

Martin MJ, Halliday WD, Citta JJ, Quakenbush L, Harwood L, Lea EV, Dawson J, Nicoll A, Insley SJ (2023) Exposure and behavioural responses of tagged bowhead whales (*Balaena mysticetus*) to vessels in the Pacific Arctic. *Arctic Science* 9: 600-615.

What is the research about?

- Increases in ship traffic due to climate change will cause increases in underwater noise pollution in the Arctic. Bowhead whales are an Arctic resident species, which rely on sound to communicate. Their sounds overlap in the same frequency band with vessel noise.
- Bering–Chukchi–Beaufort (BCB) bowhead whales migrate through areas with the highest levels of vessel traffic in the Pacific Arctic. This puts the whales at risk of vessel strike, high noise exposures, and many other potential threats that could harm the population.

What we did:

- We developed a method to document the overlap in space and time between 25 satellite-tagged BCB bowhead whales and vessels in the Pacific Arctic during July–December, 2012–2018.
- The current study reports locations from satellite tagged BCB bowhead whales in conjunction with vessel locations derived from satellite Automatic Identification System (AIS) data, and summarizes the number of vessels encountered by tagged individual whales. We also estimated changes in swim speed to investigate individual whale behavioural responses to vessel approaches within a 50 km radius (18 encounters).
- We provide a map of potential hotspot locations for BCB bowhead whale close encounters with vessels in the Pacific Arctic.

What we found:

- We report 1,332 occasions when a vessel was within 125 km of a tagged whale during July–December, 2012–2018.
- Bowhead whales were not observed to alter swim speed within 8–50 km of vessels (we could not assess distances less than 8 km). Our results suggest that bowhead whales did not exhibit detectable long-range (i.e., up to 50 km) behavioural responses to vessels, consistent with observations of closely related North Atlantic right whales (*Eubalaena glacialis*), for which vessel strikes are a leading cause of mortality.

Our recommendations:

- Future studies are required to assess how bowhead whales react to vessels at closer distances (i.e., less than 8 km).
- Future analysis using tag technology that contains 3-D movement and acoustic recorders would provide the opportunity to examine changes in the acoustic behavior of bowheads, identify the acoustic signature, received level and exact time when vessel noise is received at the whale, and ultimately allow a

more in-depth examination of bowhead behavioral response to the type and received level of vessel noise and other sounds.

Why is the research relevant to the Inuvialuit people?

- Marine mammals are an important food source for communities in the Canadian Arctic.
- Bowhead whales are of cultural and ecological importance to the Inuvialuit.
- It is important to understand how increasing vessel presence could negatively affect the behavior and population status of bowhead whales and therefore have an impact on the Inuvialuit people who rely on them.

Was the community involved?

- Yes. Bowhead whale telemetry data were collected by the Alaska Department of Fish and Game working with the Alaska Eskimo Whaling Commission, Alaska Native subsistence whalers, the North Slope Borough, DFO, and members of the Tuktoyaktuk and Aklavik Hunters and Trappers Committees, NT, Canada.