As sea ice declines in the Arctic, bowhead whales are adjusting their migration patterns

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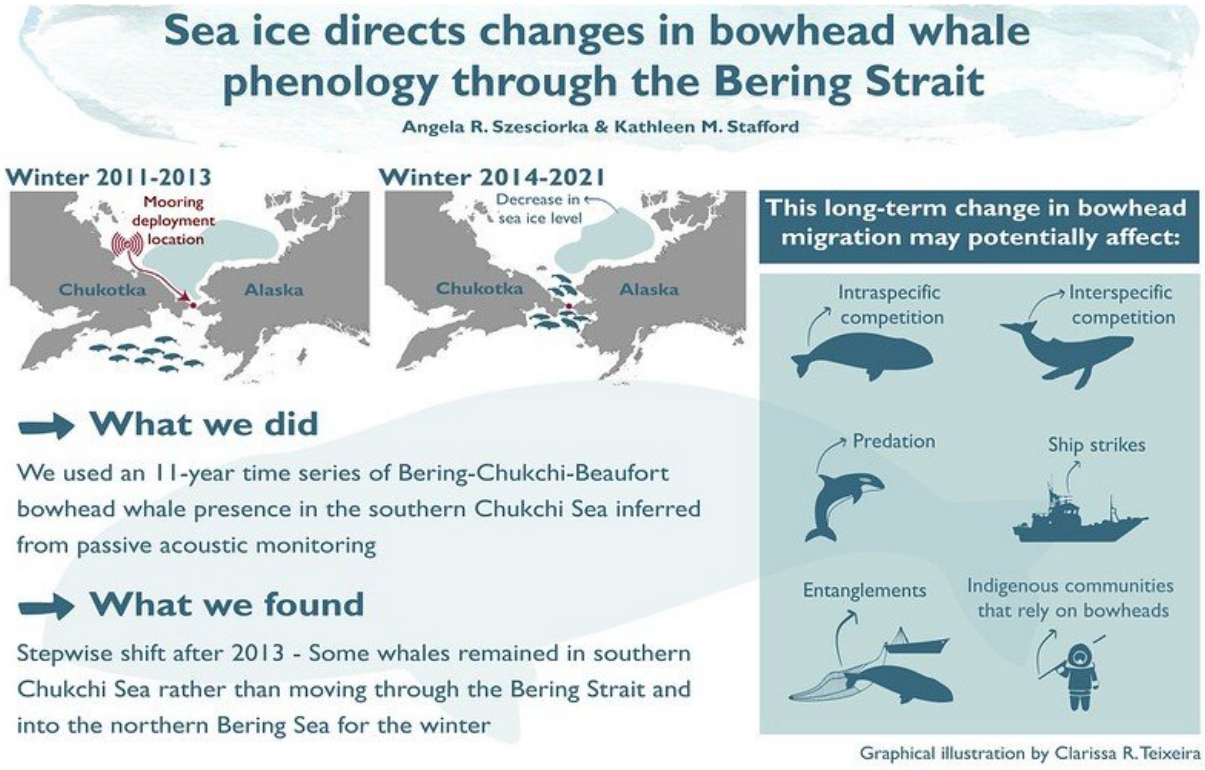

Findings of bowhead whale research. Credit: Clarissa R. Teixeira

As sea ice declines in the Arctic, bowhead whales are staying north of the Bering Strait more frequently, a shift that could affect the long-term health of the bowhead population and impact the Indigenous communities that rely on the whales, a new study by Oregon State

University researchers shows.

Bowhead whales found in the Pacific Arctic, sometimes called Bering-Chukchi-Beaufort bowheads based on their migratory patterns, normally winter in the northern Bering Sea and migrate north in the spring through the Bering Strait to the Canadian Beaufort Sea, where they spend summer and fall. They then migrate south again through the Strait for the winter.

The migration essentially follows the sea ice south through the Bering Strait, which would close up as ice formed in the Chukchi Sea. But warming temperatures in the Arctic over the past decade have led to sea ice decline and kept the Bering Strait open increasingly into the winter months, said the study's lead author, Angela Szesciorka, a research associate with Oregon State's Marine Mammal Institute.

"The lack of ice means they are losing this critical habitat, and as a result, we're seeing that these whales are not leaving the Arctic anymore for the winter," Szesciorka said. "Without that ice, there could be changes in bowhead availability for the Indigenous people who rely on the whales. The lack of ice also opens the door for other species to move into the Arctic, resulting in competition for resources, potential predation and increased human interaction due to ship strikes or entanglement in fishing gear."

The findings were just published in the journal *Movement Ecology*.

Bowhead whales are a species of baleen whale and the only one that lives year-round in Arctic and subarctic waters; the subarctic is the region just south of the Arctic. They use their large skulls to break through sea ice up to 18 inches thick, feed on zooplankton such as copepods and krill, and can reach up to 200,000 pounds and 62 feet in length. They are believed to have a lifespan of up to 200 years.

Commercial whaling in the 1800s and early 1900s decimated the population found in the Pacific Arctic, and bowheads have been listed as endangered under the federal Endangered Species Act since the 1970s. The species has rebounded to about 25,000 whales across four populations in the Arctic, including the Bering-Chukchi-Beaufort group studied by the researchers.

"That group is largest of the four bowhead populations and it appears to be growing," said co-author Kathleen Stafford, an associate professor at the Marine Mammal Institute, part of OSU's College of Agricultural Sciences and based at the Hatfield Marine Science Center in Newport.

Sea ice is believed to play an important role in the bowheads' survival. Slow-moving animals may use sea ice as shelter from potential predators, and the ice-covered water might also lend itself to improved communication among the individuals, Stafford said.

But in the Arctic, sea ice has decreased about 13% per decade since 1979, and near surface air temperatures have risen four times faster than the global average in that time. Once perennial, the sea ice in the Chukchi is now considered annual—meaning the ice is no longer surviving through the melt season.

Three bowhead whales breathing near ice. Credit: Kate Stafford, Marine Mammal Institute, Oregon State University

To better understand what that means for bowhead whales, Szesciorka and Stafford analyzed 11 years of recordings of bowhead whale calls and songs to track how the whales' movements have changed as sea ice has declined.

The recordings, made between 2009 and 2021, were collected using passive acoustic monitoring devices placed in the Chukchi Sea near the entrance of the Bering Strait. The devices also captured noise from passing vessels.

"Bowheads make a number of non-singing calls, but in the fall, winter and into spring, they are singing," Szesciorka said. "We think it's the males who are singing, and that the songs are for courtship purposes. They sing many different songs and they don't tend to repeat. It's

beautifully complex."

Analysis of the whales' calls and songs, coupled with information about sea ice and weather conditions, indicated that the bowheads' fall migration to the Bering Sea was delayed in years when there was less sea ice and that some whales are wintering instead in the southern Chukchi Sea.

"The Strait is the only gateway between the Arctic and the Pacific—anything going between the two has to pass through there, like a turnstile," Stafford said. "Not all of the bowheads are passing through this turnstile anymore."

The researchers also found that spring northward migration was earlier in years when there was less sea ice. Indigenous Traditional Knowledge also suggests that less ice and more open water has shifted the timing of the spring migration by about a month. Those changing migration patterns could impact the Indigenous communities that rely on bowhead whales for nutritional, cultural and spiritual subsistence, the researchers said.

"Bowheads have been hunted for millennia by Arctic peoples, but in the fall of 2019, there were no whales in reach of Indigenous hunters in Utqiagvik, Alaska," Stafford said. "That has the potential to decrease food security in these communities, and that is problematic."

The lack of sea ice also means that the "turnstile" at the Bering Strait is open to potential predators such as killer whales and to commercial vessels that have not previously overlapped into bowhead whale territory in the winter.

"There are some big questions for future study: Will bowheads be at increased risk of ship strikes or fishing gear entanglement if the lack of

sea ice leads to increased fishing or other ship traffic? Bowheads aren't typically around vessels, and they may not know how to respond," Szesciorka said.

"This change is happening very quickly, and it is unclear what the potential impacts might be as the Arctic continues to warm."

More information: Angela R. Szesciorka et al, Sea ice directs changes in bowhead whale phenology through the Bering Strait, *Movement Ecology* (2023). DOI: 10.1186/s40462-023-00374-5

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