

Mom & Me: A Polar Bear Survival Story

Teacher Notes

Grade Level: Grades 4-8

Time: This lesson contains several activities

Power Point: 15 minutes

Activities 1 and 2: Two 50-minute class periods

Materials

For Activity 1:

Copies of *Mom and Me: A Polar Bear Crossword Puzzle*

Computers with Internet access (or copies of mini-posters)

Pencils and erasers

For Activity 2:

Copies of *Graph A (Break-up Dates 1979-2007)*

Copies of *Graph B (Lone Female Body Mass, 1980-2007)*

Copies of *Polar Bear Ecoregions Map* (optional)

Key Words:

Addressed in *Mom and Me: A Polar Bear Crossword Puzzle*

Objective

Students will learn about the connection between mother polar bears and cubs through an interactive exploration of the Polar Bears International website. Students will also discover the connection between polar bear survival and sea ice. They will analyze this connection through a graph analysis activity, comparing two graphs—one showing female polar bear weights and the other showing sea ice coverage.

Background Information

Female polar bears prepare to raise their young long before they give birth. Mating takes place on the ice in April or May, but the fertilized egg will not implant in the female's uterus (delayed implantation) until early fall, after she has gained sufficient weight for a successful pregnancy. This delay gives her time to fatten up on seal blubber. Females often gain more than 400 lbs. during their short hunting season, allowing them to fast for up to eight months.

Female polar bears enter their maternity dens by mid- to late-October and give birth between November and January. They spend the next few months nursing their cubs up to six times a day and remain in their dens through March or April to protect their cubs from the coldest temperatures of winter. Newborns are 12 to 14 inches long (30–35 cm) and weigh little more than one pound (0.5 kg), but grow rapidly from their mother's rich, 33%-fat milk. When the family group finally emerges from its den, the mother stays nearby until her cubs develop the strength to walk long distances. Mothers can then break their long fast and lead their cubs onto the ice to hunt seals.

Solid food comes when cubs are three or four months old and the mother makes her first kill of the spring. Ringed seals—the primary food source of the polar bear—rest at breathing holes, cracks, or on the surface of the ice. The mother's success at hunting is both critical for her own needs and for modeling the hunting behavior her cubs will need to learn to find food for themselves. As long as there is sea ice, these areas are also accessible to the polar bears.

Although there has always been loss of sea ice during the warmest months of the year, the current overall decrease in sea ice and the early break up and later freeze up is translating into a longer fasting period for polar bears. Less time on the ice to hunt will lead to the inability of females bears to gain ample weight for successful pregnancies, thus prohibiting the species' ability to sustain itself.

Teacher Prep Notes

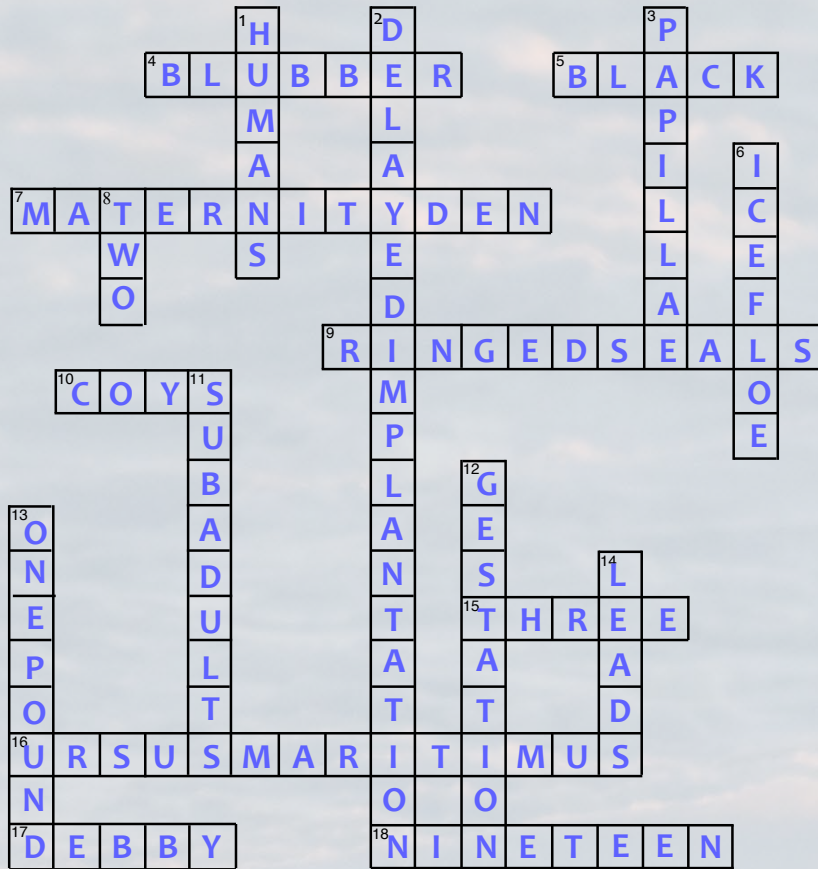
By reading the background information, students should recognize the connection between polar bear survival and sea ice. This lesson contains several activities. All activities will take 1-2 hours. Print the *Mom and Me: A Polar Bear Crossword Puzzle* PDF and mini-posters from the Polar Bears International (PBI) website: <http://www.polarbearsinternational.org/education/educational-tools-and-materials>. Also print *Graphs A and B (Break-up Dates 1979-2007 and Lone Female Body Mass, 1980-2007)* and the *Polar Bear Ecoregions Map*. Familiarize yourself with the PBI website addresses identified in the lesson. Use the questions listed in Activity 2 to create a worksheet for students to analyze graphs A and B.



Activity 1: Polar Bear Crossword Puzzle

To Do:

1. Have students watch the *All About Polar Bears* PowerPoint appropriate to their grade level for an engaging introduction to the polar bear world.
<http://www.polarbearsinternational.org/education/educational-tools-and-materials>
2. Give each student a copy of *Mom and Me: A Polar Bear Crossword Puzzle*. Have students explore the Polar Bears International website <http://www.polarbearsinternational.org/polar-bears/faq> to complete the puzzle.
3. If students do not have Internet access, photocopy the mini-posters to use in pairs or small groups to complete the puzzle. You may find mini-posters at: <http://www.polarbearsinternational.org/polar-bears/faq>



Across

- 4 Polar bears do not have this, but they eat it.
- 5 The color of a polar bear's skin.
- 7 A snow cave where cubs are born cubs (two words).
- 9 Polar bears' favorite food (two words).
- 10 What cubs are called.
- 15 Number of months a female polar bear stays in the den to give birth.
- 16 The species name for "polar bear" (two words).
- 17 A zoo bear that lived to be 42 years old!
- 18 Number of different bear populations in the Arctic.

Down

- 1 The polar bear's only enemy.
- 2 Used in reproduction to time the birth of cubs during the most favorable conditions for survival (two words).
- 3 Small bumps that keep polar bears from slipping on ice.
- 6 A flat sheet of ice floating in the sea (two words).
- 8 Number of cubs a polar bear mom typically has.
- 11 What polar bears are called after they leave their mothers between the age of 2 to 2-1/2 years old.
- 12 What the period of time a female polar bear is pregnant is called.
- 13 The weight of a newborn cub (two words).
- 14 Openings in the sea ice.

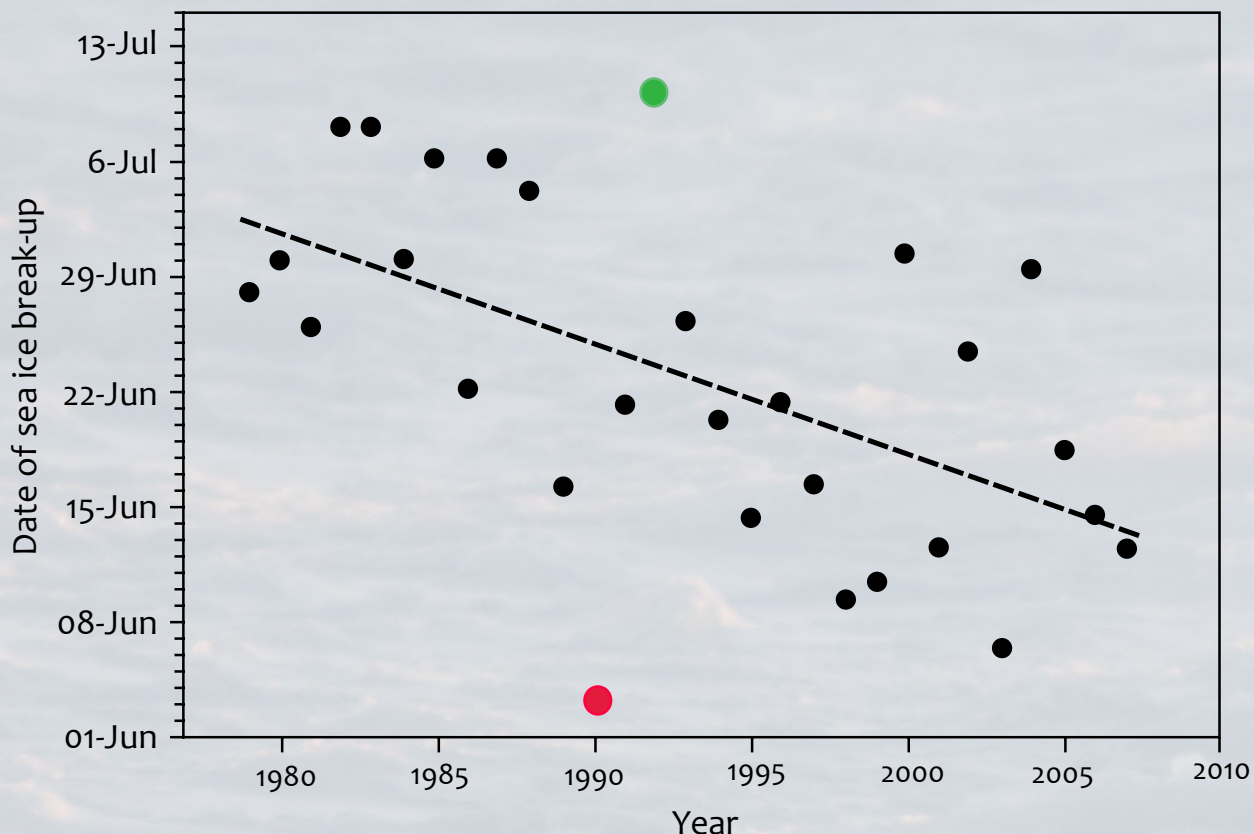
Activity 2: Polar Bears Need Sea Ice!

Graph Analysis

To Do:

1. With your students, define, discuss and locate sea ice on the Polar Bear Ecoregions Map.
2. Look at *Graph A, Break-Up Dates 1979-2007*. As a group, ask students to make observations and share what they notice in *Graph A*. Consider creating a worksheet that includes some of the following questions:
 - * In 1980, about when did the ice begin to break up? (Answer: June 30)
 - * In 2005, when did the ice begin to break up? (Answer: June 18th)
 - * Is the ice breaking up sooner or later each year? (Answer: Sooner)
 - * What do you think may be causing the ice to break up earlier each year?
 - * List several ways this earlier ice break-up negatively affects polar bears.
 - a. Polar bears hunt ringed seals from the sea ice. Earlier break-up means less hunting time.
 - b. Less hunting time means bears are unable to gain the weight they need for their winter fast.
 - c. Weight gain for females is essential because they are hunting both for themselves and their cubs.
 - d. Earlier ice break-up means bears are losing their habitat and coming ashore earlier, potentially creating a human/wildlife conflict.

GRAPH A: BREAK-UP DATES 1979-2007.

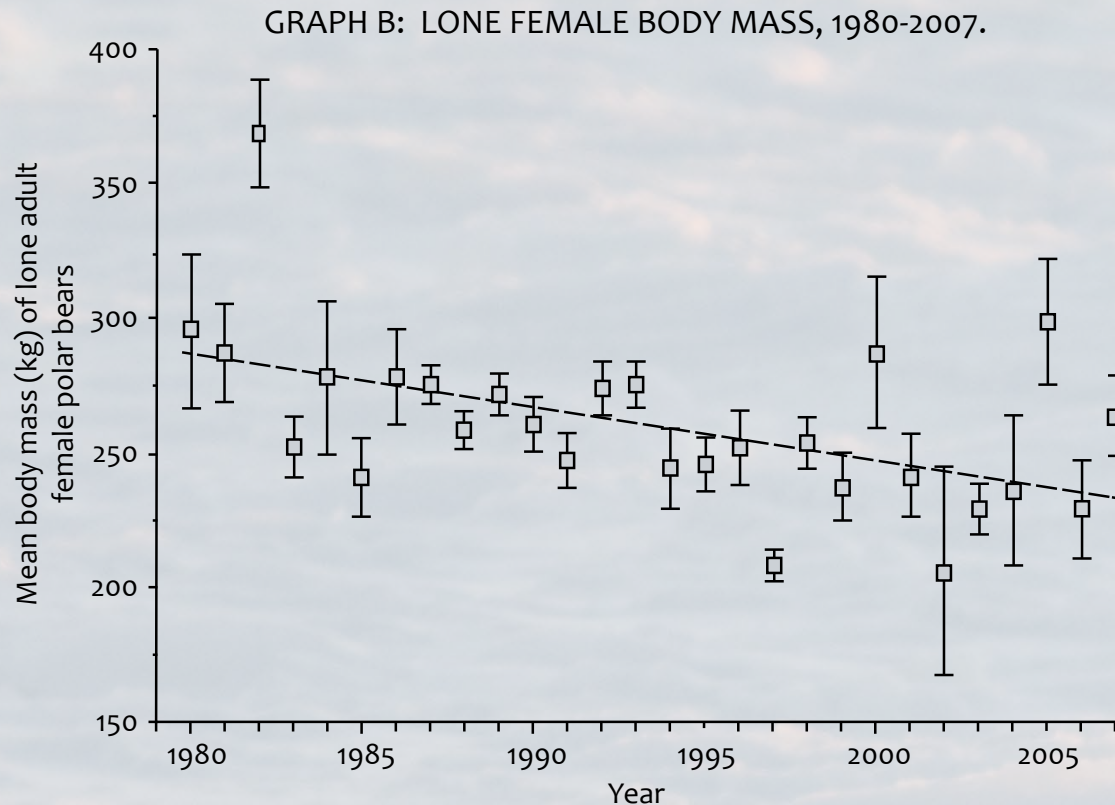


Date of break-up of the sea ice used by the Western Hudson Bay polar bear population, from 1979-2007. (From Stirling and Lunn 1999 and Lunn and Stirling unpublished data).

3. Look at *Graph B: Female Polar Bear Body Mass, 1980-2007*. This graph shows a steady decline in average female polar bear body mass and weight over time.

Use the following questions to create a worksheet or lead a discussion:

- * What was the average weight of a female polar bear in 1980? (Answer: 300kg)
- * What was the average weight of a female polar bear in 2005? (Answer: 225kg)
- * How much lighter were polar bears in 2005 than they were in 1980? (Answer: 75kg)
- * What negative effect does lighter body mass have on a polar bear?
 - a. Less weight gain for females makes it harder to reproduce and nurse cubs. This leads to the birth of fewer cubs and a lower survival rate.
 - b. Few cubs surviving leads to a decline in the polar bear population.
 - c. Lower body weight and fat reserves make travel back to the ice very difficult for mother bears after emerging from their dens. They have less stored energy to walk long distances and less energy to hunt and kill seals for themselves and their cubs.
 - d. Thin and hungry bears are tempted to seek food in settlements causing potential harm to humans, property, and themselves.



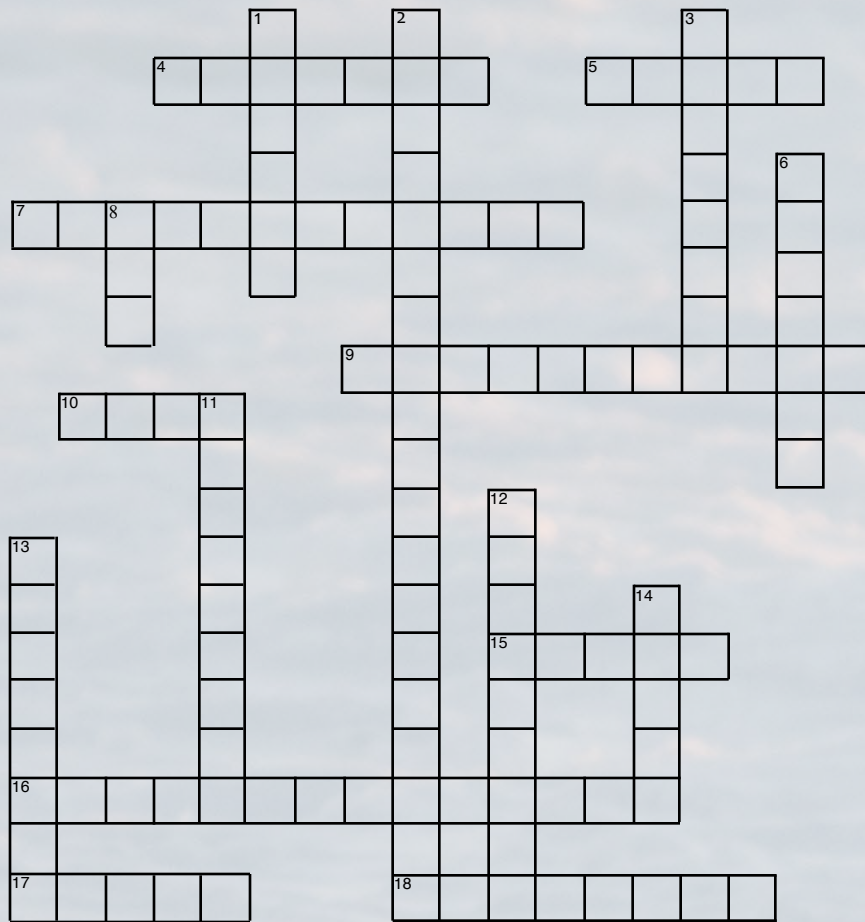
Mean estimated mass of lone (and thus likely pregnant) adult female bears in the fall in Western Hudson Bay from 1980 through 2004 (dashed line indicates fit of linear regression) (from Stirling and Parkinson 2006. *Arctic* 59: 261-275)

4. Compare graphs:
 - a. Earlier ice break-up leads to less hunting time for the bears.
 - b. Less hunting time leads to less weight gain and lower body mass, which in turn leads to lower reproduction rates and cub survival and a declining population.
5. Critical Thinking: What do you think is causing this? Earlier ice break-up dates are due to overall climate change. Temperatures have risen in the Arctic every decade since 1950. These increased temperatures have led to the ice breaking up earlier on average, greatly impacting the survival of the bears. Overall we can see that sea ice loss due to climate change is altering weight gain of polar bears. This is especially important for female polar bears as they have to increase body mass for successful reproduction. Additionally, if bears have to travel farther out to sea in search of food, it makes it more difficult to mate and therefore reproduce, further threatening the decline of the species.

Taking it Further:

Make the connection between climate change and human actions. What actions can students take to help polar bears and their Arctic habitat? To learn "How To Live Greener" use the Polar Bears International website as a resource: <http://www.polarbearsinternational.org/>.

Mom & Me: A Polar Bear Crossword Puzzle



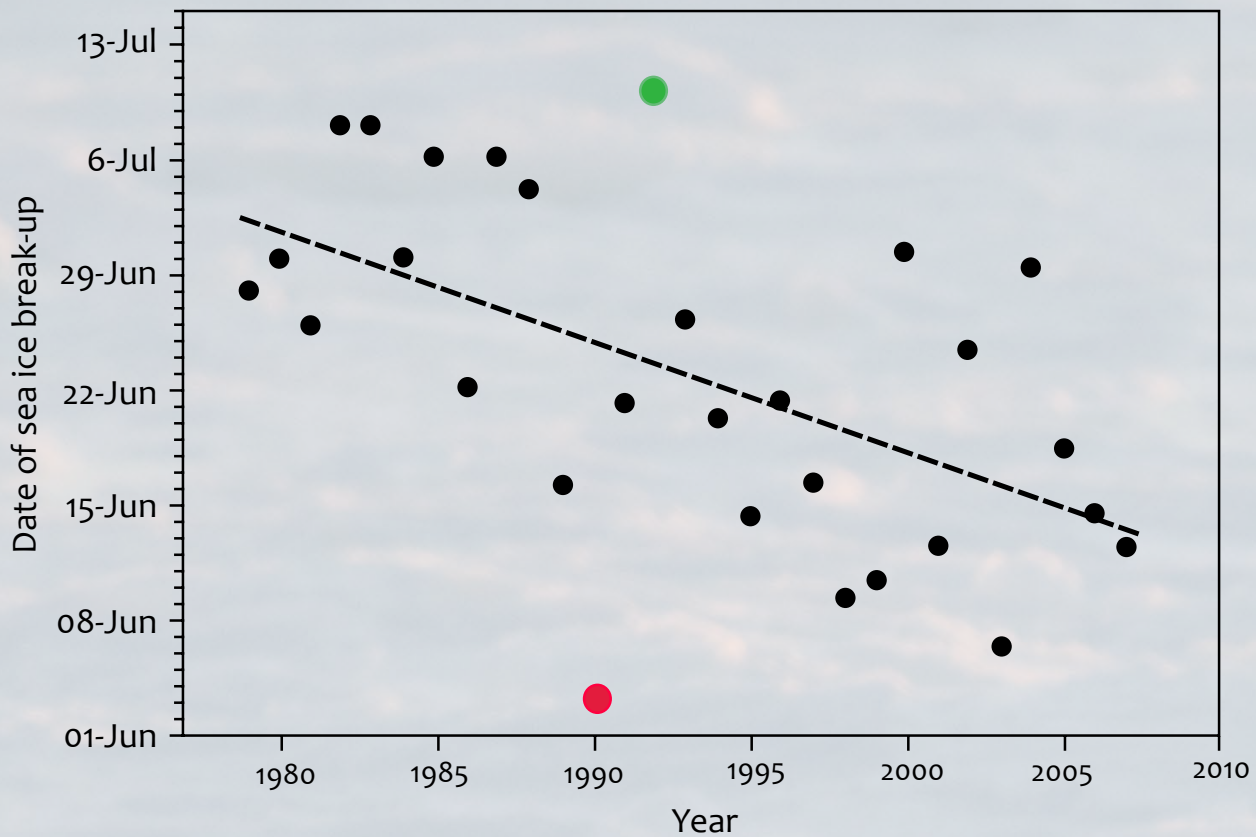
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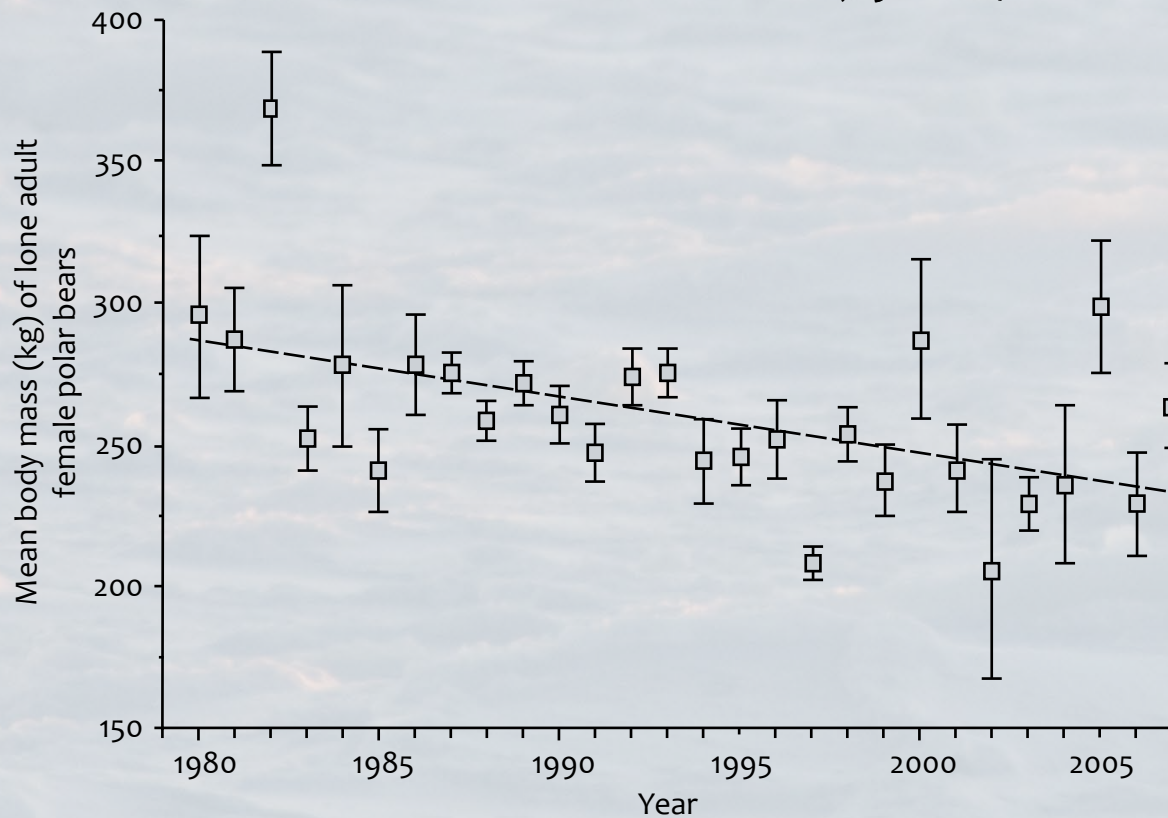
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GRAPH A: BREAK-UP DATES 1979-2007.



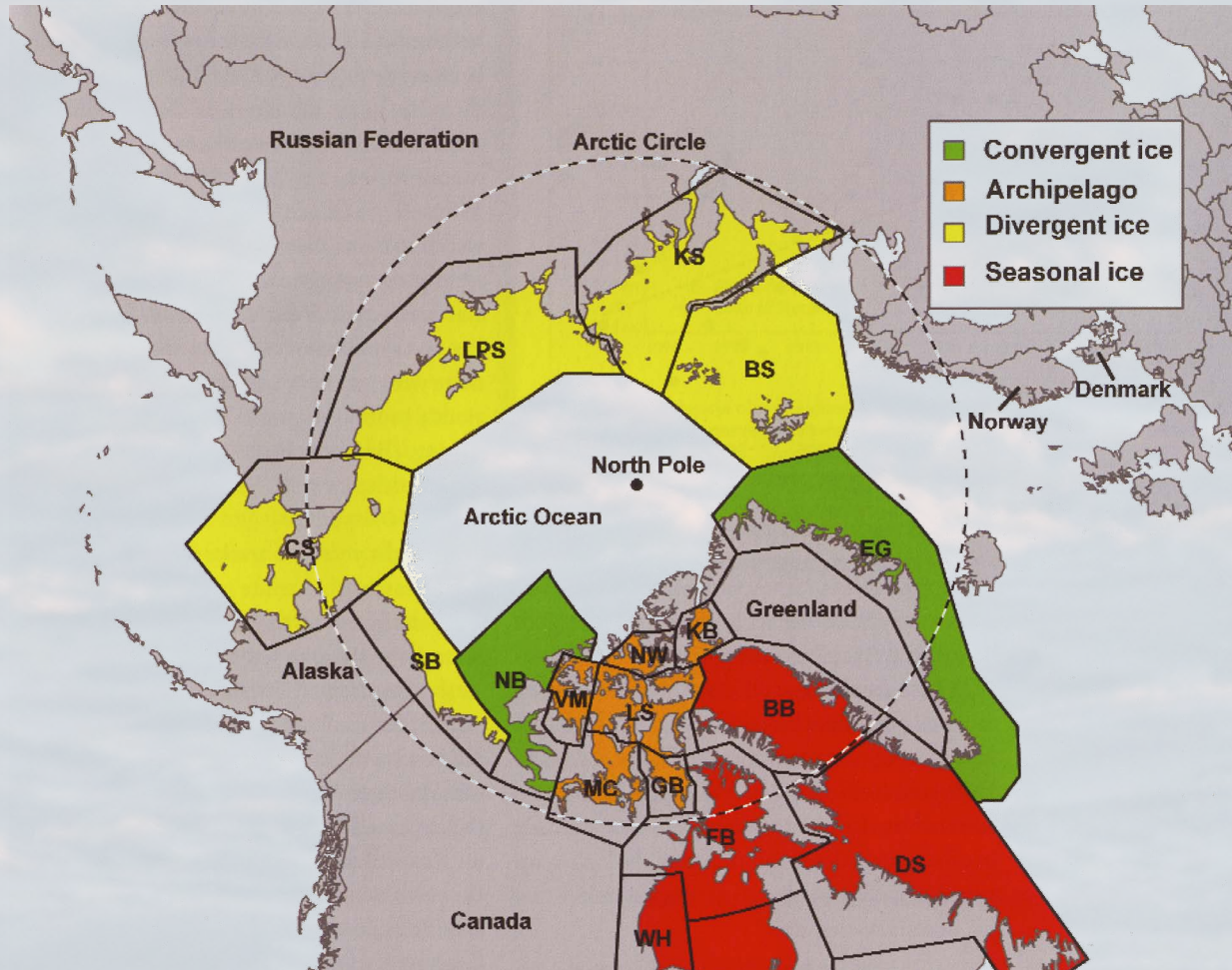
Date of break-up of the sea ice used by the Western Hudson Bay polar bear population, from 1979-2007. (From Stirling and Lunn 1999 and Lunn and Stirling unpublished data).

GRAPH B: LONE FEMALE BODY MASS, 1980-2007.



Mean estimated mass of lone (and thus likely pregnant) adult female bears in the fall in Western Hudson Bay from 1980 through 2004 (dashed line indicates fit of linear regression) (from Stirling and Parkinson 2006. **Arctic** 59: 261-275)

POLAR BEAR ECOREGIONS MAP



Map of four polar bear ecoregions defined by grouping recognized subpopulations which share seasonal patterns of ice motion and distribution. The polar basin divergent ecoregion (yellow) includes Southern Beaufort Sea (SBS), Chukchi Sea (CS), Laptev Sea (LVS), Kara Sea (KS), and the Barents Sea (BS). The polar basin convergent ecoregion (PBCE) (green) includes East Greenland (EG), and Northern Beaufort Sea (NBS). The seasonal ice ecoregion (red) includes southern Hudson Bay (SHB), western Hudson Bay (WHB), Foxe Basin (FB), Davis Strait (DS), and Baffin Bay (BB). The archipelago ecoregion (orange) includes Guls of Boothia (GB), M'Clintock Channel (MC), Lancaster Sound (LS), Viscount-Melville Sound (VM), Norwegian Bay (NW), and Kane Basin (KB).

Based on Amstrup et al. 2008 Geophysical Monograph 180, American Geophysical Union, Washington, D.C.) (Graphic: Evan Richardson)