

## WACPack: Arctic Ice, the Northwest Passage, and Global Warming

### Introduction:

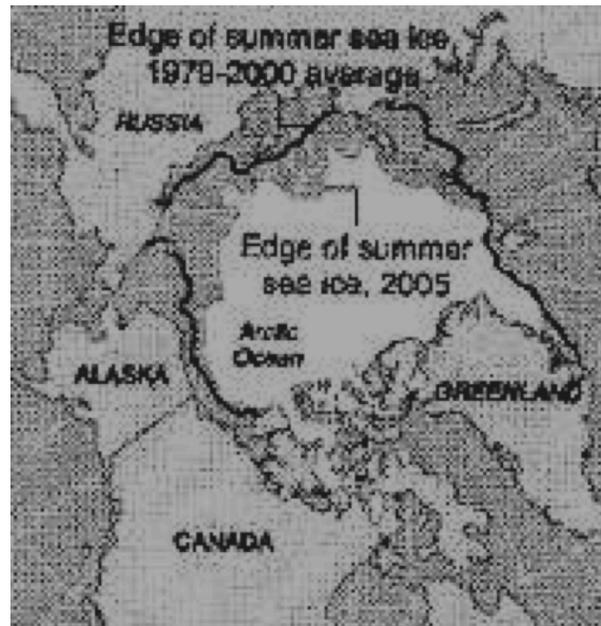
In 1492 Columbus set sail to the west from Europe, hoping to establish a sea route to Asia. He failed to achieve this goal because, after 33 days of sailing, he ran into the Americas, which blocked his route to the Orient. For the next three hundred years explorers searched for what was called the Northwest Passage, a water route across the North American Continent that could be used for trade. In 1803, President Thomas Jefferson wrote the following in his instructions to Meriwether Lewis, who was about to leave Washington as head of the Lewis and Clark Expedition: “The object of your mission is to explore the Missouri river, & such principal stream of it, as, by its course and communication with the waters of the Pacific ocean, whether the Columbia, Oregon, Colorado or any other river may offer the most direct & practicable water communication across this continent for the purposes of commerce.” The list of accomplishments of the Lewis and Clark Expedition is amazing: they explored and mapped the Northwest Territory; they documented flora, fauna, and natural features of the land; they established friendly relations with the Indian tribes they encountered; and they established a formal American presence in the Northwest. But Lewis and Clark did not find the Northwest Passage, a water route to the Pacific suitable for commerce.

At the time of the Lewis and Clark Expedition, the British already had a presence in the Northwest Territories through the Hudson's Bay Company, which had established a commercial empire built on the fur trade with Indians and trappers. Hudson's Bay is named after the British explorer Henry Hudson, who sailed into the bay north of Canada in 1610, two hundred years before Lewis and Clark, on an expedition in search of the Northwest Passage. Initially, Hudson believed that he had found it, that he had rounded the tip of North America. He spent the next few months sailing around Hudson's Bay looking for a southern outlet. Eventually, his ship, the *Discovery*, was frozen in by the sea ice; Hudson and his crew spent a miserably cold winter in Hudson's Bay. When the ice cleared in late spring and Hudson wanted to continue westward, still searching for the Northwest Passage, his crew mutinied. Hudson and several of his crew members were forced off the *Discovery* into a small boat, and never seen again.

In September of 2005 two research vessels, the *Oden* from Sweden and the *Healy* from the United States Coast Guard, became the first surface ships to traverse the Canada Basin, the ice-covered body of water between Alaska and the North Pole. The ships reached the North Pole on September 12. Scientists aboard the ships said that the trip was possible because the ice cover in the Arctic Ocean has thinned in recent decades. The prospect of a shrinking polar ice cap suggests that some time in the future, it will be possible for a modern day Henry Hudson to succeed in sailing across the top of North America, and that the Northwest Passage, the water route to Asia, will come into existence.

To examine this question, we look at the data. A September 29, 2005 *New York Times* article reported that the Arctic ice cap “shrank this summer to what is probably its smallest size in at least a century of record keeping.”

The article was accompanied by the following graphic:



The *New York Times* article describes a report from the National Snow and Ice Data Center (NSIDC) in Boulder, Colorado. Data from the NSIDC website give the extent of the September Arctic sea ice, in millions of square kilometers, from 1979 to 2005.

The table below shows the extent of the September Arctic sea ice in millions of square kilometers, in five-year intervals:

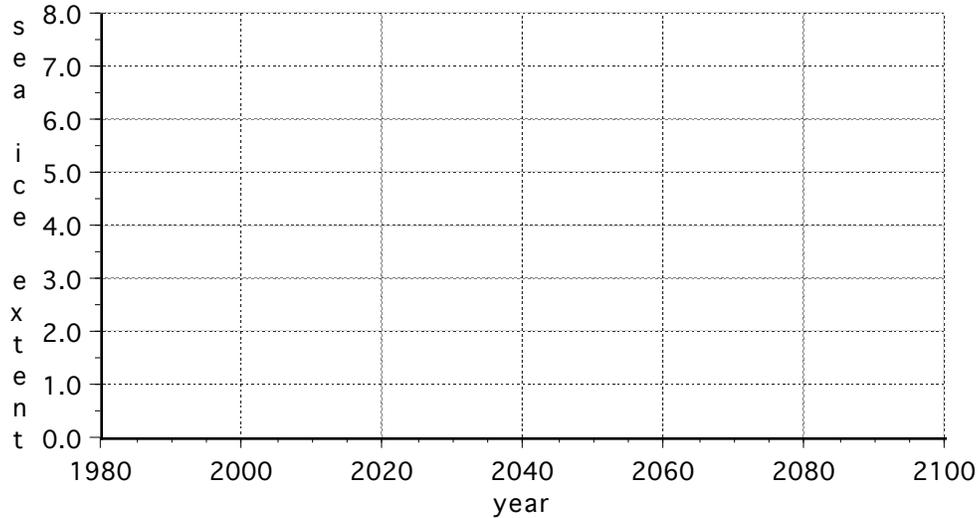
year	extent
1980	7.8
1985	6.9
1990	6.3
1995	6.2
2000	6.3
2005	5.5

Data source:

[http://nsidc.org/news/press/20050928\\_trendscontinue.html](http://nsidc.org/news/press/20050928_trendscontinue.html)

Begin by graphing the data on the graph below. Then answer the questions.

Extent of Arctic Sea Ice, September of Each Year



1. Examine the six points on the graph, and visualize the trend of the data points. Is the trend you are visualizing a straight line or a curve?

Answer: \_\_\_\_\_

2. Carefully draw the trend line or curve on the graph, and extend the trend into the future to the year 2050. [Note: we will refer to this as a trendline, even if it is a curve.] It is important that you draw the line or curve with great care. The result should be a smooth (not wiggly) line or curve on your graph that accurately shows the trend of the six data points.

3. Use your trendline to predict the extent of September Arctic sea ice in the year 2020, in the year 2030, and in the year 2040.

Answers: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

4. Use your trendline to predict the year in which the extent of the September Arctic sea ice will reach zero -- that is, the year in which there will be no ice in the Arctic region in the summer.

Answer: \_\_\_\_\_

### Questions for further thought:

Think both about what your predictions from the trendline might mean and about what they don't mean. What these predictions mean for the Northwest Passage? Think about whether the data and your model are consistent with the hypothesis that global warming is occurring. You will also want to think about the possible limitations of your trendline model. Do you expect it to be an accurate forecast of the future? Or do you think the model might break down in some fashion? If you expect that your model might break down, discuss the factors that you think will cause the model to break down and the ways in which this will affect your predictions.

This data, and your trendline model, by themselves, are not enough to prove that global warming is occurring. Think about what additional information or data you would need in order to be able to conclude, with certainty, that either global warming is occurring or that global warming is not occurring.

Professor Michael Burke is the creator and author of this WACPack, with minor edits made by Jean Mach.

### Sources:

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Ambrose, Stephen E. *Undaunted Courage*. New York, NY: Simon & Schuster Inc. 1997

Millman, Lawrence. "Looking for Henry Hudson" in *Smithsonian*, Oct. 1999

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