

Ecological Change Drives a Decline in Mercury Concentrations in Southern Beaufort Sea Polar Bears

In the southern Beaufort Sea, the length of the annual open water season (i.e., the period of time when sea ice is absent from the biologically productive continental shelf water) has increased at a rate of ~9 days/decade since the 1980's. While most bears stay with the sea ice as it retreats over the deeper, unproductive water of the Arctic Basin, a growing proportion of the bears now spend the summer on land where they have access to the remains of subsistence-harvested bowhead whales.

A study by researchers from the University of Connecticut and the U.S. Geological Survey documented a recent decline in total mercury concentrations in polar bears from Alaska's southern Beaufort Sea. Research findings indicated that changes in polar bear foraging behavior, not declining environmental concentrations of mercury, are driving short-term declines in mercury concentrations in Beaufort Sea bears.

Mercury bioaccumulates and biomagnifies, leading to tissue concentrations in Arctic marine predators, like polar bears, that often exceed threshold values for adverse biological effects. Elevated mercury concentrations have been associated with impaired neurological and immune system development and function, as well as liver and kidney disease. In the most recent circumpolar assessment, mercury concentrations were found to be highest in polar bears sampled from the greater Beaufort Sea region and were above those associated with liver abnormalities in other wildlife.

Scientists analyzed polar bear hair samples collected from 2004 to 2011, a period during which land use by bears increased steadily and diet substantially changed. During this time, mercury concentrations declined by 15% per year for adult male polar bears and 4.4% for adult females.

Bowhead whales filter feed on plankton, occupying a lower trophic position, and thus potentially represent a less mercury-contaminated food source relative to other prey species. By contrast, bears remaining on the sea ice likely spend most of that time fasting, which can trigger the release to the circulatory system of contaminants like mercury compounds that were previously bound up in fat and muscle tissue. In the future, the bowhead whale subsidies available to land-based bears may not be sufficient for the number of individuals making use of them. Based on projected changes in the sea-ice habitat, both animals coming ashore and those remaining on the sea ice during summer are likely to experience further long-term declines in body condition and potentially increased circulating levels of contaminants.



Polar bears feeding on bowhead whale carrion, Kaktovik, Alaska, September 2015. Photo courtesy of Stewart Breck, USDA.

MANAGEMENT IMPLICATIONS

- Periodic assessments of factors that can influence animal and population health are crucial for informing decisions to support effective resource management.
- Flexibility in spatial and feeding behaviors of polar bears, such as coming ashore during the open water season and feeding on alternative food sources like bowhead whale carrion, may mediate a short-term decline in exposure to some contaminants like mercury.
- Increased residency of polar bears on land, coupled with expanding human activity due to retreating sea ice, has the potential to lead to greater human-polar bear interaction and conflict.

THIS BRIEF REFERS TO:

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