Polar bears experience limited energy savings in summer, new study finds

July 16 2015

A young polar bear on pack ice over deep waters in the Arctic Ocean, October 2009. Credit: Shawn Harper

Polar bears are unlikely to physiologically compensate for extended food deprivation associated with the ongoing loss of sea ice, according to one-

of-its-kind research conducted by University of Wyoming scientists and others, and published today in the journal *Science*.

"We found that polar bears appear unable to meaningfully prolong their reliance on stored energy, confirming their vulnerability to lost hunting opportunities on the sea ice—even as they surprised us by also exhibiting an unusual ability to minimize heat loss while swimming in Arctic waters," says John Whiteman, the UW doctoral student who led the project.

The loss of sea ice in the Arctic, which is outpacing predictions, has raised concern about the future of polar bears, leading to their listing as a globally threatened species under the U.S. Endangered Species Act in 2008. The bears depend on hunting seals on the surface of the sea ice over the continental shelf, most successfully from April to July. In parts of the polar bears' range, the lengthening period of sea ice retreat from shelf waters—caused by increasing temperatures—can reduce their opportunities to hunt seals, leading to declines in bear nutritional condition.

Some earlier research suggested that polar bears could, at least partially, compensate for longer summer food deprivation by entering a state of lowered activity and reduced metabolic rate similar to winter hibernation—a so-called "walking hibernation." But the new research shows that the summer activity and body temperature of bears on shore and on ice were typical of fasting, non-hibernating mammals, with little indication of "walking hibernation."

Researchers Hank Harlow, left, and John Whiteman, right, collect a breath sample from a polar bear on pack ice in October 2009. Credit: Daniel Cox

Whiteman and his colleagues concluded in the *Science* publication: "This suggests that bears are unlikely to avoid deleterious declines in body condition, and ultimately survival, that are expected with continued ice loss and lengthening of the ice-melt period."

The researchers reached that conclusion by capturing more than two dozen polar bears, implanting temperature loggers and tracking their subsequent movements on shore and on ice in the Arctic Ocean's Beaufort Sea, north of Alaska and Canada, during 2008-2010. The unprecedented effort, logistically supported by the U.S. Geological Survey (USGS) and funded by the National Science Foundation, USGS,

U.S. Fish and Wildlife Service (USFWS), as well as the Environmental Protection Agency, required the assistance of numerous personnel, multiple helicopters and deployment of the U.S. Coast Guard ice-breaker, the Polar Sea.

"Many colleagues—even some on our research team—doubted whether the study was possible, until we actually did it," says Merav Ben-David, the UW professor who developed the research plan along with Professor Hank Harlow, an eco-physiologist and colleague in the Department of Zoology and Physiology, and Steve Amstrup, previously with the USGS and currently the chief scientist at Polar Bears International. "This project was logistically so intense that it may never be replicated."

At the same time, the scientists found that polar bears use an unusual physiological response to avoid unsustainable heat loss while swimming in the cold Arctic waters. To maintain an interior body temperature that allows them to survive longer and nowadays more frequent swims, the bears temporarily cool the outermost tissues of their core to form an insulating shell—a phenomenon called regional heterothermy.

"This regional heterothermy may represent an adaption to long-distance swims, although its limits remain unknown," wrote the scientists, who in an earlier publication—in the journal *Polar Biology*—noted that one of the bears in the study survived a nine-day, 400-mile swim from shore to ice. When recaptured seven weeks later, the bear had lost 22 percent of her body mass, as well as her cub.

By shedding light on potential mechanisms that facilitated that bear's survival during her long swim, as well as the overall metabolism and activity of bears, the current study "profoundly contributes to understanding the value of summer habitats used by polar bears in terms of their energetics," Harlow says. Amstrup adds, "It fills a gap in our otherwise extensive knowledge of polar bear ecology and corroborates

previous findings that the key to polar bear conservation is arresting the decline of their sea ice habitat."

More information: Summer declines in activity and body temperature offer polar bears limited energy savings, www.sciencemag.org/lookup/doi/ … 1126/science.aaa8623

Provided by University of Wyoming