

Biomes: Wild Arctic: Teacher's Guide

Grade Level: 6-8

Curriculum Focus: Ecology

Lesson Duration: Two to three class periods

Program Description

Explore the close relationship the creatures of the Arctic have with their fragile ecosystem. Students take an in-depth look at how the region's whales, seals, birds, and bears are threatened by climate changes happening around them. They'll also see how these animals may be sounding an early warning of things to come for the entire global environment. This program has one feature segment.

Onscreen Questions

- What life forms make up the Arctic food web?
 - Why do small changes in temperature cause big problems for Arctic species?
 - What is a key species?
 - Why is the Arctic less resilient to change than other environments?
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Lesson Plan

Student Objectives

- Learn key terms, including food web, zooplankton, and sea ice.
- Discuss Arctic plants and animals.
- Devise at least three Arctic food chains.
- Help create a food web showing connections among Arctic life..

Materials

- *Biomes: Wild Arctic* video and VCR, or DVD and DVD player
 - Computer with Internet access
- Paper and pencil

Procedures

1. After watching *Biomes: Wild Arctic*, ask students to define the following terms:
 - **Arctic** (region around the North Pole, including the Arctic Ocean and parts of North America, Asia, and Europe)
 - **food chain** (hierarchy of organisms where each member eats the one below it)
 - **food web** (the connected food chains within an ecological community)
 - **phytoplankton** (microscopic single-celled plants that float in the ocean)
 - **zooplankton** (microscopic animals that float in the ocean, including single-celled animals and tiny crustaceans such as copepods)
 - **sea ice** (a layer of ice formed from seawater; it changes with seasons and floats on the ocean, carried by winds and currents)
2. Ask students to describe how muskoxen, slugs, and the lungworm parasite make up a food chain. (The parasite lives in the slug. When the muskoxen eat grass, they also eat the slugs living in it.) How does this food chain endanger the muskoxen? (The lungworm gets passed to the muskoxen, infecting them.)
3. Tell students that they will examine different food chains that make up the Arctic food web. Ask them to consider the organisms featured in the program. Write their answers on the board, and make sure the list includes the following:
 - phytoplankton
 - algae
 - seabirds
 - thick-billed murre
 - narwhal
 - beluga
 - polar bear
 - zooplankton
 - ringed seal
 - arctic tern
 - arctic cod
 - walrus
 - bowhead whale
 - caribou Stories
4. Ask students to name the organism that makes up the foundation of the Arctic food web. (phytoplankton) Next, tell them that, working with a partner, they will devise at least three food chains from the list above. Each food chain should include at least three organisms and show direct links only, each organism to be followed by its predator.

(Arctic cod → ringed seal → polar bear)
5. Students may refer to the program or find information about Arctic wildlife at the following sites:

Canada's Arctic: Animals

- <http://www.arctic.uoguelph.ca/cpl/organisms/birds/marine/puffins/thickbilled.htm>
- <http://www.arctic.uoguelph.ca/cpl/organisms/birds/marine/gulls/arcticTern.htm>
- <http://www.arctic.uoguelph.ca/cpl/organisms/fish/marine/gadidae/arctic.htm>



- <http://www.arctic.uoguelph.ca/cpl/organisms/mammals/Terrestrial/caribou.htm>
- <http://www.arctic.uoguelph.ca/cpl/organisms/mammals/Marine/walrus.htm>
- <http://www.arctic.uoguelph.ca/cpl/organisms/mammals/Terrestrial/polarbear.htm>
- <http://www.arctic.uoguelph.ca/cpl/organisms/mammals/Marine/ringed.htm>
- <http://www.arctic.uoguelph.ca/cpl/organisms/mammals/Marine/bowhead.htm>
- <http://www.arctic.uoguelph.ca/cpl/organisms/mammals/Marine/beluga.htm>
- <http://www.arctic.uoguelph.ca/cpl/organisms/mammals/Marine/narwhal.htm>

Arctic Mission: Wildlife Articles

- http://www.nfb.ca/sedna/arcticmission/ma_ressources/sc_faune.html

Arctic Wildlife

- <http://www.mnh.si.edu/arctic/html/wildlife.html>

Bering Land Bridge National Preserve (National Park Service)

- <http://www.nps.gov/bela/html/plantani.htm>

Animal Info Books (Beluga Whale, Polar Bear, Walrus)

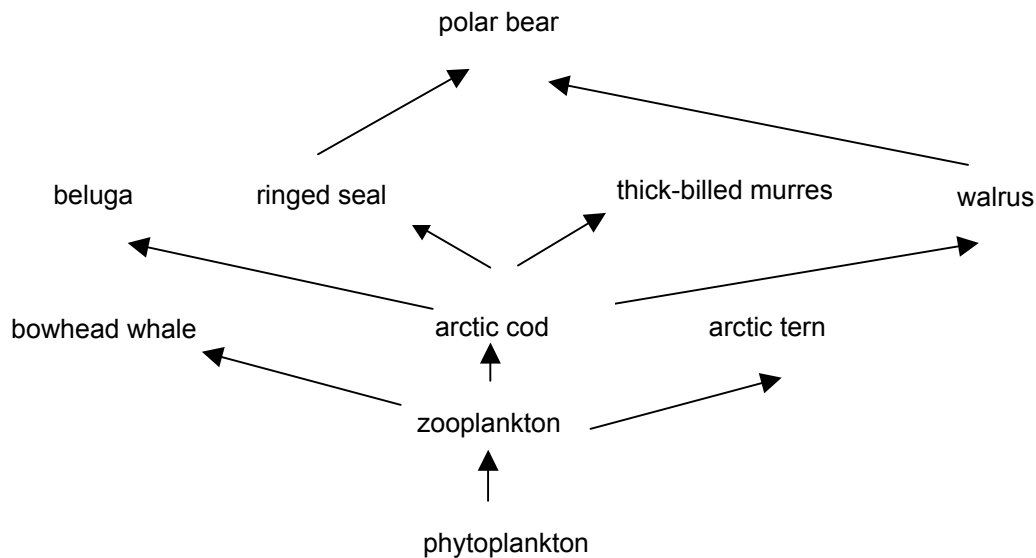
- <http://www.seaworld.org/animal-info/info-books/index.htm>

Enchanted Learning: Arctic Animals (for younger students)

- <http://www.EnchantedLearning.com/coloring/arcticanimals.shtml>

- When students have completed their food chains, explain that they will share their food chains to create a food web that shows connections among Arctic organisms. Examples follow:
 - phytoplankton → zooplankton → arctic cod
 - phytoplankton → zooplankton → bowhead whale
 - arctic cod → ringed seal (or walrus) → polar bear
 - clams (or crabs) → walrus → polar bear
 - phytoplankton → zooplankton → bowhead whale
 - zooplankton (copepods) → arctic cod → ringed seal (or seabird, narwhal, beluga whale)
 - zooplankton → arctic cod → thick-billed murres
 - phytoplankton → zooplankton → arctic tern
 - algae → copepods → arctic cod
- To create the food web, write “phytoplankton” on the bottom of the classroom board. Ask students to share food chains that include phytoplankton. Write the name of the organism that eats phytoplankton above it on the food chain. Above that organism, write the name of the organism that eats it and draw an arrow from predator to prey. Every time you add a new organism, ask students to share their food chains that include that organism. Keep building the

web until all students have contributed. When you're done, ask students if they can make additional connections. One part of your food web might look like this:



8. Now ask students to talk about how sea ice fits in this food web. (Sea ice is the primary habitat for many species; for example, it is the primary hunting ground for polar bears.) Then ask students to name ways that global warming is threatening this web. (Global warming melts sea ice. Warmer temperatures are disrupting breeding and feeding cycles.) Why is the Arctic food web fragile and susceptible to climate change? (It does not have the diversity that other webs have.)

Assessment

Use the following three-point rubric to evaluate students' work during this lesson.

- 3 points:** Students recalled several key concepts and examples of Arctic wildlife from the program; devised three clear, accurate food chains, each with at least three organisms; participated actively in development of the Arctic food web; gave two or more examples of how global warming affects the food web.
- 2 points:** Students recalled one or two key concepts and examples of Arctic wildlife from the program; devised two or three satisfactory, accurate food chains, each with exactly three organisms; participated in development of the Arctic food web; gave one example of how global warming affects the food web.
- 1 point:** Students recalled few or no key concepts and examples of Arctic wildlife from the program; devised one food chain, or food chains that did not include three organisms; did not participate in development of the Arctic food web; gave no examples of how global warming affects the food web.

Vocabulary

Arctic

Definition: Region around the North Pole, including the Arctic Ocean and parts of North America, Asia, and Europe

Context: The top predator in the Arctic is the polar bear.

food chain

Definition: A hierarchy of organisms where each member eats the one below it

Context: In one Arctic food chain, polar bears hunt seals, which eat cod, which eat smaller fish, which, in turn, eat plankton.

food web

Definition: All the connected or linked food chains within an ecological community

Context: The Arctic food web lacks diversity, which makes it much more fragile and vulnerable to climate changes.

phytoplankton

Definition: Microscopic single-celled plants that drift in ocean currents

Context: Phytoplankton is the foundation of the food web for Arctic animals.

sea ice

Definition: A layer of ice formed from seawater; it changes with seasons and floats on the ocean, carried by winds and currents

Context: Sea ice is the primary habitat for many Arctic species.

zooplankton

Definition: Microscopic animals that float in the ocean

Context: Zooplankton can be single-celled animals, tiny crustaceans such as copepods, or other marine animals in a larval stage.

Academic Standards

National Academy of Sciences

The National Science Education Standards provide guidelines for teaching science as well as a coherent vision of what it means to be scientifically literate for students in grades K-12. To view the standards, visit <http://books.nap.edu>.

This lesson plan addresses the following science standards:

- Life Science: Structure and function in living systems; Regulation and behavior; Populations and ecosystems; Diversity and adaptations of organisms
- Physical Science: Transfer of energy



Mid-continent Research for Education and Learning (McREL)

McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education addresses 14 content areas. To view the standards and benchmarks, visit <http://www.mcrel.org/>.

This lesson plan addresses the following national standards:

- Science – Life Sciences: Understands biological evolution and the diversity of life
- Language Arts – Viewing: Uses viewing skills and strategies to understand and interpret visual media

The National Council for the Social Studies (NCSS)

NCSS has developed national guidelines for teaching social studies. To become a member of NCSS, or to view the standards online, go to <http://www.socialstudies.org>

This lesson plan addresses the following thematic standard:

- People, Places, and Environments
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Support Materials

Develop custom worksheets, educational puzzles, online quizzes, and more with the free teaching tools offered on the Discoveryschool.com Web site. Create and print support materials, or save them to a Custom Classroom account for future use. To learn more, visit

- <http://school.discovery.com/teachingtools/teachingtools.html>
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DVD Content

This program is available in an interactive DVD format. The following information and activities are specific to the DVD version.

How To Use the DVD

The DVD starting screen has the following options:

Play Video – This plays the video from start to finish. There are no programmed stops, except by using a remote control. With a computer, depending on the particular software player, a pause button is included with the other video controls.

Video Index – Here the video is divided into four parts (see below), indicated by video thumbnail icons. Watching all parts in sequence is similar to watching the video from start to finish. Brief descriptions and total running times are noted for each part. To play a particular segment, press Enter on the remote for TV playback; on a computer, click once to highlight a thumbnail and read the accompanying text description and click again to start the video.



Curriculum Units – These are specially edited video segments pulled from different sections of the video (see below). These nonlinear segments align with key ideas in the unit of instruction. They include onscreen pre- and post-viewing questions, reproduced below in this Teacher's Guide. Total running times for these segments are noted. To play a particular segment, press Enter on the TV remote or click once on the Curriculum Unit title on a computer.

Standards Link – Selecting this option displays a single screen that lists the national academic standards the video addresses.

Teacher Resources – This screen gives the technical support number and Web site address.

Video Index

I. Beneath a Frozen World (8 min.)

Not all Arctic animals live on top of the pack ice. Journey beneath it to discover the creatures that come to life during the region's short summer.

II. Predators and Prey (15 min.)

Most Arctic animals depend on pack ice for survival. See how even the smallest shift in annual temperatures could spell disaster for them.

III. A Changing Species (9 min.)

Global warming has already affected Arctic sea birds. See how murrelets are adapting to a warmer climate.

IV. Arctic Herds (14 min.)

New plant growth is crucial for the survival of caribou calves and for a female's ability to conceive. Explore the devastating possibilities of a warmer future.

Curriculum Units

1. The Forest Sea Ice

Pre-viewing question

Q: What animals would you expect to see in the Arctic?

A: Answers will vary.

Post-viewing question

Q: What is a plankton bloom?

A: During this period each spring, zooplankton grow rapidly. A plankton bloom provides much of the year's primary food production.

2. The Food Web

Pre-viewing question

Q: Why is the food web so productive during the Arctic's short growing season?

A: Answers will vary.



Post-viewing question

Q: How would an early departure of ice affect humans in the Arctic?

A: Answers will vary.

3. Return of the Birds

Pre-viewing question

Q: Why do sea bird colonies stay within flying distance of open water?

A: Answers will vary.

Post-viewing question

Q: What unique ability do murres have?

A: These birds can dive under the ice and “fly” underwater in search of food. Their short, stubby wings make these ungainly birds graceful underwater.

4. A Fragile Chain

Pre-viewing question

Q: In a short food chain, what happens when a species is removed?

A: Answers will vary.

Post-viewing question

Q: Are diverse ecosystems more stable?

A: Answers will vary.

5. At the Floe's Edge

Pre-viewing question

Q: What can studying Arctic animals teach us about global warming?

A: Answers will vary.

Post-viewing question

Q: How will bowhead whales be affected by global warming?

A: Answers will vary.

6. Summer on Land and at Sea

Pre-viewing question

Q: Why do polar bears weigh less than they used to?

A: Because the Arctic ice melts about two weeks earlier than it used to, polar bears have less time in which to hunt and feed their young.

Post-viewing question

Q: In the long run, how could reduced ice cover affect polar bears?

A: Ice connects different populations of polar bears and, therefore, helps to prevent genetic inbreeding and to maintain genetic diversity. With less ice cover, polar bears might develop more genetic weaknesses. It could also mean higher densities of bears in smaller areas, leading to social disruption and infanticide.



7. Watching the Murres

Pre-viewing question

Q: What animal species is the best indicator of environmental change in your area?

A: Answers will vary.

Post-viewing question

Q: What have scientists recently observed about the murres?

A: Their breeding timing is not as well synched with the presence of ice. Consequently, the chicks are not being fed as well as they were when the ice remained until later in the summer.

Additionally, in the new, hotter summers, scientists have witnessed adult murres dying of heat exposure as they try to protect their chicks from the baking sun.

8. Dietary Shifts

Pre-viewing question

Q: What can we learn by observing an animal's diet?

A: Answers will vary.

Post-viewing question

Q: How has the murres' diet changed?

A: The Arctic cod, an ice-adapted fish, used to be the principal food fed to murre chicks. In recent years, murres have been feeding their chicks capelin, which are smaller and provide less nourishment.

9. Land Parasites

Pre-viewing question

Q: Are the effects of global warming greater on land or at sea?

A: Answers will vary.

Post-viewing question

Q: If parasites continue to multiply, what will happen to Arctic land animals?

A: Answers will vary.

10. A Living Landscape

Pre-viewing question

Q: What animals follow migrating caribou?

A: Many large carnivores, such as wolves, wolverines, foxes, and grizzly bears, as well as mosquitoes, fish, and many kinds of birds.

Post-viewing question

Q: How will climate change affect the caribou?

A: Warmer temperatures are predicted to alter the plant community, changing prime year-round habitat for some caribou herds. In addition, warmer temperatures and less ice mean more mosquitoes. Mosquitoes torment the caribou, causing them to eat less and gain less weight, which in turn reduces the females' chances of getting pregnant.



11. Heading South

Pre-viewing question

Q: How does the weather change with the seasons in your area?

A: Answers will vary.

Post-viewing question

Q: How does cold weather affect the caribou's ability to graze?

A: Snow makes it harder for caribou to graze. They must use their large hooves to dig down into the snow to uncover lichen. However, if the snow has been packed down by wind or if there is freezing rain, it can have a devastating effect on their ability to graze.

12. On Thin Ice

Pre-viewing question

Q: What does it mean to be resilient?

A: Answers will vary.

Post-viewing question

Q: What will the Arctic ecosystem be like in 50 years?

A: Answers will vary.