Arctic climate models playing key role in polar bear decision

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The pending federal decision about whether to protect the polar bear as a threatened species is as much about climate science as it is about climate change.

The U.S. Fish and Wildlife Service (FWS) is currently considering a proposal to list the polar bear as a threatened species under the Endangered Species Act, a proposal largely based on anticipated habitat loss in a warming Arctic.

Climate models - mathematical representations of the natural processes affecting climate - factored heavily in the scientific information requested by the FWS to guide its official recommendation, which was due Jan. 9. While scientists have used such models for decades, their use in this decision demonstrates the growing recognition of the value of modeling to predict future climate conditions and inform policymaking.

Eric DeWeaver, the physical climatologist on the International Polar Bear Science Team and a professor of atmospheric and oceanic sciences in the University of Wisconsin-Madison, evaluated existing climate models to identify those that best represent observed changes in sea ice - a crucial component of polar bear habitat - and which are expected to best predict future conditions in the Arctic.

His findings, detailed in a U.S. Geological Survey report provided to the FWS, were applied in subsequent reports to predict how Arctic sea ice changes over the next 100 years will likely affect polar bear populations.

These reports, available online at http://www.usgs.gov/newsroom/special/polar_bears, formed the basis of the scientific guidance requested by the FWS.

Climate models strive to represent the physical laws that govern climate systems to forecast how climate will respond to changes, such as greenhouse gas increases. Due to the variability of natural systems and the difficulty of mathematically representing such complex systems, all models contain some element of uncertainty, DeWeaver says.

"A climate model is not a crystal ball," he says. "It's impossible to make a perfect representation of climate... There are choices you make in model development that lead to a range of model behaviors. Often it is not possible to say that one [model] is better than another."

A discussion of the uncertainty inherent to climate models sometimes creates the impression that the models cannot provide useful information, he says, which is absolutely not the case.

Instead, he likens climate modeling to other predictive sciences like weather forecasting and economics. While short-term predictions may accurately pinpoint specifics, longer-scale projections are expected to reveal bigger-picture trends but fewer details.

For Arctic sea ice, the trend is clear, DeWeaver says - all models point to widespread reductions in sea ice in coming decades. What's less certain is how much melting to expect and how quickly.

Since each model represents climate in a slightly different way, the exact degree of melting - and timing of the first occurrence of an ice-free Arctic - vary from model to model.

Far from being a drawback, these variations in model output are

"enormously helpful in understanding a range of outcomes," DeWeaver says. "Having a multi-modal ensemble gives you a way to boil things down to the essentials," identifying the most robust changes consistent across several models.

Anticipated climate change has been a key element of the polar bear equation throughout the entire listing process, he says. Unlike most species considered for federal protection, polar bears' numbers have not yet shown significant decline.

However, escalating habitat losses anticipated due to global warming and other pressures are expected to severely impact bear populations in the near future, according to the listing petition filed by the advocacy group the Center for Biological Diversity.

In the scientific reports filed with the FWS, the climate models predict a loss of more than 40 percent of prime spring and summer polar bear habitat by 2050, based on current rates of greenhouse gas production. Polar bear biologists believe these losses will lead to the demise of more than 60 percent of the current population within the next 50 years, with near-extinction likely by the end of the century.

The application of climate science to this decision is a win-win situation for both scientists and policymakers, with the need for information driving advances in basic scientific knowledge and improved policy, DeWeaver says. "It sets a precedent that yes, you can use models [that include] uncertainty - and that's good," he says.

Source: University of Wisconsin-Madison