



Arctic Adaptations and Global Impacts

Middle School Grades

Lesson Summary

Students will learn about the Arctic Beaufort Sea and research the adaptations of people and animals in the arctic regions. They will also learn about how their actions can affect the Arctic and learn about the International Polar Year.

Prior Knowledge & Skills

- Research skills
- Organizing and analyzing geographic information

AAAS Science Benchmarks

The Physical Setting

Processes that Shape the Earth

NSES Science Standards

Life Science

Populations and Ecosystems

Diversity and Adaptations of Organisms

NCGE Geography Standards

Places and Regions

Standard 4

Physical Systems

Standard 8

Teaching Time: 2 to 3 hours

Materials

- Computers with internet access
- From Sea to shining Sea map (online PDF)
- Student copies of Polar Research handout (attached PDF)
- Student copies of Polar Regions: Key Vocabulary (attached PDF)
- Student copies of NOAA: Global Warming FAQ
- Student copies of “Global Warming: How Hot? How Soon?” (attached)

Advanced Planning

Preparation Time: ~10 minutes

1. Review the instructions
2. Gather the necessary supplies.

Recommended Reading: (online)

- The National Geographic News Website article: “Global Warming: How Hot? How Soon?” located at http://news.nationalgeographic.com/news/2005/07/0727_050727_globalwarming.html

National Geographic Xpeditions: Geography Standards in Your Classroom

<http://www.nationalgeographic.com/xpeditions/>


Geography Standard: 8

XPEDITION HALL

 Check out:
X1: Globe Projector
STANDARDS

- **Standard #1:** How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective

ACTIVITIES

- [Be an Explorer Every Day!](#)
- [Creative Climates](#)
- [Get an Animal's-Eye View](#)
- [Preserving Biodiversity](#)

Lesson Plans

Grade Level: K-2 3-5 6-8 9-12

Select Lesson Plan:

Polar Regions: Arctic Adaptations and Global Impacts

Overview:

Ocean literacy involves understanding, among other things, that the ocean supports a great diversity of life and ecosystems, and that the ocean and humans are inextricably interconnected. This lesson explores these principles through the [From Sea to Shining Sea](#) map (PDF, [Adobe Reader](#) required), using the habitat of the Beaufort Sea and other Arctic communities as examples. Students will learn about the adaptive capabilities of animals and people living in these environments, look at recent climate changes, study the effects of global warming on polar regions such as the Beaufort Sea area, and ultimately understand the interconnectedness of life in these regions with life around the world. Finally, they will learn about, and practice articulating, the message of the upcoming International Polar Year.

Connections to the Curriculum:

Geography, life science, social studies

Connections to the National Geography Standards:

Standard 4: "The physical and human characteristics of places"

Standard 8: "The characteristics and spatial distribution of ecosystems on earth's surface"

[Ocean Literacy: Essential Principles and Fundamental Concepts](#) (PDF, [Adobe Reader](#) required)

- Principle 5: The ocean supports a great diversity of life and ecosystems
- Principle 6: The ocean and humans are inextricably interconnected

National Science Education Standards

- Life Science: Populations and Ecosystems
- Life Science: Diversity and Adaptations of Organisms

Time:

Two to three hours

Materials Required:

- [From Sea to Shining Sea](#) map (PDF, [Adobe Reader](#) required)

- Computers with Internet access
- Student copies of [Polar Research handout](#) (PDF attached)
- Student copies of [Quick Quiz: The Arctic Regions Show what you know!](#) (PDF attached)
- Student copies of [Polar Regions: Key Vocabulary](#) (PDF attached)
- Student copies of [NOAA: Global Warming FAQ](#)
- Student copies of ["Global Warming: How Hot? How Soon?"](#) (attached)

Objectives:

Students will

- identify the arctic Beaufort Sea on the [From Sea to Shining Sea map](#) (PDF, [Adobe Reader](#) required);
- research the biological and behavioral adaptations of people, plants, and animals of the Beaufort Sea area;
- describe the effects of global warming on Arctic areas;
- describe how human behavior around the world is affecting this region; and
- describe the International Polar Year, its mission, and its message.

Geographic Skills:

Organizing Geographic Information
Answering Geographic Questions
Analyzing Geographic Information

S u g g e s t e d P r o c e d u r e

Opening:

Guiding Question: How have the people and animals living in the arctic Beaufort Sea area adapted to their extreme environments? How are these arctic dwellers interconnected with the rest of the world?

Display the front of the [From Sea to Shining Sea map](#) (PDF, [Adobe Reader](#) required) and ask for a volunteer to identify the Arctic region, and then find the Beaufort Sea. Explain that the Beaufort Sea is a main artery of the Arctic's rich ecosystem. Read the following statements to the class, and ask them if they think the questions are *True* or *False*. Then review the answers with them.

- Polar bears are a main predator of penguins (False. Polar bears live in the Arctic, while penguins live in the Antarctic.)
- The North Pole spends half the year in darkness and half in light. (True)
- The Arctic is entirely frozen, making it one of the coldest habitats on earth. (False. It's not entirely frozen, in fact its frozen area fluctuates seasonally. The Antarctic is the coldest, driest, windiest, most uninhabited continent on earth.)
- There is an Arctic shipping shortcut between the Atlantic and Pacific Oceans that expedites water travel between Europe and Asia. (False. However, some scientists believe such a pathway could be ice-free and open for travel sometime this century.)
- The Arctic area is considered an early warning system for climate change. (True, because of its unique environment and sensitivity to temperature change)
- There is land beneath the North Pole that causes ice to melt in the summer months. (False. There is no land beneath the North Pole;

it is a shifting pack of sea ice 6 to 10 feet thick that floats above the Arctic Ocean.)

- Global warming affects the Beaufort Sea and its surrounding regions. (True. It has changed the pattern and rates of melting ice in the Arctic regions.)
- The Arctic region hosts many species of plants and animals. (True. Although a harsh habitat, it supports a thriving ecosystem.)
- What happens in the Arctic regions affects people around the world. (True. Students will be exploring this truism in this lesson.)

Explain that the class will be researching human, plant, and animal life in this area, as well as recent climate changes that are affecting this particular habitat. As they do so, students will be exploring how we are all interconnected, using the Beaufort Sea environment as an example of how climate changes affect sea ice, and therefore the inhabitants of this community, and ultimately us, as well.

As a further introduction, you may also have students explore the [interactive version of the From Sea to Shining Sea map](#) and the related thematic pages online at the Marine Conservation Biology Institute's (MCBI) website.

Development:

Activity 1: Arctic Life Adaptability

Pair students or allow them to choose partners. Explain that the pairs will be researching a specific arctic animal, plant, or human culture indigenous to the Beaufort Sea and its surrounding arctic regions and the many ways that the organism has adapted to such harsh habitats. (Make sure students understand the following terms: *behavioral adaptation* and *biological adaptation*. See [Polar Regions: Key Vocabulary](#) (PDF, [Adobe Reader](#) required). Have each pair of students choose one of the following animals, plants, or human cultures indigenous to the Beaufort Sea area:

- Ringed seal
- Polar bear
- Inupiat Eskimos
- Athabaskan Indians
- Arctic cisco
- Beluga Whales
- Bowhead Whales
- King Eider
- Loons
- Thick-billed Murres
- Guillemots
- Porcupine caribou
- Albatross
- Elephant seal
- Fur seal
- Arctic fox
- Arctic Hare
- Caribou
- Arctic Tern
- Puffin
- Lichen
- Arctic moss
- Collared Lemming
- Musk Ox
- Narwhal
- Walrus

Have students use the Internet, beginning with the resources listed below, to research their chosen topic guided by the [Polar Research handout](#) (PDF, [Adobe Reader](#) required). Once students have completed their research and the poster described on the handout, have them share their findings with the class.

Activity 2: *Interconnectedness of Polar Regions with the Rest of the World*

Pose the following questions to your students:

- Based upon what you've learned about plant, animal, and human adaptations in the Beaufort Sea communities, how do you think global warming affects these species?
- Does what we do in _____ (name of students' local area) really affect the life in the Beaufort Sea area?
- Do you think our actions affect life in other polar regions, such as Antarctica?
- How might what happens in these polar regions affect us and others around the world?

Have students hypothesize how what we do may affect the polar environments. Then have them brainstorm how they think these changes may ultimately affect us. Assign students to explore the following resources to get more information about how global warming is changing the Arctic life, and how these changes may subsequently affect the place where they live.

[NOAA: Global Warming FAQ](#)

[Global Warming: How Hot? How Soon?](#)

After discussing the two articles in class, use the information from the articles to revisit the following questions:

- How might climate changes affect life in the Beaufort Sea area and other polar regions?
- What is one cause of the climate changes in these areas?
- Does what we do affect life in the Beaufort Sea area and other polar regions? How?
- How might the happenings in polar regions, such as the Beaufort Sea area, affect us and others around the world?

Closing:

Explain to students that scientists are trying to educate the public about the importance of polar regions, such as the Beaufort Sea area. They hope to make people aware of how their behaviors directly affect such regions, and, alternatively, how they are affected by what happens in these regions. Although polar regions are comprised of remote areas, what happens there has a profound significance for global climate and ultimately for environments, ecosystems, and human society worldwide.

Tell students about the upcoming [International Polar Year \(IPY\)](#), a two-year program of science, research, and education focused on the polar regions, and refer them to the website for additional information and resources.

Divide the class into small groups. Assign half the groups the role of

representing a culture indigenous to a polar region whose area is being threatened by increasing changes in the environment. Assign the other half of the groups the role of speaking on behalf of other cultures of the world (perhaps in their own area, in rain forests, or in island or coastal regions) whose communities and cultures are impacted by changes in the polar regions. Have the groups imagine that they will be speaking as part of IPY and must prepare a brief (approximately 5 minute) presentation that raises awareness of the interconnectedness of changes in the polar environments, their respective community, and the global community.

Student groups should begin their research using the [International Polar Year, 2007 2009](#) website and appropriate Related Links below, and incorporate the following in their presentations:

- an overview of how global warming has so far affected the polar regions
- specific examples of how the people, animals, or plants have adapted to polar climate and environment
- analysis of how climate change is/will directly affect the people, animals, or plants of the polar regions
- findings on how climate changes in the polar regions may impact other communities around the world
- thoughts on what humans can do, or are doing, to improve the situation

Have students share their presentations in class.

Suggested Student Assessment:

Have students complete the [Quick Quiz: The Arctic Regions Show What You Know](#) (PDF, [Adobe Reader](#) required) to assess their comprehension of material. (Note on adapting the quiz: To make the quiz more challenging, offer the questions without the word bank, and have students insert terms they recall on their own from the lesson.)

You may also use the following five-point rubric to evaluate students' IPY presentations. Give students one point for each of the following for a total of five points:

- Their overview of the effects of global warming on polar regions was clear, comprehensive and concise.
- They provided at least two examples of how plants, animals, or humans have adapted to life in polar regions.
- They offered a thorough analysis of how climate change is/will directly affect(ing) the people, animals, or plants of the polar regions.
- They communicated findings on how climate changes in the polar regions may impact other communities around the world.
- They shared thoughts on what people can or are doing to improve the situation.

Extending the Lesson:

Inquiry Extension

- Read more about the history and mission of the [International Polar Year](#).
- Learn more about the heightened interest in polar bears and how they are reacting to climate and other environmental changes

caused by both natural and man-made actions. Read "[What has been happening to polar bears in recent decades?](#)".

- Have students conduct Internet research for information on how the distribution of polar ice in the southern hemisphere has undergone major changes recently.

Cross-Curricular Extension

- What's it like to live in Antarctica? Have students learn about life at the research stations and write a pretend diary page of what life might be like if they were part of one of the families in the [Australian Antarctic Division](#). (Language Arts)
- After students have shared what they learned about their species, see if the class can develop any food webs connecting the various species of the Beaufort Sea area. (Life science)

Try This at Home

- Take an [Arctic Adventure quiz](#) about arctic animal adaptations with your sibling or parent.
- From September 2006-July 2008, the Tara a sailboat and research platform will be frozen in the Arctic ice and carried past the North Pole. Follow their [adventures](#). Click on the British flag to access the site in English.

Related Links:

[College of Exploration](#)

[Marine Conservation Biology Institute \(MCBI\): From Sea to Shining Sea](#)

[National Geographic News: "As Arctic Ice Melts, Rush is on for Shipping Lanes, More"](#)

[National Geographic: Crittercam—Antarctica](#)

[National Geographic: Crittercam—Arctic](#)

[National Geographic: Oceans for Life EdNet Community—Educator Resources](#)

[National Geographic: Xpeditions—Sea to Shining Sea map](#)



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Directions: Use the Internet to find out the following information on your polar organism.

- Approximate size
- Habitat
- Diet
- Predators
- Ways in which the animal or human culture has adapted to the environment (list and describe any biological or behavioral adaptations that apply)
- Environmental factors that threaten its survival
- Current environmental issues that are in some way connected to your life
- Current environmental issues that may also affect communities worldwide

Draw a picture or print out a picture of your assigned subject and glue it onto a half-sheet of poster board. Label and describe any of the adaptations. Present all your findings on the poster board in a clear, easy-to-read format.

Quick Quiz: The Arctic Regions

Show what you know!

Directions: Place the letter corresponding with the correct answers from the Word Bank below in the space next to each question. Answers may be used more than once or not at all.

1. Approximately how many people live in the Arctic region? _____
2. Is there a shipping shortcut that runs through the Arctic Circle? _____
3. Which area of the world is considered an early warning system for climate changes because of its unique environment? _____
4. The North Pole is located on a shifting pack of _____.
5. Which animal might you find in the Arctic? _____
6. Hibernating during the cold months is an example of a(n) _____.
7. The ability of an animal's blood to absorb more oxygen in order to survive in a given environment is an example of a(n) _____.
8. _____ affects the polar regions.
9. Do Arctic ice melting trends affect communities outside the immediate region? _____
10. Developing longer teeth to attack tough prey is an example of _____.

Word Bank:

- a. yes
- b. no
- c. beluga whales
- d. penguins
- e. 4 million
- f. 2 thousand
- g. behavioral adaptation
- h. biological adaptation
- i. global warming
- j. ice
- k. the Arctic
- l. the Antarctic

Answer Key:

1. e
2. b
3. k
4. j
5. c
6. g
7. h
8. i
9. a
10. h

behavioral adaptation: something an organism does to survive in its habitat (example: hibernating)

biological adaptation: a physical change in an organism that results over time in reaction to its environment (example: thicker skin to protect from extreme temperatures; larger eyes to adjust to low light)

climate: all weather conditions for a given location over a period of time

indigenous: originating and living in an area or environment

International Polar Year (IPY): a two-year program of science, research and education focused on the polar regions