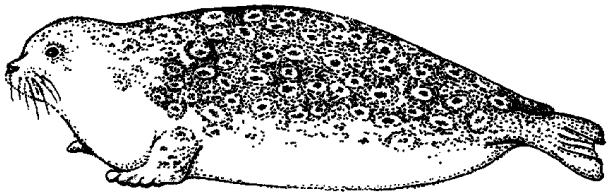
Phoca hispida

size: to 1.5 m (4.9 ft.) and to 70 kg (154 lb.), males somewhat longer than females

distribution: widespread and abundant in arctic waters; they breed and dig out birthing lairs in land-fast ice.

diet: depending on location and season, amphipods, shrimps, squids, cods, and sculpins

predators: polar bears and killer whales



Atlantic cod

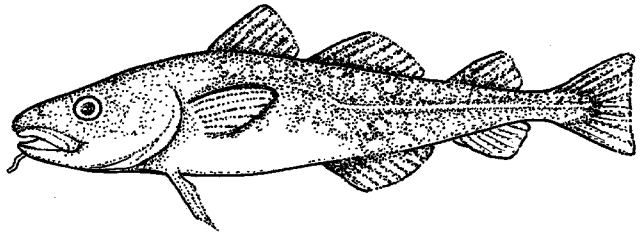
Gadus morhua

size: to 1.8 m (5.9 ft.) and to 91 kg (201 lb.)

distribution: Arctic Ocean south to Virginia

diet: molluscs, crustaceans, and bottom plants

predators: fishes, whales, and seals



polar bear

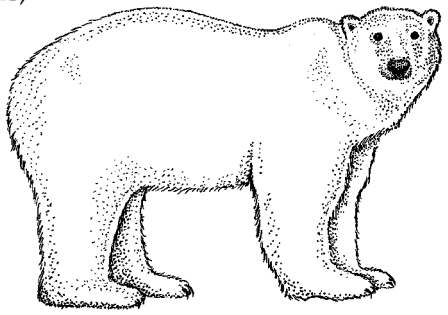
Ursus maritimus

size: males to 3 m (9.8 ft.) and to 650 kg (1,433 lb.)
females to 2.5 m (8.2 ft.) and 250 kg (551 lb.)

distribution: circumpolar Arctic

diet: mostly ringed and bearded seals, occasionally harp seals, hooded seals, and young walruses. Polar bears also eat the carcasses of beluga whales, narwhals, and bowhead whales

predators: none



narwhal

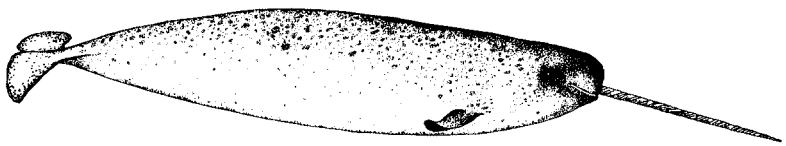
Monodon monoceros

size: to 4.5 m (14.8 ft.) and 1,500 kg (3,300 lb.), males usually larger than females

distribution: circumpolar in the Arctic above 65°N latitude

diet: squid, polar cod, bottom-dwelling fish, and crustaceans

predators: occasionally killer whales; polar bears may feed on carcasses



walrus

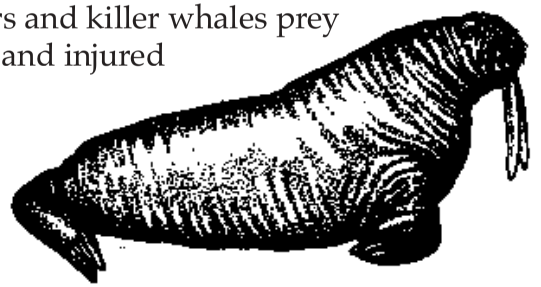
Odobenus rosmarus

size: males to 3.6 m (11.8 ft.) and 1,700 kg (3,748 lb.)
females to 3.1 m (10.2 ft.) and 1,250 kg (2,756 lb.)

distribution: circumpolar with distinct populations concentrated in the Bering, Chukchi, and Laptev Seas and around northeastern Canada and Greenland

diet: molluscs, mainly bivalves such as clams

predators: Polar bears and killer whales prey on young and injured adults.



How Low Can It Go?

OBJECTIVE

Students will investigate how salt and other dissolved solids can lower the freezing point of water.

BACKGROUND

Pure water freezes at 0°C (32°F). When substances, such as salt, dissolve in water, water molecules have difficulty locking together to freeze to a solid. Salt water freezes at a lower temperature, about -2.2°C (28°F). As this water freezes, the salt (sodium chloride) is pushed out. Solid ice is mostly fresh water. The remaining liquid water under ice becomes saltier as more water freezes.

MATERIALS

one set per student group:

- ❑ copy of ***How Low Can It Go?*** funsheet on page 11
- ❑ two plastic bowls
- ❑ two thermometers
- ❑ water
- ❑ salt
- ❑ measuring cup
- ❑ freezer

ACTION

1. Measure water to fill bowls three-quarters full. Record amount of water used.
2. Take the water temperature of each bowl. Record results.
3. For one bowl, mix in one tablespoon of salt per cup of water used. Stir to dissolve. (This will approximately equal the salt in ocean water.)
4. Record temperature again. It should have remained the same.
5. Place both bowls in the freezer side by side.
6. Observe the bowls every 15 minutes, noting if ice has formed across the top of the bowl. Also record water temperatures for each bowl. Be careful to place thermometer in the same location for each bowl. As the surface water freezes solid, use a blunt pencil to chip a small hole for the thermometer.
7. Repeat steps 1 through 6 again using sugar, baking soda, or cornstarch as the dissolved substance. Does this make a difference in the rate or degree of freezing?

DEEPER DEPTHS

Leave the bowls overnight in the freezer. Check the bowls in the morning. Do both bowls freeze solid? If not, why not? (Hint: let students taste the unfrozen water in the bottom of the bowl. Is it salty?) Ice floes can have pockets of liquid brine—super salty water.

How Low Can It Go?

	water without salt	water with salt
amount of water		
initial temperature		
temperature after mixing		
temperature in freezer after		
15 minutes		
30 minutes		
45 minutes		
60 minutes		
75 minutes		
90 minutes		
105 minutes		
120 minutes		
temperature after 24 hours		

Scrimshaw Scribbles

OBJECTIVE

Students will learn about art of Native Americans by recreating examples using simple materials.

MATERIALS

- ❑ paper
- ❑ pencil
- ❑ cutting board
- ❑ large, soft bar of white floating soap
- ❑ plastic knife
- ❑ black water-based paint
- ❑ paintbrush
- ❑ illustrations of scrimshaw (see Bibliography on page 24)

BACKGROUND

Many Native American artists use animal bones and ivory (*tusks*) in their art. One of the most popular uses is to carve pictures into them. The artists stain the bone or ivory to bring out the highlights of their etchings. This type of art is known as *scrimshaw*.

ACTION

1. Show illustrations of scrimshaw. Native Americans often carve animals found around them—polar bears, walruses, ravens, and whales. Discuss a few other animals students might see if they lived in the Arctic.
2. To begin the activity, place the bar of soap on the paper and have students draw an outline of the soap shape. Remove the bar of soap.
3. Students should sketch their animal on the piece of paper within the outline of the soap shape. Lines can touch the edges. Simple sketches result in the best carvings.
4. Place the soap bar on the cutting board. Use the plastic knife to scrape off the soap's brand name.
5. Place the paper sketch on the soap bar. Trace the lines on soap using the blunt side of the plastic knife.
6. Remove the paper and use the plastic knife to carve details and shape the soap.
7. After soap is carved, paint the area with black water-based paint. Allow to dry for about 5 minutes.
8. Lightly run water over the soap to remove excess paint. The paint should remain in the carved areas. Let the bar of soap dry for at least two hours.

Polar Legends

OBJECTIVE

Students will read legends about arctic animals, nature, and people. They will explore story characters and create arctic legends of their own.

MATERIALS

- ❑ paper
- ❑ colored pencils or markers
- ❑ books listed below or other reference materials

BACKGROUND

Myths, legends, historical accounts, and storytelling have been a part of Native American life for centuries. Without established written languages, people remembered and recorded historical events and traditions through oral presentations. Legends often explain natural phenomena, how and why the world behaves as it does.

Books that relate Native American legends include: *The Wolf and the Raven. Totem Poles of Southeastern Alaska,* by Viola E. Garfield and Linn A. Forest, University of Washington Press, 1961; *Tlingit Tales, Potlach and Totem Poles*, by Lorie K. Harris. Naturegraph Publishers, 1985; and *Tlingit, Their Art, Culture and Legends,* by Dan and Nan Kaiper, Hancock House Publishers, 1981. *Northwest Coast Indians*, by Mira Bartók and Christine Ronan, GoodYear Books, 1993.

Inuit stories can also be found on the Internet, key words *inuit legends* and *inuit authors.* Learn about Inuit life at *http://siksik.learnnet.nt.ca/ Inuuqatigiit/titleopage.html* or about tradional Inuit whale hunting at *http://www.usask.ca/education/ideas/tplan/sslp/aborigin/trad.htm* Visit the Emily Ticasuk Ivanoff Brown Elementary School at North Pole Alaska at *http://www3.northstar.k12.ak.us/Schools/tic/tic.html*

ACTION

1. Divide students into groups of four or five and distribute reference materials.
2. Read selected legends and stories aloud to class or individually in groups.
3. As a class or in groups, discuss the following points. What parts do these legends have in common? Do they center around a theme or set of themes. For example, does a legend explain the creation of the earth, moon, or stars?
4. Ask student groups to create an original story outline. The outline should include a main character found in the Arctic, supporting character(s) (at least one), and action. Action could include a conflict and resolution plot or a problem-and-solution plot.
5. Students can present their outlines to the class. As an option, students could illustrate outlines with paintings or sketches. ***Scrimshaw Scribbles*** on page 12 would also supplement this activity.

Lemming Lowdown

OBJECTIVE

Students will chart and graph hypothetical population levels and predict the effect of lemming population increases and decreases on other animals.

MATERIALS

- ❑ copies of ***Lemming Lowdown*** funsheet on page 15
- ❑ pencils

BACKGROUND

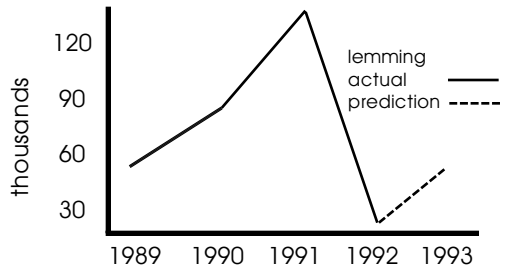
Arctic animal populations living on the tundra often follow multiyear cycles of repeated explosions and crashes in the numbers of individuals. Changes in the rates of reproduction and mortality cause these dramatic fluctuations. This is especially true of animals that rely on one major food source. Lemmings—small furry rodents that live underground and eat plant matter—follow such a cycle.

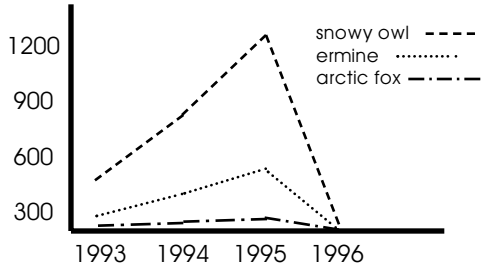
When food sources are plentiful, lemmings reproduce quickly. A female lemming can give birth to up to eight babies every five weeks. As the population grows, food becomes scarce and living spaces become crowded. Eventually, lemmings leave the area they are in and move to find a new one. Often thousands of lemmings migrate at the same time.

ACTION

1. Read **BACKGROUND** above, discuss food chains, food webs, and predator-prey relationships.
2. Copy and distribute ***Lemming Lowdown*** funsheet to individuals or student groups.
3. Have students plot data points on the graph provided.
4. Using these data points as a base, have students estimate the next four-year population cycle assuming that environmental conditions remain stable.
5. Have students estimate the population variations of predators that feed on lemmings, such as snowy owls, ermine, and arctic foxes.

ANSWER KEY



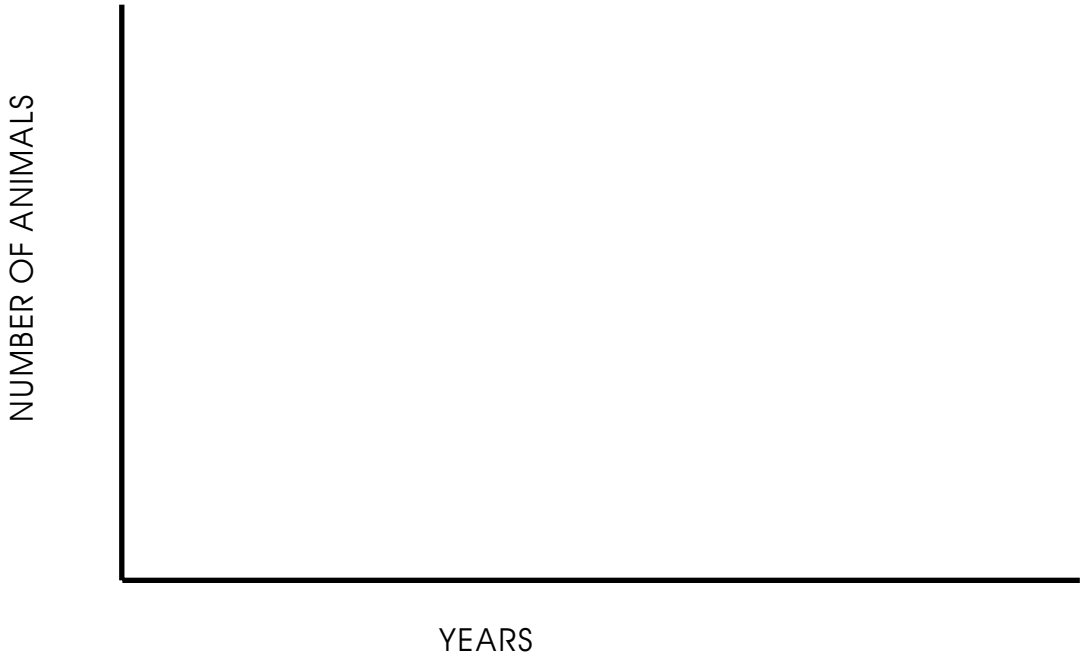


Lemming Lowdown

As a field biologist you have been studying lemmings along the tundra regions of Scandinavia and northwest Russia. You have spent the past five years with a small population that usually lives in a 100-acre area. Using various tagging techniques, you have been able to estimate the populations for the following past years. Here is your data:

year	estimated numbers
1989	50,000
1990	85,000
1991	134,000
1992	20,000

To continue your studies, you need to write a report predicting future population numbers through 1996. You also need to predict population numbers for animals that eat lemmings: the snowy owl, the ermine, and the arctic fox. About 1,000 lemmings will support four breeding pairs of snowy owls, 10 breeding pairs of ermine, and one breeding pair of arctic foxes. Use the chart below to fill in your graph. Add lines for snowy owls, ermine, and arctic foxes.



Compass Capers

OBJECTIVE

Students will build a simple compass and use it to find their way along a course.

MATERIALS

per student pair:

- ❑ large darning needle
- ❑ magnet
- ❑ masking tape
- ❑ small pan or saucer
- ❑ water
- ❑ sheet of 8-1/2" x 11" paper
- ❑ slice from bottle cork
- ❑ cookie sheet

BACKGROUND

Small, lightweight, and easy to use, the compass showed early explorers which direction was north regardless of harsh weather or terrain. The magnetic field of the earth aligns magnetized compass needles in a general north/south direction. Magnetic poles and geographic poles are not at the same places, though. And over time, magnetic poles move from place to place. Today the magnetic south pole centers around Hudson Bay, Canada, about 2,092 km (1, 300 mi.) from the geographic north pole. Old basalt rock rich in iron shows magnetic poles switching north and south during certain periods.

ACTION

1. Distribute materials and have students assemble on flat table or desk.
2. Magnetize the darning needle by sliding one end of the magnet along the needle in one direction at least ten times.
3. Tape the needle to the piece of cork.
4. Pour enough water in the pan or saucer to float the cork and needle.
5. Watch as the needle settles into a north/south direction. All the needles should point in the same direction.
6. When the needle has settled, have students mark north, south, east and west on the paper. *(Ask students in which direction the sun rises and sets.)*
7. Students can try the compass in the schoolyard. Have each pair sketch a map of schoolyard landmarks. Pairs hide an object in the schoolyard, noting directions on the map. Students then exchange maps and use the compass to find the hidden objects.

DEEPER DEPTHS

Given the materials above, have students create a compass without listening to verbal instructions or reading written directions.

Heat Keepers

OBJECTIVE

Students will investigate how the shape and volume of body forms affect heat loss.

MATERIALS

one per student:

- ❑ three cups hot oatmeal
- ❑ two thermometers
- ❑ shallow baking sheet or pan
- ❑ five 10" square sheets of wax paper
- ❑ measuring cup
- ❑ large spoon

BACKGROUND

In the arctic environment, temperatures often drop below -70°C (-94°F). Warm-blooded mammals have many ways of keeping warm. A larger body size and a smaller amount of surface area exposed to the cold is one way to conserve body heat. For example, the ear flaps of an arctic fox are much stubbier, shorter, and more rounded than the ears of a prairie-dwelling kit fox. When resting, small animals curl into a round ball, tucking feet and nose under fur.

ACTION

1. Place 1/2 cup of oatmeal each on two sheets of wax paper.
2. Quickly record the temperature of each lump. The temperatures should be similar.
3. Using the wax paper as a wrapping, shape one lump of oatmeal into a round shape. Use the large spoon to flatten the other lump out to about 1/2" thickness.
4. Record the temperatures of the oatmeal every minute. Which shape cools faster? Why? (*More surface area per volume dissipates heat faster.)*
5. Once oatmeal lumps cool to room temperature, begin another experiment using two new sheets of wax paper. Place one-half cup of oatmeal on one sheet and one cup of oatmeal on another.
6. Quickly record the temperatures of each lump. The temperatures should be similar.
7. Using the wax paper as a wrapping, shape both lumps of oatmeal into a ball. The one-cup lump will be larger.
8. Record the temperatures of the oatmeal every minute. Which shape cools faster? Why? (*Once again, more surface area per volume dissipates heat faster.)*
9. Using the results of this experiment, have students hypothesize the best body shape for a warm-blooded animal to conserve body heat in the cold Arctic. (*large and round*)

Hot Polar Debate

OBJECTIVE

Students will research available literature for factual information and logically argue a point of view. They will demonstrate real-life decision making processes and evaluate outcomes.

MATERIALS

- ❑ copy of player cards on page 19
- ❑ access to resource materials

BACKGROUND

Arctic land and the surrounding waters hold vast mineral resources—coal, natural gas, oil, gold, and stocks of fishes. During the past 40 years, humans have begun to mine, drill, and collect these resources for use in other areas of the country or world. With increased development comes the possibility of oil spills, pollution, excessive silting of rivers from mining, and the decrease of fish stocks. As the human population continues to grow, individuals must make wise decisions about how to conserve resources to gain the best long-term use.

ACTION

1. Divide students into four groups. Each group will represent a different faction in an environmental issue. The issue at hand is the wise use of natural resources.
   - Group One is the local townspeople.
   - Group Two is a team of conservation specialists who have been studying resource management.
   - Group Three is a group of industrialists who want to use the natural resources.
   - Group Four represents fishermen who use the area.
2. Copy and distribute the player cards to the student groups. Familiarize yourself with the scenario by reading all four player cards. Give the student groups time to familiarize themselves with the situation. Students can gather additional information from books, magazines, newspapers, and journals from special interest groups.
3. When all groups are ready, stage a town council meeting. Groups should choose one spokesperson to present group views. Mediate between the groups. At the end of the meeting, have townspeople vote on the appropriate action.
4. After the activity is over, discuss how conservation issues are complex problems that affect people as well as animals.

Polar Debate

Scenario: A small town of 500 people live along the Alaskan coast. The area is rich in oil and natural gas but not easily accessible. Removal of oil and gas will mean building roads and level work areas that would destroy many acres of wilderness. Some industries want to develop the area. The townspeople who own the land must decide what is best—to begin development or to find another source of revenue to help keep the town alive.

LOCAL TOWNSPEOPLE

You live in a small town of only 500 people. Most people earn a living by fishing inshore or hunting in the local mountains. Most young people who grow up here move to bigger cities to find jobs. Your town is slowly dying. Without another source of income, most people will move away in 20 years. You and your friends agree that you would like a better life.

Polar Debate Player Cards

CONSERVATION SPECIALISTS

You and your team have been studying the area for many years. You know the forests hold many different animals—deer, fox, bear—along with oil and gas deposits deep underground. You have been assigned to find alternative ways for the townspeople to find income. You want to find a balance between use of the natural resources and impact on environment. In general, you see industrialists as money grabbers who do not care about the environment or the townspeople. Your team has found out that the resources will be depleted in 20 years if development continues at its present pace. The ecological damage from mining and drilling will be expensive to fix.

Polar Debate Player Cards

INDUSTRIALISTS

Your company sees many opportunities to mine and drill for oil in the town's local mountains. Your field experts confirm that there are deposits of oil and natural gas, although they can not tell exactly how much. Your company is willing to begin development. If successful, the money generated from the oil sales will double the company's profit. Company employees also will earn big bonuses. To help convince townspeople, your company is willing to pay for a new indoor recreation center. The center will create 20 new jobs and allow high school athletes to train here instead of in the city. Your company will also pay the town $1,000 per acre for leasing the land.

Polar Debate Player Cards

FISHERMEN

You feel the town can make a turnaround with traditional activities. You feel fishing will improve in the coming years and more young people will stay to help fish. If the mining and drilling is conducted in the mountains, the rivers will carry more silt. The silt will clog the bay and fish will die.

Polar Debate Player Cards

Penguins in the Arctic?

OBJECTIVE

Students will understand the differences between the Arctic and the Antarctic and the animals that live in each habitat.

MATERIALS

one set per student pair:

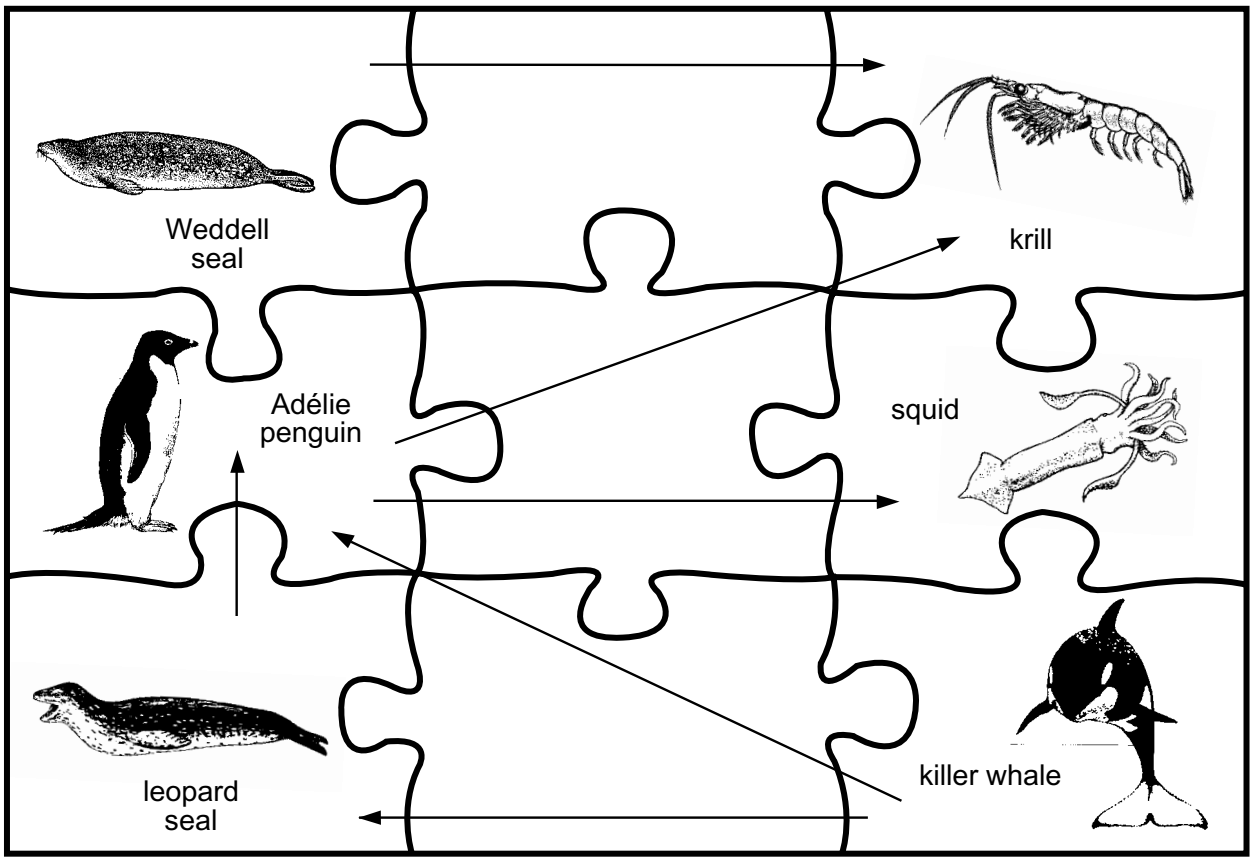
- ❑ copy of page 21 with puzzle pieces cut apart
- ❑ 8-1/2" x 11" construction paper, any color
- ❑ glue
- ❑ markers

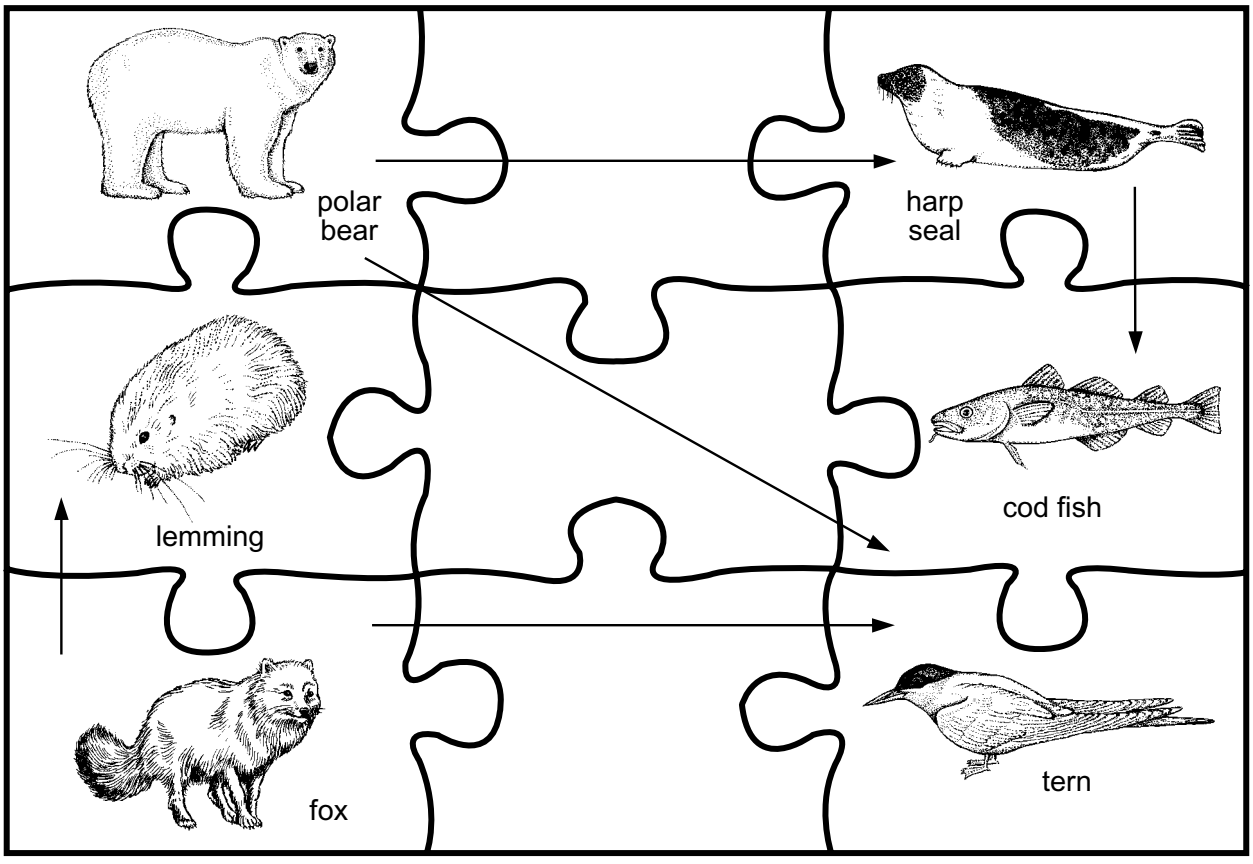
BACKGROUND

Although the Arctic and the Antarctic appear similar, these regions have very different characteristics. The Arctic is an ocean ringed with land masses while the Antarctic is a continent surrounded by the Southern Ocean. The Arctic has less severe winter temperatures— -70°C (-94°F) verses -88°C (-126 °F) in the Antarctic—and the land supports extensive plant life during the summer months. Large land predators such as polar bears, wolves, and foxes live on the tundra. The largest land animal in the Antarctic is a tiny insect.

ACTION

1. Using a large writing surface, draw two columns, one labeled Arctic and the other Antarctic.
2. Ask students to describe a few differences between these two places. These could be climate, human exploration, land area, ocean area, or others.
3. Divide students into pairs.
4. Distribute cut up puzzle pieces and construction paper.
5. Fold the construction paper in half along the width. Label the top half "Arctic" and the bottom "Antarctic."
6. Using only the puzzle pieces with animal images, ask students to hypothesize which animals live at which pole.
7. Students use the remaining puzzle pieces to create the correct food web. How many pairs of students guessed correctly?
8. Have students compare the animals that live in the Arctic and the Antarctic. Relate the prime differences discussed earlier in step 2 to characteristics of the animals that allow them to survive in one region but not another.
9. Based on the food webs created, have students infer why penguins would probably not survive in the Arctic. Why couldn't polar bears survive in the Antarctic?





Pack Your Sled for An Arctic Exploration

OBJECTIVE

Given limited resources and various methods of travel, students will chart a course across the Arctic.

MATERIALS

- ❑ copies of map on page 23, enlarged 130% on 11" x 17" paper
- ❑ ruler
- ❑ pencils
- ❑ reference books on arctic explorers such as Frederick A. Cook, Sir Hubert Wilkins, Robert E. Peary, Matthew Henson, or Will Steger

BACKGROUND

Early arctic explorers needed to plan carefully in order to survive harsh environmental conditions. Even with modern communication and travel technologies, arctic explorers today must also plan carefully. Food shortages, broken gear, and worn shelter can all bring disaster to an expedition.

Modern-day arctic explorers include Will Steger and the International Arctic Project. The research team traveled from the Russian arctic island of Severnaya Zemlya in March, 1995, to Resolute, Canada, in July, 1995. A daily journal of the trip is available on the Internet. Find *http://ics.soe.umich.edu/ed712/IAPProfile.html*

ACTION

1. Discuss as a class the expeditions of early explorers. What were the hardships? In what ways is exploration easier today?
2. Discuss specific items people would need to survive. List items on the board. Weight is very important when traveling by sled, boat, or plane. Can students approximate the weights of the items listed?
3. Divide students into working groups. Distribute the enlarged copy of the map. NOTE: The map scale applies only when page is enlarged 130%.
4. Have students choose starting and ending destinations. Also choose supplies and methods of transportation from the list below. (Speeds estimated for best travel conditions.)
   - canoe-sled holds 454 kg (1,000 lb.) and travels 48 km (30 mi.) a day.
   - Twin Otter plane holds 3,178 kg (7,000 lb.) and cruises at 370 km/hr. (230 mi./hr.)
   - dog sled holds 545 kg (1,200 lb.) and travels 40.2 km (25 mi.) per day
   - skiers can pull 45.4 kg (100 lb.) and travel 16 km (10 mi.) per day
   - hikers can carry 22.7 kg (50 lb.) and travel 9.6 km (6 mi.) per day
5. Use the map to chart a course. Student groups can present results to class.

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*Books available through the SeaWorld Adventure Park nearest you. Videotapes available through SeaWorld San Diego. Call for prices.

Note: Contact the SeaWorld park nearest you for a free comprehensive marinelife bibliography.