

# Dietary flexibility may have helped some large predators survive after last ice age

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During the late Pleistocene, a remarkably diverse assemblage of large-bodied mammals inhabited the "mammoth steppe," a cold and dry yet productive environment that extended from western Europe through northern Asia and across the Bering land bridge to the Yukon. Of the large predators—wolves, bears, and big cats—only the wolves and bears were able to maintain their ranges well after the end of the last ice age.

A new study led by researchers at the University of California, Santa Cruz, suggests that dietary flexibility may have been an important factor giving wolves and [bears](#) an edge over saber-toothed cats and cave lions.

"We found that dietary flexibility was strongly species-specific, and that large cats were relatively inflexible predators compared to wolves and bears. This is a key observation, as large cats have suffered severe range contractions since the last [glacial maximum](#), whereas wolves and bears have ranges that remain similar to their Pleistocene ranges," said Justin Yeakel, first author of a paper on the new findings published in the *Proceedings of the Royal Society B*.

Yeakel, now a postdoctoral researcher at Simon Fraser University in British Columbia, worked on the study as a graduate student at UC Santa Cruz with coauthor Paul Koch, professor of Earth and planetary sciences at UCSC. The other coauthors are Paulo Guimarães of the University of São Paulo, Brazil, and Hervé Bocherens of the University of Tübingen, Germany.

The researchers based their findings on an analysis of stable isotope ratios, chemical traces in [fossil bones](#) that can be used to reconstruct an animal's diet. They used previously published stable isotope datasets to reconstruct predator-prey interactions at six sites located from Alaska to western Europe. The sites covered a range of time periods before, during and after the last glacial maximum, the period around 20 to 25 thousand years ago when the ice sheets reached their greatest extent.

The study found that the diets of the large cats were similar in different locations, especially in the post-glacial period. Wolves and bears, in contrast, ate different things in different locations. Prey species on the mammoth steppes included bison, horses, yaks, musk oxen, caribou, and mammoths. The researchers noticed changes in predator diets coinciding with an increase in caribou abundance starting around 20,000 years ago.

"During and after the last glacial maximum, many predators focused their attention on caribou, which had been a marginally important prey resource before then," Yeakel said. "Large cats began concentrating almost solely on caribou in both Alaska and Europe. Wolves and bears also began consuming more caribou in Alaska, but not in Europe."

The cave lions and saber-toothed cats of the mammoth steppes were morphologically similar to modern lions, but they went extinct within the past 10,000 years. There were bears similar to modern bears, as well as the short-faced bear, which was larger than a polar bear and has since gone extinct. Interestingly, the short-faced bear is the only species that did not focus on caribou in the post-glacial period.

After the last [ice age](#), a growing human population coincided with the demise of the mammoths and other large fauna of the mammoth steppes. Many species are still around, however, including wolves and bears. According to Yeakel, studies of past ecosystems can inform scientists' understanding of modern carnivores and their capabilities.

"If you look at wolves today, they are specialist carnivores preying on large herbivores like deer and elk, but when we look in the fossil record we see that [wolves](#) are remarkably flexible. Their environment today is fairly artificial compared to when they evolved," he said.

The study found that large-scale patterns of interactions differed between locations, but remained stable over time. In Alaska, there was relatively little overlap in the preferred prey of different predator species, whereas predator-prey interactions were less "compartmentalized" in Europe.

"The large-scale patterns don't seem to change, which suggests this community was resilient to the climate changes associated with the last glacial maximum. That makes sense, because it survived multiple ice ages further back in time," Yeakel said.

Provided by University of California - Santa Cruz

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