Arctic sea ice loss impacts beluga whale migration

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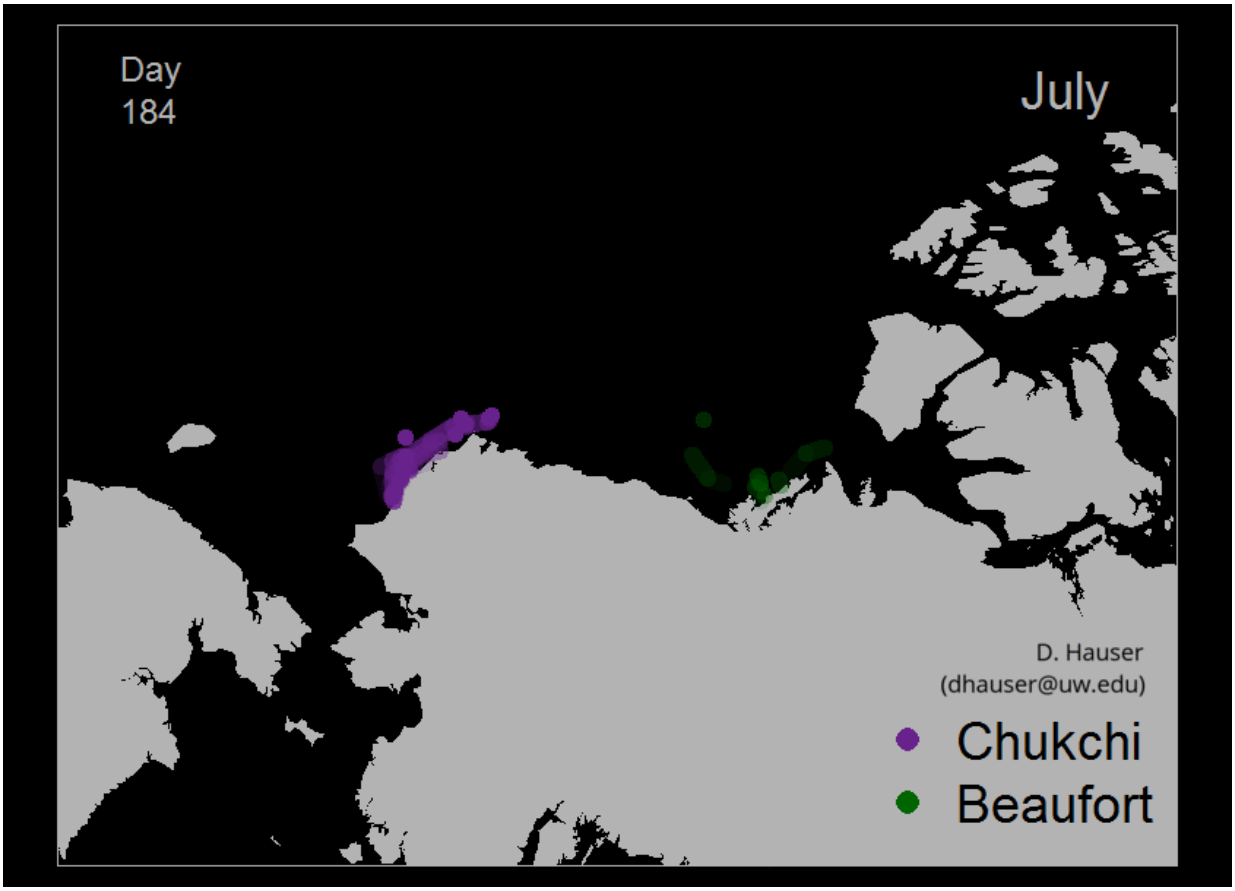

Daily locations of Eastern Chukchi Sea ('Chukchi') and Eastern Beaufort Sea ('Beaufort') beluga whales tagged from 1993-2007. See Hauser et al. (2014) for details and full credits. Data were collected in collaboration with the Alaska Beluga Whale Committee, North Slope Borough, Village of Point Lay, Alaska Department of Fish & Game, National Marine Fisheries Service (Chukchi whales) as well as Fisheries & Oceans Canada and villages in the Inuvialuit Settlement Region (Beaufort whales). Credit: Donna Hauser/University of

The annual migration of some beluga whales in Alaska is altered by sea ice changes in the Arctic, while other belugas do not appear to be affected.

A new study led by the University of Washington finds that as Arctic sea ice takes longer to freeze up each fall due to climate change, one population of belugas mirrors that timing and delays its migration south by up to one month. In contrast, a different beluga population, also in Alaska, that migrates and feeds in the same areas doesn't appear to have changed its migration timing with changes in sea ice.

The paper was published Dec. 21 in the journal *Global Change Biology*.

"The biggest take-home message is that belugas can respond relatively quickly to their changing environment, yet we can't expect a uniform response across all beluga populations," said lead author Donna Hauser, a postdoctoral researcher at the UW's Polar Science Center.

"If we're trying to understand how these species are going to respond to climate change, we should expect to see variability in the response across populations and across time," Hauser said. "That may complicate our predictions for the future."

Two genetically distinct beluga populations spend winters in the Bering Sea, then swim north in the early summer as sea ice melts and open water allows them passage into the Beaufort and Chukchi seas. There they feast all summer on fish and invertebrates before traveling back south in the fall. Other research suggests the whales are taught by their mothers when to migrate and which route to take, so it was unclear if

belugas would be responsive to sea ice changes.

Beluga whale pod in the Chukchi Sea. Credit: Vicki Beaver/North Slope Borough

The Chukchi beluga population's response to follow sea ice timing and delay migration likely means the whales are opportunistically feeding later into the fall, but researchers don't yet know if that delay is overall beneficial. On one hand, the whales might be gaining valuable food resources, but they also risk getting blocked from their migration path south if the ice quickly freezes up and catches them off guard.

In contrast, the Beaufort beluga population's apparent indifference to sea

ice timing is surprising, Hauser said, given that both populations frequent many of the same feeding areas and otherwise appear to have similar life histories. Perhaps the Beaufort whales have a tradition of feeding elsewhere that requires they move away earlier in the fall, regardless of sea ice characteristics, she explained.

"This all suggests that beluga whales can respond to their changing Arctic conditions, although all populations will not necessarily respond the same," Hauser said.

Very few studies exist on beluga whales, a marine mammal that lives in some of the Earth's harshest conditions. Analyses on their body condition or population trajectories will need to take place before researchers can say whether their response—or lack thereof—to environmental change is beneficial or detrimental to the health of the populations.

Researchers, however, note that when they do see changes, they are happening quickly—within a 10-year span for whales that often live to be over 60 years old. That means migration patterns that are inherited over generations are changing within the lifespans of multiple generations of whales, Hauser said.

A beluga whale surfaces for air. Credit: Kate Stafford/University of Washington

In this study, the researchers used migration data collected intermittently from two different periods—referred to in the paper as "early" and "late"—for both populations, corresponding roughly to the 1990s and 2000s decades. Satellite-linked tags attached to the whales tracked their movements around and away from the high Arctic feeding grounds.

They also used acoustic data from two underwater hydrophones that recorded the vocalizations of marine mammals each day for about six years. The social signals—an assortment of squeaks, whistles and cries—told researchers when belugas were present up to about 3 miles from the instrument. The use of underwater microphones is a good way

to detect belugas in their dark, icy environment, said Kate Stafford, a co-author and oceanographer at the UW's Applied Physics Laboratory who uses the underwater microphones to study a range of animals in the Arctic.

These two datasets let the researchers track exactly when belugas passed certain key points along their fall migration, then correlate those days to regional sea ice information.

"One of the predictions of climate change is animals are going to change their seasonal presence in a region," Stafford said. "This study shows that at least one population of belugas might be adapting to rapid changes in its environment. We can't be sure, but this study is a start in documenting how an Arctic species is reacting to these changing conditions."

More information: Donna D. W. Hauser et al, Decadal shifts in autumn migration timing by Pacific Arctic beluga whales are related to delayed annual sea ice formation, *Global Change Biology* (2016). DOI: 10.1111/gcb.13564

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