Arctic Animals

K–3 Teacher's Guide

A SEAWORLD EDUCATION DEPARTMENT PUBLICATION

CONTENTS

To the Teacher

The ***Arctic Animals*** Teacher's Guide for grades K–3 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. Find the Arctic Circle on a map or globe.
2. Name two countries and the ocean that lie within the Arctic Circle.
3. Describe two physical characteristics of the arctic environment.
4. Place three arctic animals in their habitat.
5. List two 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 above 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.

camouflage — coloration that allows an animal or other organism to blend in with the surrounding environment.

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

food chain — a 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 results when a person's or an animal's body temperature falls below normal.

ice floe — a flat expanse of floating ice.

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.

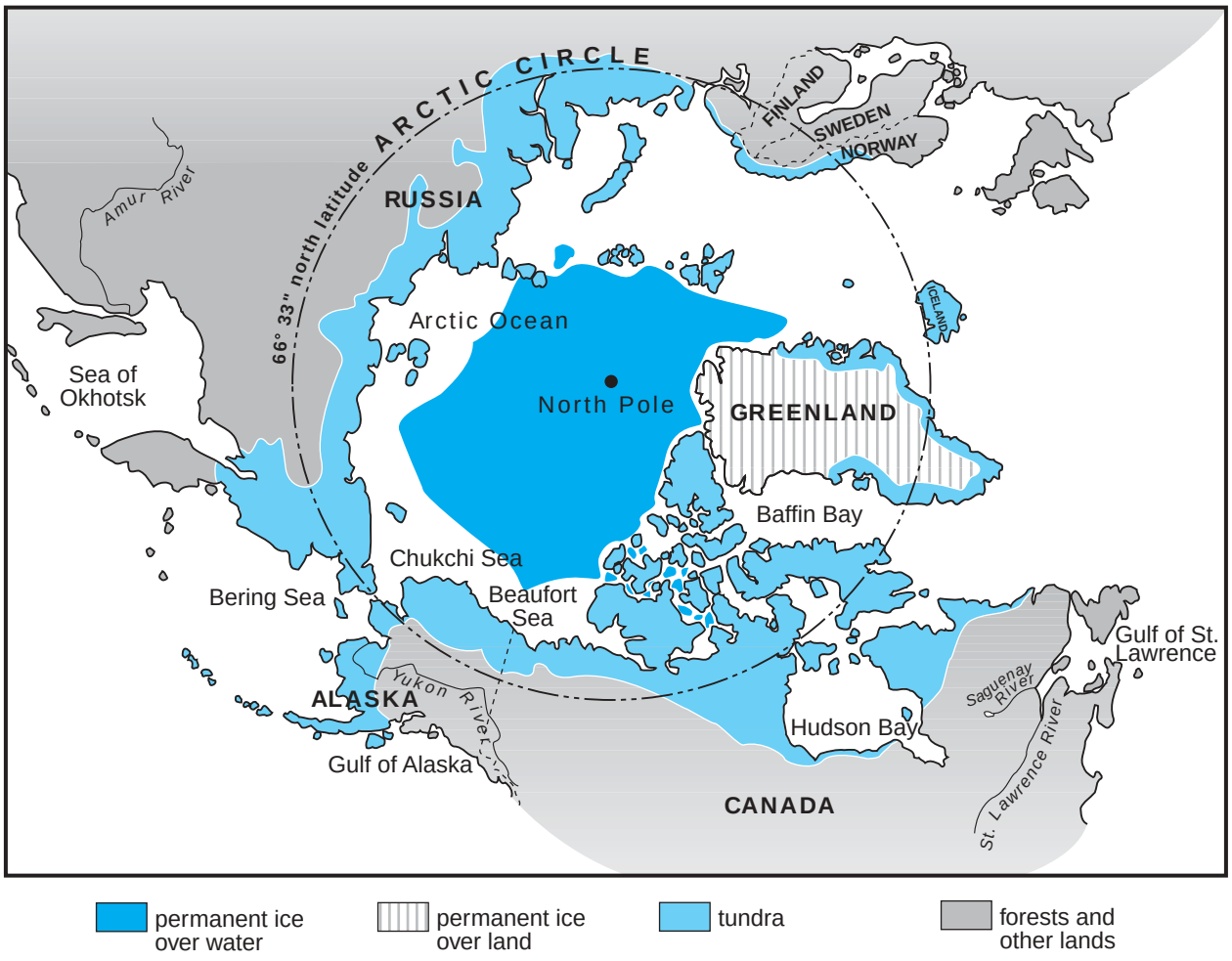
prey — an animal eaten by another animal.

predator — an animal that eats another animal.

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 10°C (50°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 of southern Alaska slowly moves down the mountainside, releasing decades-old ice and snow 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 diet of people 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.

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 outside 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.

- ❑ Learn all you can about the Arctic. The more you know, the better you can help.
- ❑ Support other people who work to protect the Arctic. These are two organizations to consider supporting:
  - American Zoo and Aquarium Assn., 7970–D Old Georgetown Road, Bethesda, MD 20814
  - Hubbs-SeaWorld Research Institute (H-SWRI), 2595 Ingraham, San Diego, CA 92109
- ❑ 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 in cars and for heating and cooling.
  - Support legislation that helps the environment locally and globally.
  - Refuse to 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

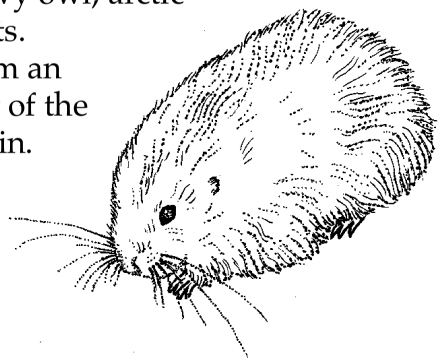
Dicrostonyx torquatus

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 fox, snowy owl, arctic skua, and stoats. Lemmings form an important part of the arctic food chain.



Atlantic puffin

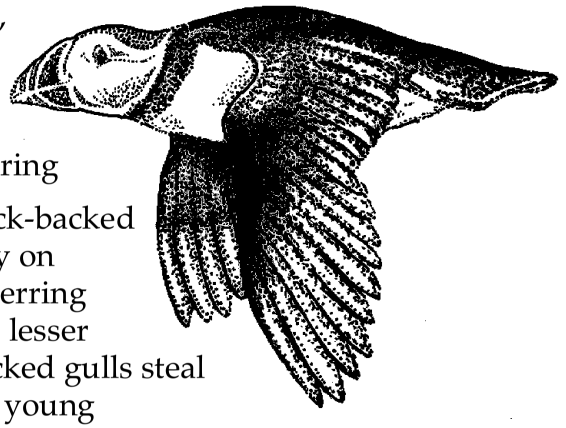
Fratercula arctica

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

distribution: North Atlantic Ocean

prey: small fishes; including sand eels, 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

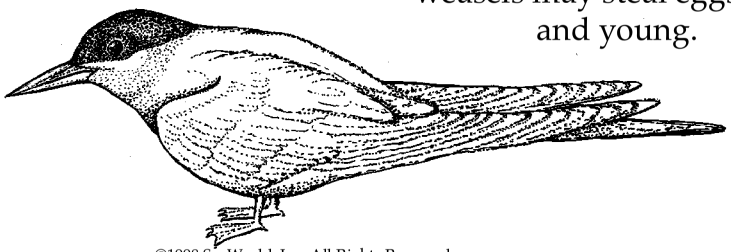
Sterna paradisaea

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.

prey: small fishes, molluscs, and pelagic crustaceans

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



greenland shark

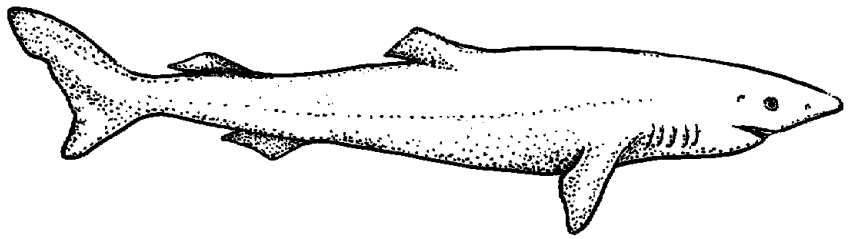
Somniosus microcephalus

size: more than 4 m (13.1 ft.)

distribution: North Atlantic and Arctic Oceans

prey: 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

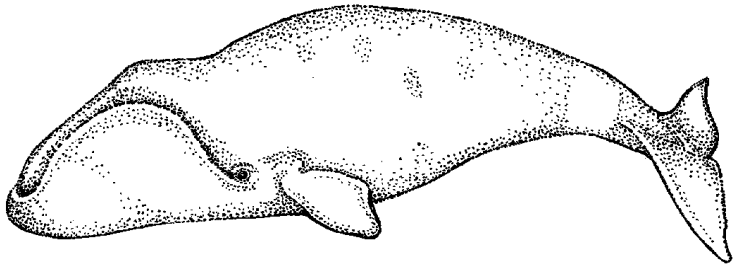
Balaenea mysticetus

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

prey: mostly planktonic swarms of krill and other small crustaceans

predators: none, but hunted by humans



harp seal

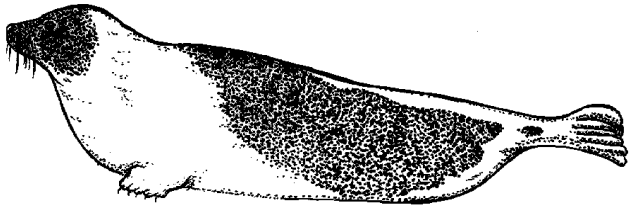
Phoca groenlandica

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

prey: 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

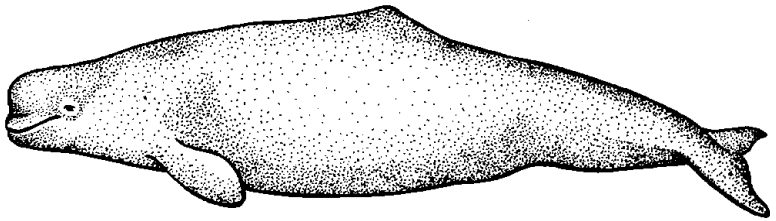
Delphinapterus leucas

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

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

predators: killer whales and polar bears



ringed seal

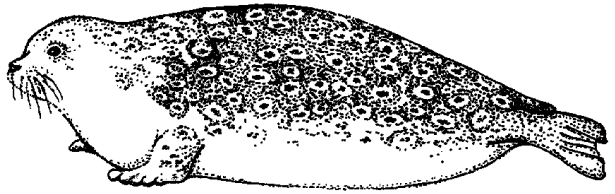
Phoca hispida

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.

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

predators: polar bears and killer whales



Atlantic cod

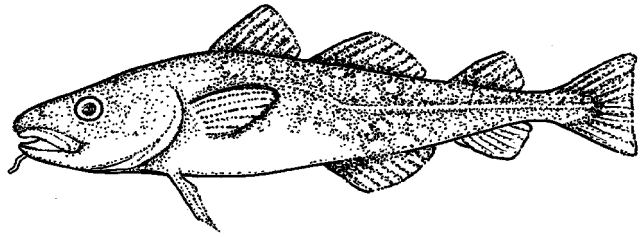
Gadus morhua

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

distribution: Arctic Ocean south to Virginia

prey: molluscs, crustaceans, bottom plants

predators: fishes, whales, seals



polar bear

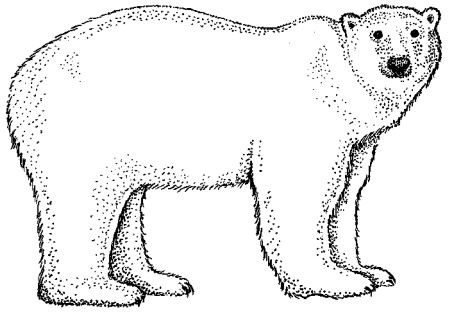
Ursus maritimus

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

prey: mostly ringed and bearded seals, also harp and hooded seals and the carcasses of beluga whales, walruses, narwhals, and bowhead whales

predators: none



narwhal

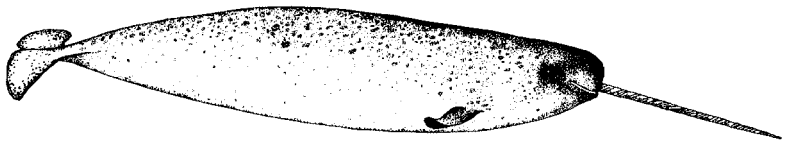
Monodon monoceros

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

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

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



walrus

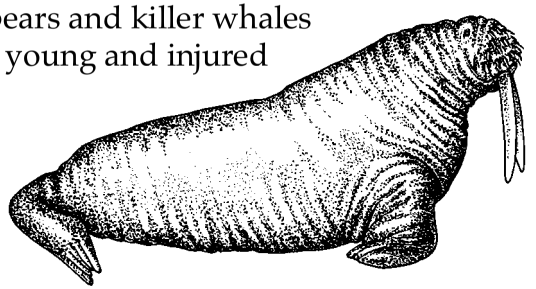
Odobenus rosmarus

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

prey: molluscs, mainly bivalves such as clams

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



Polar Caps

OBJECTIVE

Students will identify the ocean and countries of the arctic region.

MATERIALS

- ❑ atlas, globe, or map showing the Arctic
- ❑ color pencils or markers
- ❑ glue

one set per student:

- ❑ 9" paper plate
- ❑ two 8" yarn strings
- ❑ copy of map on page 11

BACKGROUND

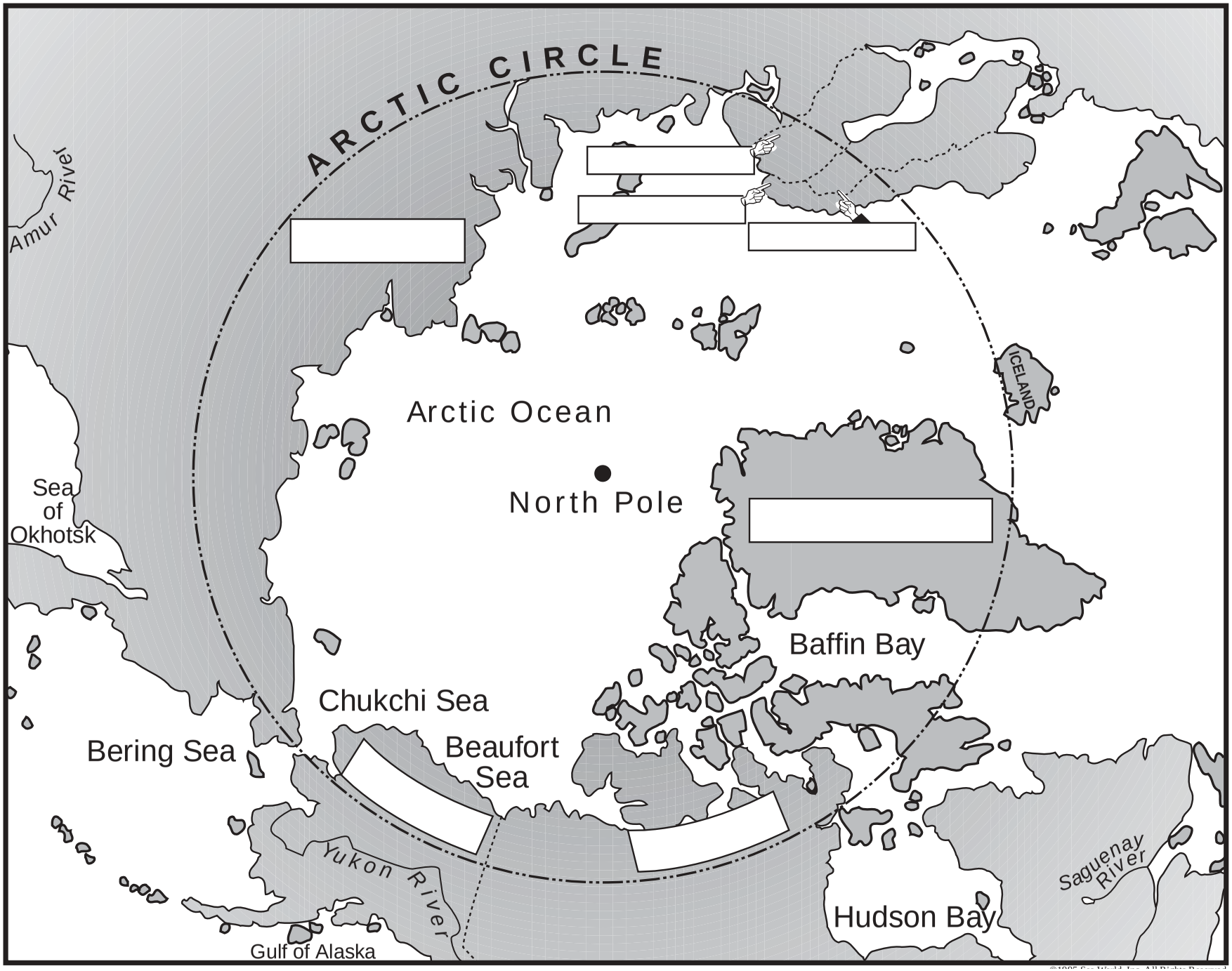
The Arctic lies at the top of the world and includes the North Pole. Scientists use the 66° 33" north latitude line to define the Arctic Circle. The Arctic region includes seven countries—Canada, Finland, Greenland, Norway, Sweden, Russia, and the United States. The North Pole sits on permanently frozen ocean water, not on land. In fact, more than half the "land" of the Arctic is frozen ice moving across the surface of the Arctic Ocean.

ACTION

1. Distribute colored pencils or markers and copies of the map on page 11.
2. Using the atlas or map of the Arctic, have students write the names of the countries within the Arctic Circle. Teachers of younger students may want to prewrite the names and have students trace letters.
3. Have students identify and color the Arctic Ocean blue. Color each country a different color.
4. Students cut out their colored maps. They glue them on the bottom of a paper plate.
5. Punch a hole on opposite sides of the paper plate rim. Have students thread yarn through holes and tie.
6. Students can now put on their polar caps. You may want to take your caps for a walk. Try this song (to the tune of the "Military March") and these hand motions (in italics) as you parade around the room:

Look at my polar cap on my head.
(POINT TO TOP OF HEAD.)
It's the Arctic, so it's said.
(WAG FINGER.)
Land of ice and rain and snow.
(SHIVER.)
Let's name the animals that we know.

Beluga whales swim in the sea.
(SWIM.)
Puffins fly on the breeze. *(FLY.)*
Polar bears prowl on the land.
(CRAWL.)
And walruses wallow in the sand.
(WIGGLE ON THE FLOOR.)



Seal Scientist

OBJECTIVE

Students will review their knowledge of time and clocks during imaginary seal watching.

BACKGROUND

Scientists in the Arctic study a seal's breathing pattern by waiting on the ice beside a seal's "breathing hole." This is the place where seals come up to the surface to take a breath of air. Often the hole is no larger than the size of a seal's neck.

MATERIALS

- ❑ ***Diving Time*** funsheet on page 13
- ❑ clock teaching tool with movable arms (available at most education supply stores)
- ❑ 3" x 5" cards with one of the following written on each: 9 a.m., 9:10 a.m., 9:25 a.m., and 10:44 a.m.
- ❑ pencils
- ❑ enlarged image of the ringed seal animal card on page 8 or color photo of a ringed seal from book or magazine. *National Geographic* 189 (1), July 1991, p. 30 has one.

ACTION

1. Copy and distribute the ***Diving Time*** funsheet and pencils to students.
2. For reading students: Choose one to four students to read the story at the top of the page. As times are read, have students pick out the correct time on the 3" x 5" card. Discuss any question students might have about the story.

   For non-reading students: Read the story to them as they follow along on their paper. As a time is read, ask students to pick the card with the correct time. Or show the time on the clock teaching tool.
3. Ask students to answer questions. Students can write answers on the board and tell how they found the answer. Younger students can move the hands on the clock teaching tool and count minutes. Students copy answers on their worksheets.
4. After answering questions, ask students to make believe they are scientists. What will happen in the afternoon? Students can also draw a picture of themselves and the seal at the research camp.

DEEPER DEPTHS

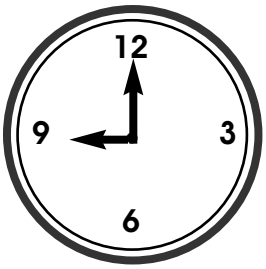
Watch a dog or cat or any other animal's movements. Have students draw or write what they see. Can students determine a pattern? Share the results with the class.

Seal Scientist

My Day on the Ice

It was May 1 and the weather was mild, a warm 1.6°C (35°F). I picked up my folding chair and walked a short distance from the research camp onto the ice. I looked at my watch. It was 9 a.m. I began my study of seals.

As I walked toward the hole in the ice, a ringed seal rolled over and slipped into the water. I set up my chair, sat down, and waited quietly. At 9:10 a.m. the seal peeked through the hole to look at me, but slipped back into the water. I picked up my chair and moved back. At 9:25 a.m. the seal came out onto the ice. It stayed on the ice until 10:44 a.m. Then it dove and stayed under water for 10 minutes. The next time I saw the seal, it took a quick breath and dove again. My watch showed 10:55 a.m. I was getting cold. I walked back to the research camp for a hot chocolate.



Questions

What time did you start your study? _____ a.m.

What time did you end your study? _____a.m.

How long did you stay to study the seal? _____ minutes (_____ hrs. _____ min.)

How long did the seal stay under water the first time? _____ minutes

How long did the seal stay under water the second time? _____ minutes

How long did the seal stay under water the third time? _____ minutes

How long did the seal stay under water during the study time? _____ minutes

How long did the seal stay on top of the ice during the study time? _____ minutes

Polar Explorer Relays

OBJECTIVE

Students will discover some of the necessary equipment a polar explorer uses on an expedition to the Arctic.

BACKGROUND

To survive in the harsh cold of the arctic environment, polar explorers need warm clothes, water, a nutritious diet, and emergency first aid for frostbite and *hypothermia*. Being properly equipped and prepared for all weather conditions can mean the difference between survival or injury and death.

MATERIALS

- ❑ four orange safety cones

two of each:

- ❑ winter knit hat
- ❑ ski goggles
- ❑ snow jacket
- ❑ pair of snow boots
- ❑ scarf
- ❑ water bottle
- ❑ lunch box
- ❑ pair of mittens
- ❑ compass
- ❑ backpack
- ❑ first aid kit (bandages)
- ❑ map

ACTION

1. Divide students into two teams.
2. Set safety cones at least 9 m (30 ft.) apart from each other to designate two end lines.
3. Have each team stand in a line (single file) behind a safety cone on the same side.
4. Near the opposite pylon, line up gear in the following order: hat, goggles, scarf, jacket, mittens, backpack, water bottle, lunch box, compass, map, first aid kit, boots. Each line of gear should have one of these items.
5. Tell students this game is a relay race. The object is to put on or carry all the gear past the finish line.
6. At GO!, each first student runs to the opposite cone, puts on the hat, runs back, and gives the hat to the next person in the team line. The next team member puts on the hat, runs to the equipment line at the opposite cone, puts on the goggles, runs back to the team, and gives both the hat and goggles to the next team member. The relay race continues until the last player in one of the lines is wearing all the items, and crosses the finish line to win.
7. Work with students to create a list of other items an arctic explorer would need on a trip to the North Pole.

Fresh Floats

OBJECTIVE

Students will investigate the densities of fresh water and salt water and will observe how fresh water floats on top of salt water.

MATERIALS

one set per student group:

- ❑ one 2-liter plastic soda bottle, cut in half, or a clear plastic tub
- ❑ one 2-oz. food jar (like those for pimentos or baby food)
- ❑ salt
- ❑ water
- ❑ blue food coloring
- ❑ 4" x 6" sheet of plastic wrap

BACKGROUND

The movement of water in the ocean is not only driven by winds and the turn of the earth, but also by masses of cold, salty water formed at the poles that sink to the ocean floor. As sea water freezes in the Arctic, the salt is "squeezed out." The newly frozen *ice floe* is mostly fresh water that floats. The ocean water beneath the ice floe has become slightly saltier and more dense. This heavier water sinks to the ocean floor and flows to the equator. As this water slowly sinks, other surface water replaces it. The cycle repeats itself as more surface water freezes. Fresh water returns to the ocean as ice floes melt or rain falls.

ACTION

1. Fill the bottom half of the plastic soda bottle with water. Fill the 2-oz. food jar with water.
2. Add about 2 tablespoons of salt to the water in the plastic soda bottle.
3. Add 4 drops of blue food coloring to the water in the 2-oz. food jar.
4. Carefully place plastic wrap over top of food jar.
5. Holding the plastic wrap and the top of the jar, carefully lower the food jar into salty water in the soda bottle. Once the jar is settled on the bottom, slowly lift the plastic wrap off. The fresh blue water should rise to float on top of the salty water.

DEEPER DEPTHS

Students may want to try this experiment with variations. Try water of different temperatures, water with more or less salt, water in the bottle and jar that is both fresh or both salt, or ice colored with blue food coloring.

Pop-up Seal Pup

OBJECTIVE

Students will learn that ringed seals dig lairs under the snow as a place to give birth to their young.

BACKGROUND

To help protect their young from cold weather and predators, ringed seals build lairs under snow drifts. Female ringed seals give birth in March or April, usually to one pup. The pup stays in the lair for about six weeks, drinking mother's milk and growing stronger. The pup lives on its own after about two months; able to swim and catch small fish.

MATERIALS

one set per student:

- ❑ 6" x 8" white construction paper
- ❑ one white cotton ball
- ❑ one cotton swab
- ❑ 8-1/2" x 11" photocopier paper

for group:

- ❑ colored chalk
- ❑ glue
- ❑ staplers
- ❑ black paint

ACTION

1. Distribute a sheet of white construction paper to each student. Have students fold paper in half so that the two short ends meet. Staple it together on the sides. Leave the end opposite the fold open.
2. Have students rip small semi-circle pieces off the top one half inch of their papers (open end) to give the effect of snow drifts. Students may rip one layer at a time. Save paper scraps.
3. Have students tear a small door in the top paper layer, close to the fold, so that the door swings open and shut. This will expose the lair.
4. To make more snow drift images, tear a "wave" pattern along an edge of the photocopy paper. Lay the torn paper pattern on top of the white construction paper. Rub the flat side of the chalk over the paper-edge pattern so that the reverse image shows on the construction paper. Move the torn photocopy paper as needed to create overlapping snow drifts.
5. Place three or four staples around the lair opening (be careful not to staple door shut). Use scraps of paper to stuff the insides of the construction paper envelope. Staple top shut.
6. Distribute swabs, cotton balls, and paint. Glue cotton ball in lair opening. Dip swab into paint and touch to cotton ball to make eyes and nose.

Snow Talking

OBJECTIVE

Students will learn how different cultures view their world and name what they see.

MATERIALS

- ❑ picture book of Inuits or other polar peoples (see Bibliography on page 24)
- ❑ pencils
- ❑ writing paper
- ❑ crayons, markers

BACKGROUND

Most Inuits live in a world covered with ice and snow for at least nine months a year. The English language has only a few words like powder and slush for different kinds of snow. The Inuit language has 14 different words. Each word describes a form of snow or snow object. Distinguishing different kinds of snow is important for traveling, for hunting animals, and for building shelters.

snow that is spread out—*aput*
snow block for building—*auverk*
drifting snow—*perksertok*
first snow fall—*apingaut*
snow for melting into water—*aniuk, anio*
snow that is hard—*sitidlorak*
snow house—*iglu*
snow like salt—*pokaktok*
snow mixed with water—*massak*
newly drifted snow—*akelrorak*
snow on clothes and boots—*ayak*
snow is soft—*mauyak*
it snows—*kannertok*
snow knife—*panar*

ACTION

1. Talk with students about different words they use in their home. Some families call a sofa a couch. Or a bathroom a lavatory. Introduce Inuits and where they live. Discuss how important snow must be to them.
2. Use the words above to write or tell a story of an Inuit's day. What kind of snow would an Inuit melt to get a drink of water? What kind would he use to build a shelter? What kind would she brush off her clothes?
3. Have students draw a picture of their story.

Dog sleds often run best on sitidlorak or snow that is hard.

Ice Power

OBJECTIVE

Students will investigate how ice expands when freezing and how powerful that expansion can be.

MATERIALS

- ❑ three plastic drinking glasses
- ❑ plastic container with a wide mouth
- ❑ stiff plastic sheet to cover the mouth of the container
- ❑ various objects of known weight
- ❑ water
- ❑ freezer

BACKGROUND

As water freezes, the molecules move from a free-form flowing structure to a static lattice structure. The lattice structure takes up more space, so water expands as it changes from a liquid to a solid. Under laboratory conditions at a temperature of -22°C (-7.6°F), the pressure of freezing and expanding water is about 55 tons per square foot. This is enough pressure to burst the water pipes typically found in many family homes.

ACTION

1. Fill the plastic glasses to the rim with water. Ask students to predict what will happen when the water freezes.
2. Freeze the water in the plastic glasses overnight and examine the next day. Did the water expand? Are there differences in the way water froze in the three glasses?
3. Now fill the container to the rim with water. Place the plastic sheet over the mouth of the plastic container. Ask students to predict how much weight will be needed to keep the frozen water from expanding out of the container's mouth. Have students add that weight to the top of the container.
4. Freeze water in the plastic container overnight. Did the students predict the weight on top of the container correctly? If not, try experiment again with students predicting again.

DEEPER DEPTHS

Different liquids have different freezing temperatures. Try freezing a variety of liquids. Use orange juice to make popsicles. Or try oil or very salty water. Do these make popsicles too? You might also want to try inedible items such as rubbing alcohol and glycerin. Ask students if they know how antifreeze works in a car radiator.

The Hold of the Cold

OBJECTIVE

Students will investigate the effects of temperature on growing plants.

MATERIALS

- ❑ 10 dried lima bean seeds
- ❑ paper towels
- ❑ two plastic bags
- ❑ water
- ❑ refrigerator

BACKGROUND

In the Arctic, temperatures often drop below 0°C (32°F), and cold winds lower surface temperatures even more. Many plants have only three months to sprout, grow, and produce seeds for the next summer. Timing is critical. Often, plants that sprout early die because of cold spring weather.

ACTION

1. Have students predict what will happen to the growing beans if one set of five is sprouted in the warm room and another set of five is sprouted in the refrigerator. (Students may want to sprout beans inside a cabinet to eliminate the effect of light.)
2. Assemble the two sprouting packages in exactly the same way. Dampen two or three paper towels, place five beans in paper towels, wrap loosely, and slip into one plastic bag.
3. Put one sprouting package in the refrigerator and another somewhere in the classroom or inside a cabinet.
4. Check the sprouting packages each day. Record the growth of the beans by writing a descriptive paragraph or drawing pictures. Discuss results after five or six days. Students may want to plant sprouted beans and grow plants in the classroom window sill. Is there a difference in growth rate now too?

DEEPER DEPTHS

Ask students if they think some plants are adapted to sprout in colder weather. Discuss which plants grow first in spring. What plants grow later? Repeat the experiment again using the seeds of early growing and late growing plants. Do some sprout better than others?

What's for Dinner?

OBJECTIVE

Students will gain an understanding of animal interaction and the role of camouflage in the dynamics of an ecosystem.

BACKGROUND

Many animals in the Arctic change color with the seasons. Arctic foxes, weasel-like stoats, snowshoe hares, and ptarmigans change the color of their fur or feathers from brown in the summer to white in the winter. This *camouflage* helps them hide from *predators* and sneak up on *prey*. In winter, white colors blend in with the snow while in the summer dark colors blend with rocks and soil.

MATERIALS

- ❑ 3" pieces of yarn in five colors: brown, red, green, blue, and white; 30 pieces each
- ❑ four orange safety cones
- ❑ copies of ***What's for Dinner?*** funsheet on page 21
- ❑ books and magazines showing pictures of animal camouflage
- ❑ stop watch
- ❑ pencils

ACTION

1. Mark a clear area of carpet or grass with safety cones, at least 6 m (20 ft.) square.
2. Divide students into four groups. Ask students to choose partners within their group. Students can name their group after an arctic animal.
3. While students aren't watching, distribute the pieces of yarn evenly inside the area marked by the safety cones.
4. Have students gather around the outside of the marked area and discuss the difference in colors. Can they spot some colors easier than others?
5. Explain that they are hungry animals, and the yarn is food. Each group will hunt separately (group 1 to go first). Group partners need to decide who will hunt and who will stay home to hold the food.
6. Hunters have 30 seconds to pick up yarn pieces one at a time. Hunters must bring a yarn piece back home before hunting another one.
7. After each group hunts, record the color and number of yarn pieces on the ***What's for Dinner?*** funsheet.
8. At the end of a session, compare colors and numbers among the four groups. Did some colors get eaten before others? Did other colors not get caught? Did group 1 gather more food than group 4?

What's for Dinner?

color	group 1	group 2	group 3	group 4
brown				
red				
green				
blue				
white				

Web Connection

OBJECTIVE

Students will learn how animals are interconnected with the arctic ecosystem and how humans impact these interrelationships.

MATERIALS

- ❑ colored markers or crayons
- ❑ yarn
- ❑ copies of animal cards on pages 7 to 9
- ❑ copies of illustrations on page 23

BACKGROUND

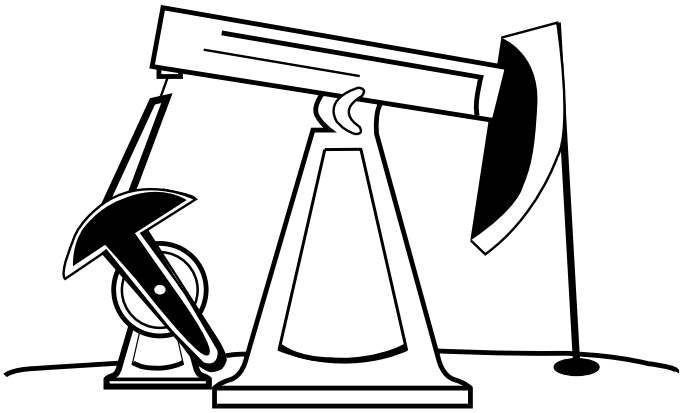
Wherever animals live, they depend on either plants or other animals for food. One way of showing the connection between animals is by diagraming a *food chain* or a *food web*. An arctic food chain might include a harp seal that eats a cod. In turn, a polar bear might eat the harp seal. A food web might also include a polar bear, but the diagram shows many prey items—harp seals, ringed seals, bearded seals. The food web would also expand to show prey items for all the seals. A food web weaves together many straight line food chains.

ACTION

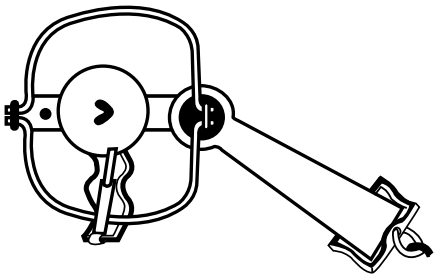
1. Ask students to name some animals that they know live in the Arctic. As they suggest names, either show animal cards or pictures from magazines.
2. Once you have about 10 animals, ask students who eats what. Try to arrange animals on the floor or a table so students can see the connections (older students may work in groups to do this).
3. Once you get the connections defined, paste or staple images on a bulletin board. Have students tie or tape yarn to show which animal eats what prey. Some animals have more than one prey item.
4. Use the images on page 23 to introduce humans. What do we eat or harvest? How do we fit into the ecosystem?

DEEPER DEPTHS

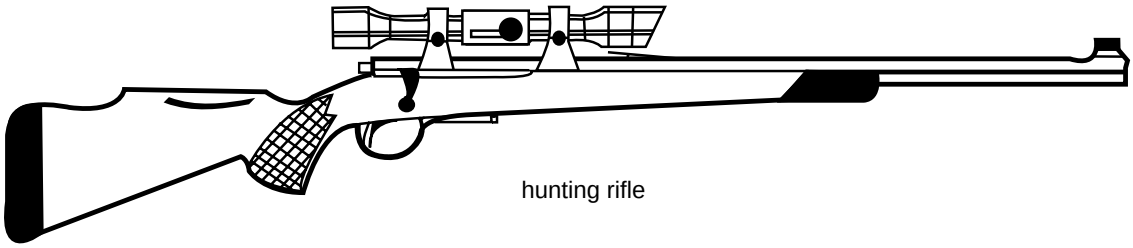
Older students may want to do poster reports on how humans use the Arctic. Reports could focus on fishing, raising caribou, mining, or hunting wildlife.



oil rig

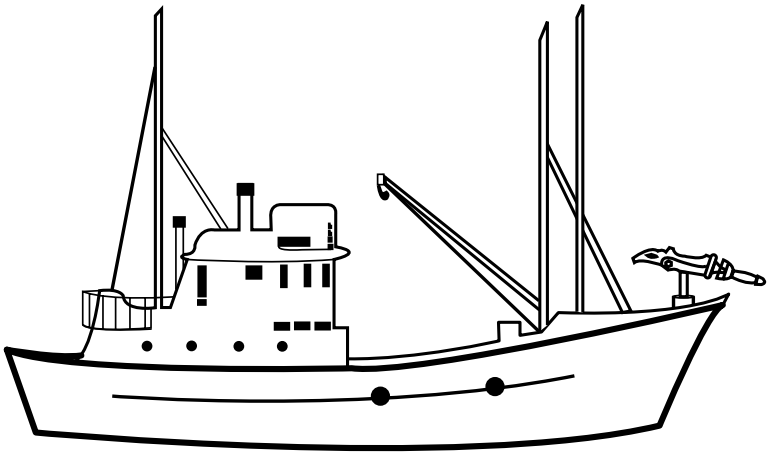


steel spring trap

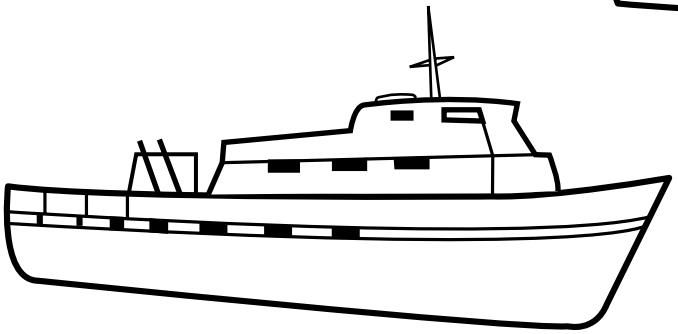


hunting rifle

trash pile



whaling boat



fishing boat

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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.