

Study connects greenhouse gas emissions to polar bear population declines

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A polar bear photographed in the Greenland Sea in September 2012. Credit: Cecilia Bitz/University of Washington

New research from the University of Washington and Polar Bears International in Bozeman, Montana, quantifies the relationship between

greenhouse gas emissions and the survival of polar bear populations. The paper, published online Aug. 31 in *Science*, combines past research and new analysis to provide a quantitative link between greenhouse gas emissions and polar bear survival rates.

A warming Arctic is limiting polar bears' access to sea ice, which the bears use as a hunting platform. In ice-free summer months the bears must fast. While in a [worst-case scenario](#) the adult bears will die, before then they will lose the ability to successfully raise cubs.

"Until now, scientists hadn't offered the quantitative evidence to relate greenhouse gas emissions to [population decline](#)," said second author Cecilia Bitz, a UW professor of atmospheric sciences.

Bitz did data analysis for the new report that shows a direct link between cumulative greenhouse gas emissions and polar bear demographic changes. The link largely explains recent declining trends in some polar bear subpopulations, such as in western Hudson Bay. The paper also has policy implications because it allows a formal assessment of how future proposed actions would impact polar bears.

"I hope the U.S. government fulfills its legal obligation to protect polar bears by limiting greenhouse gas emissions from [human activity](#)," Bitz said. "I hope investments are made into fossil fuel alternatives that exist today, and to discover new technologies that avoid greenhouse gas emissions."



A polar bear photographed in Churchill, Canada, in November 2021. Credit: Erinn Hermsen/Polar Bears International

In 2008, polar bears became the first species listed under the Endangered Species Act because of the threat of climate change. The biological link between warming and polar bear survival was clear, and scientists projected that up to two-thirds of the world's polar bears could disappear by mid-century.

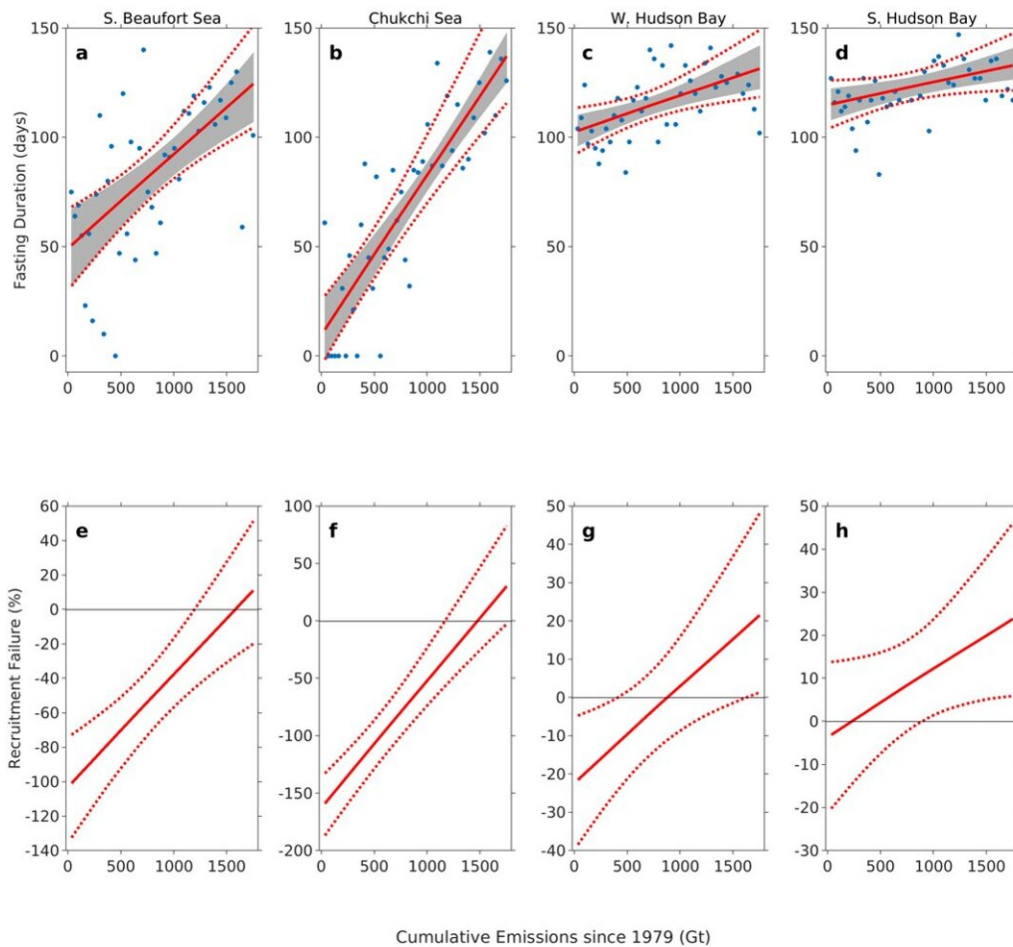
The Endangered Species Act requires that any government-authorized projects, including oil and gas leases, do not further endanger any listed species. But a document released by the U.S. Department of the Interior in 2008, known as the [Bernhardt Opinion](#), required specific proof of how a proposed project's greenhouse gas emissions would affect a

species' survival before the ESA could be fully implemented for species threatened by climate change.

"We've known for decades that continued warming and sea ice loss ultimately can only result in reduced distribution and abundance of polar bears," said lead author Steven Amstrup, chief scientist emeritus at Polar Bears International and adjunct professor at the University of Wyoming. "Until now, we've lacked the ability to distinguish impacts of greenhouse gases emitted by particular activities from the impacts of historic cumulative emissions. In this paper, we reveal a direct link between anthropogenic greenhouse gas emissions and cub survival rates."

The new paper, published in the 50th anniversary year of the Endangered Species Act and the 15-year anniversary of the listing of polar bears, brings new science to fill that knowledge gap.

Advances in climate science mean that precise links can now be established between emissions and species survival. Bitz was second author on a 2020 *Nature Climate Change* study that modeled [polar bear survival against sea ice decline](#), connecting polar bear fasting to ice-free days and calculating the annual fasting limits that lead to mortality. That study considered not just adult polar bear's survival, but also its recruitment success, meaning its ability to have cubs and raise them to the age of independence.



Cumulative post-1979 greenhouse gas emissions are shown along the bottom axis. The vertical axis is the number of days that polar bear must fast without access to sea ice as a hunting platform. The results show that regions in Hudson Bay (right columns), which had ice-free months even before 1979, have only slightly longer fasting seasons today. The more enclosed waters of the Beaufort and Chukchi seas (left columns) have experienced a dramatic increase in the number of days that polar bears must fast, and their recruitment failure, or failure to raise offspring, has also risen dramatically. All four populations now have a recruitment failure above zero, meaning their populations are in decline. Credit: S. Amstrup and C. Bitz/Science

The new paper links ice-free days and polar bear fasting limits to cumulative greenhouse gas emissions. It finds that, for example, the hundreds of [power plants](#) in the U.S. will emit more than 60 gigatons of greenhouse gas emissions over their 30-year lifespans, which would reduce polar bear cub survival in the southern Beaufort Sea population by about 4%.

"Overcoming the challenge of the Bernhardt Opinion is absolutely in the realm of climate research," Bitz said. "When the memo was written in 2008, we could not say how human-generated greenhouse gas emissions equated to a decline in polar bear populations. But within a few years we could directly relate the quantity of emissions to climate warming and later to Arctic sea ice loss as well. Our study shows that not only sea ice, but [polar bear](#) survival, can be directly related to our greenhouse gas emissions."

The study has implications beyond polar bears and sea ice, authors say. The same method of analysis can be adapted for other species and species habitat with direct connections to global warming, such as [coral reefs](#), the endangered [Key deer](#) that reside in the Florida keys, or beach-nesting species that are affected by rising sea levels.

"Polar bears are beautiful creatures, and I hope they survive global warming. However, the health and well-being of humans, especially the most vulnerable, is of the utmost importance," Bitz said. "All of us have experienced heat extremes in the last few years. The harm is inescapable.

"Everything governments and industries can do to reduce [greenhouse gas emissions](#) matters, and will help avoid the worst consequences. I'm excited to see the innovative proposals for the Inflation Reduction Act—I hope they stimulate the healthier future that [polar bears](#), and all of us, need."

More information: Steven C. Amstrup, Unlock the Endangered Species Act to address GHG emissions, *Science* (2023). [DOI: 10.1126/science.adh2280](https://doi.org/10.1126/science.adh2280).
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Provided by University of Washington

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