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Climate Change and its Effects on Polar Bears

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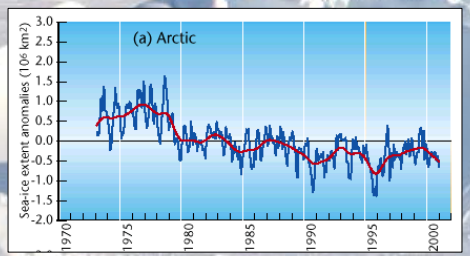
Climate Change Background

Global warming occurs as a result of the greenhouse effect. Greenhouse gases, which are responsible for the greenhouse effect, include carbon dioxide, methane, and water vapor. Anthropogenic emissions of greenhouse gases have caused global warming, which has consequences at local levels everywhere. In general, projected temperature rises are greatest in the arctic regions.

Drastic increases in temperature world wide can be observed since 1980.

Climate Change in the Arctic

The arctic is one of the most vulnerable areas to climate change, because of melting permafrost and melting ice sheets. Satellite measurements of the area of the Arctic covered by sea ice show that it is the second consecutive winter that the sea ice has not re-formed enough to compensate for the unprecedented melting seen during the past few summers. Many coastal communities face increasing exposure to storms, and thawing ground.

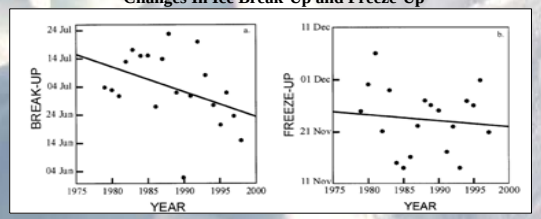


Sea ice decrease.

Future Projections

By the middle of this century it is likely there will no longer be year-round arctic sea ice, and polar bears may disappear from the wild within this century. Polar bears are highly pagophilic and completely dependent on sea ice for food. The earlier breakup of sea ice caused by warmer temperatures has resulted in significant declines in the physical condition and reproductive success of polar bears in the Hudson Bay area.

Changes In Ice Break-Up and Freeze-Up



Dates of breakup (1979—98) in the Hudson Bay area.

Dates of freeze-up (1979—1997) in the Hudson Bay area.

What Makes Polar Bears Vulnerable?

- Narrow habitat tolerance
- Large geographic range over international borders
- Reproduces in aggregates with a long gestation period and few young per litter
- Slow maturation
- Dependence on ice drifts for hunting
- Hunted by humans
- Population size is declining

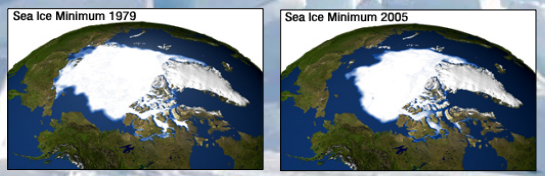
Habitat

•Between 1978 and 2005 the amount of ice has decreased 20%.

•The decrease in ice coverage will force polar bears to spend more time on land.

•Land travel has especially high energy costs for polar bears, because their bodies are adapted best for swimming and hunting on the ice.

•Denning could be impacted by the unusual warm spells by limiting access to high quality areas, and rain or warming could cause snow dens to collapse or open them to ambient conditions.



Change in sea ice cover from 1979 to 2005.

Feeding

Polar bears do almost all of their winter hunting on the ice surface. Polar bears carry half of their body weight in fat, and have evolved a fasting mode to replace the hibernation of other bears.

•Primary food source:

- •Ringed seals
- •Bearded seals

•Secondary food source:

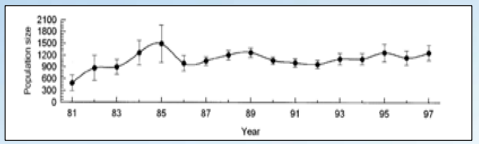
- •Harp seals
- •Hooded seals
- •Carcasses of: Beluga whales, walruses, narwhals, and bowhead whales

Effects of Climate Change on Feeding

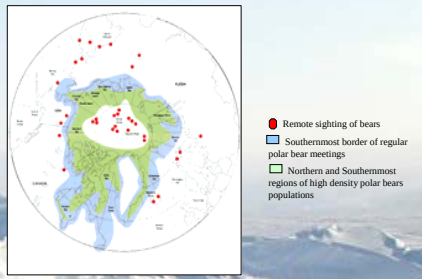
Ringed seals live on the ice, and are becoming less accessible prey because of a shorter ice season. Polar bears catch ringed seals when they poke breathing holes in the ice, but their success rate rarely exceeds 5% of attempts.
Because of the shorter ice season, polar bears have less time to hunt and are returning to land in poorer condition. Body mass for both male and female polar bears is declining significantly.

Population Trends

Because female bears require large amounts of fat stores for the fasting season and reproduction, when they are food stressed they will reproduce less successfully, and there will be lower sub-adult survival. Female bears also have to swim further from the drifting ice floes to maternity dens, reducing reproductive success. Climate change will most likely lower reproductive rates much sooner than it will cause mortality of adult polar bears. The current conservation status of the polar bear is threatened, but the USFWS is considering moving it to endangered.



Trends in natality and condition of adult male and female polar bears, expressed as three-year running means; the proportion of yearlings that were alone when captured in the fall; and population size (1981 – 97).



Anthropogenic Affects

Unlike most top predators, polar bears have a higher proportion of their original range, unaffected by human development. Climate change affects the human-bear interaction because a decreased hunting season leads to decreased food and thus more contact with humans.

Case Study: Hudson Bay Polar Bears

Hudson Bay polar bears are unique in the Arctic because of their tendency to fast for six to eight months each year, depending heavily on hunting during the sea ice season for survival. Since the sea ice season is the shortest in Hudson Bay of all the regions of the Arctic Ocean, these bears are likely to be among the first to be affected by sea ice decline. For every week earlier the ice breaks up in Hudson Bay, bears come ashore roughly 10 kg lighter and in poorer condition. In the Hudson Bay, scientists have found the main cause of death for cubs to be either lack of food or lack of fat on nursing mothers.

Conclusions

Polar bears are key indicators of the effects of climate change on the arctic ecosystem, because their existence is directly related to the sea ice habitat, where they hunt. As the Arctic continues to warm, their habitat will be reduced further and local extinction is likely to occur, especially in southern populations. Already, ice cover is decreasing and visibly affecting the physical condition and reproductive success of southern polar bear populations. The main threat to polar bears is starvation caused by shorter hunting seasons and earlier ice-breakup. For females in particular, this stress causes lower reproductive success and fewer cubs surviving to adulthood. Polar bear survival is dependent on mitigating climate change and the melting of sea ice, because unlike most top predators, it is not a fragmented habitat that is causing the population decline.