Study reveals how Arctic food webs affect mercury in polar bears

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With growing concerns about the effects of global warming on polar bears, it's increasingly important to understand how other environmental threats, such as mercury pollution, are affecting these magnificent Arctic animals.

New research led by biogeochemists Travis Horton of the University of Canterbury and Joel Blum of the University of Michigan lays the groundwork for assessing current and future effects of mercury deposition and climate change on polar bears.

The study appears in the December issue of the journal *Polar Research*.

Mercury is a naturally occurring element, but some 150 tons of it enter the environment each year from human-generated sources such as coal-burning power plants, incinerators and chlorine-producing plants. Deposited onto land or into water, mercury is picked up by microorganisms, which convert some of it to methylmercury, a highly toxic form that builds up in fish and the animals that eat them. As bigger animals eat smaller ones, the methylmercury is concentrated---a process known as bioaccumulation. Sitting at the top of the food chain, polar bears amass high concentrations of the contaminant.

Although that much is known, the details of how mercury moves through different food webs---particularly in the Arctic, where snow and ice contribute to mercury deposition---are not well understood. To tease out that information, Horton, Blum and co-workers studied polar bear hair

samples from museum specimens collected in the late 19th and early 20th centuries, before mercury emissions from human-generated sources began to escalate.

By looking at three chemical signatures---nitrogen isotopes, carbon isotopes and mercury concentrations---the researchers learned that polar bears get their nutrition (and mercury) from two main food webs. At the base of one web are microscopic plants that float on the surface of the ocean (known as phytoplankton). The foundation of the second web is algae that live on sea ice.

The study showed that polar bears that get most of their nutrition from phytoplankton-based food webs have greater mercury concentrations than those that participate primarily in ice algae-based webs.

While it's tempting to speculate that declining sea ice, due to global warming, may force polar bears to depend more on phytoplankton-based webs, thus increasing their mercury exposure, the study doesn't directly address that issue. It does, however, provide other useful information, said Blum, who is the John D. MacArthur Professor of Geological Sciences and a professor of ecology and evolutionary biology.

"If you want to understand the potential effects of changing ecosystems on polar bears, you need to be aware of the existence of these two food webs, which may possibly be affected by sea ice," Blum said. "This work provides background information that will be important in our in-depth understanding of mercury bioaccumulation in polar bears."

More information: Polar Research: www.wiley.com/bw/journal.asp?ref=0800-0395

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