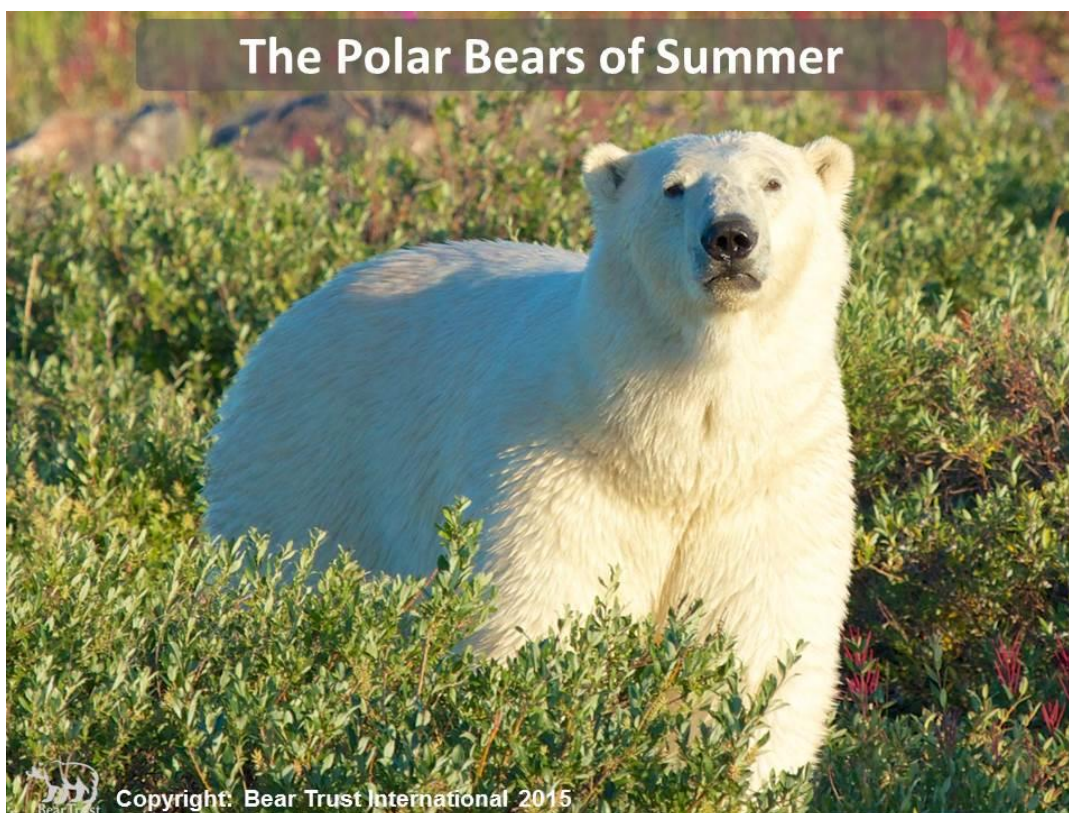


STUDENT PAGES: The Polar Bears of Summer

BACKGROUND INFORMATION



This lesson includes 4 main parts:

1. Read a story about polar bears called "The Polar Bears of Summer: What Do You Eat While The Ice Is Gone?"
2. Work individually on activities that correspond with the story.
3. Calculate your carbon footprint and compare your footprints with those of students in other states and countries.
4. Work in science teams on a group activity, where you will explore the scientific controversy around polar bears and land-based foraging.

Background Information About Bears and Science

Bears Worldwide

There are 8 species of bears worldwide: American black bear, Asiatic black bear, brown bear, giant panda bear, polar bear, sloth bear, spectacled bear, and sun bear. Of these 8 species, 6 are listed as Endangered or Vulnerable (not endangered, but facing high rate of extinction in the wild)

by the International Union for Conservation of Nature (IUCN). Only the American black bear and brown bear are considered species of Least Concern globally by the IUCN.

Polar Bears

- Polar bears are listed as Vulnerable on the IUCN (International Union for the Conservation of Nature) Red List of Threatened Species. Vulnerable means that the species is not currently Endangered, but facing high rate of extinction in the wild.
- In the US, polar bears are listed as threatened and protected by the Endangered Species Act.
- Scientists estimate that there are between 20,000-25,000 polar bears worldwide today.
- There are 19 sub-populations of polar bears. Of these 19 sub-populations, 3 are declining, 6 are stable, 1 is increasing, and scientists do not have sufficient data to estimate how the other 9 subpopulations are doing.
- There is a Polar Bear Specialist Group (PBSG) of the IUCN Species Survival Commission. This group is the "authoritative source for information on the world's polar bears, and one of IUCN/SSC's more than 100 specialist groups that work to produce and to compile scientific knowledge about the world's species and give independent scientific advice to decision-makers and management authorities"*.

*The text in quotes came from the PBSG/IUCN webpage on 5.18.15: <http://pbsg.npolar.no/en/index.html>

- To learn more about the current status of polar bears, please visit the Polar Bear Specialist Group website: <http://pbsg.npolar.no/en/index.html>

Scientific Controversy

As part of this lesson, you will use real-world data from some studies done on polar bears in western Hudson Bay, Canada. The data from these studies show that some polar bears in some polar bear subpopulations are consuming land-based foods during the ice-free period.

Currently, there is some **scientific controversy** around the topic of polar bears eating land-based foods, like snow goose eggs. Scientific controversy is a healthy part of the scientific process.

What is **scientific controversy**?

Dr. Anne Egger, Ph.D. and Dr. Anthony Carpi explain **scientific controversy** on the Vision Learning website (<http://www.visionlearning.com/en/library/Process-of-Science/49/Scientific-Controversy/181>). Here's what they say: "Scientists can disagree about lots of things, from the mundane (like what is the best kind of analytical instrument to use) to the profound (whether or not string theory, a recently developed theory in physics, is an accurate representation of reality). Two scientists disagreeing over an instrument or string theory - or even the interpretation of data

- does not count as a controversy, however. A true scientific controversy involves a sustained debate within the broader scientific community (McMullin, 1987). In other words, a significant number of people must be actively engaged in research that addresses the controversy over time. No matter what the content of the disagreement, the scientists involved all share some fundamental knowledge and agree that the subject matter is worth being concerned about and that the various arguments are legitimate.

What makes the arguments legitimate is that they are based on data. It is not enough for scientists to simply say, "I don't agree with you." Instead, they must conduct the research to garner enough evidence to support their claim. An argument must explain the majority of data available - not just the data collected to support one side. This is not necessarily the case in public controversies such as that over offshore drilling, where a group or individual can decide that some data are more important than other data - the number of birds that died or the economic impact of drilling or the percentage of oil imports. In a scientific controversy, all of the data must be explained and taken into account.

Though controversies are often discussed in informal settings (the same way you might discuss a controversial issue with your friends), the real debate is carried out at research meetings and through the publication of journal articles (see the "Scientific Journal Articles module" created by Vision Learning to learn more). It is only through this process that the debate becomes part of the scientific literature (see the Utilizing the Scientific Literature module created by Vision Learning to learn more) and helps science progress. There is no authoritative body in science that decides what the right answer in a controversy is, nor does it require complete consensus among all scientists. The resolution to a controversy comes when one argument is widely accepted and other arguments fade away. Often, the evidence in favor of one side of the controversy becomes so overwhelming that people simply stop arguing about it. Usually, that happens when multiple lines of evidence coming from multiple research methods (and perhaps multiple disciplines) all converge".

What is the **scientific controversy** surrounding polar bears and land-based foods? First, let's make sure we all know the issues that are **NOT** part of the scientific controversy:

1. Scientists **AGREE** that global warming is occurring and that much of this global warming is human-caused (for example, human-caused CO₂ emissions).
2. Scientists **AGREE** that global warming is reducing the Arctic sea ice. The duration of the ice-free period is increasing due to earlier break-up and later freeze up of Arctic sea ice.
3. Scientist **AGREE** that the increasing loss of Arctic sea ice affects polar bears because polar bears need ice platforms to hunt their primary prey, seals. Historically, polar bears gained most of their annual fat reserves during spring by hunting seals from the ice. Because Arctic sea ice is becoming less available, polar bears are spending increasingly more time on land. This is especially true for polar bears in western Hudson Bay and James Bay, at the southernmost part of the polar bear's range.
4. Scientists **AGREE** that some polar bears in some areas eat land-based foods, including eggs, caribou, fish, etc.

Hypotheses About the Scientific Controversy

Okay, we know that polar bears are spending increasingly more time on land due to increasing loss of sea ice as a consequence of global warming. What do polar bears DO on land during this ice-free period?

THAT is the center of the **scientific controversy**. We can evaluate this **scientific controversy** as two competing hypotheses:

Hypothesis 1A: Overall, land-based foraging by polar bears will not help offset lost opportunities to hunt seals and land-based foraging will not help the polar bear population cope with continuing loss of Arctic sea ice.

More Information about Hypothesis 1A: When polar bears are forced ashore, they have historically used the fat stores they've accumulated from ice-based hunting of seals to survive the ice-free period. The period polar bears spend on land is often referred to as a "fasting period" or "walking hibernation". Polar bears don't den up during this ice-free period, but most bears reduce their activity presumably to reduce energy expenditure. Because the duration of the ice-free period is increasing, the duration of the fasting period by polar bears is also increasing. During this fasting period, it is recognized that some individual polar bears might opportunistically eat some land-based foods but, overall, any land-based foraging will have minimal effect on individuals and on the polar bear population. Some evidence to support this hypothesis comes from scientific studies that show a decrease in Arctic sea ice in western Hudson Bay has been linked to: 1) decreased survival of some age classes of polar bears, 2) a decline in mean body condition index of polar bears, and, 3) a decline in mean weights of suspected pregnant females.

Hypothesis 1B: Land-based foraging by polar bears might help offset lost opportunities to hunt seals and such behavior by polar bears might reflect a flexible foraging strategy that could help the polar bear population cope with continuing loss of Arctic sea ice.

More Information about Hypothesis 1B: Some scientists question the use of the term "fasting" to describe polar bears in western Hudson Bay during the ice-free period. Some evidence to support this hypothesis comes from scientific studies showing some polar bears consume land-based foods. Evidence to support the hypothesis that land-based foraging might help polar bears cope with continuing loss of Arctic sea ice comes from a recent scientific DNA study showing polar bears have been distinct from brown bears for much longer than previously thought (at least 600,000 years). Assuming results from this new DNA study are accurate, this means polar bears found a way to persist through 4 warming periods on par with current day conditions: 150,000BP; 240,000BP; 325,000BP; 410,000BP. Presumably, polar bears did not have access to seals during the 4 previous warming periods. Populations of polar bears were no doubt reduced during these warming periods, but the species did not go extinct.