

# Beluga whales' calls may get drowned out by shipping noise in Alaska's Cook Inlet

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Beluga whales photographed in August 2021 in Cook Inlet, Alaska. The population was most recently estimated at just 331 animals. A first description of this population's vocal repertoire shows that many of the most common calls are masked by shipping noise. Credit: Ariel Brewer/University of Washington

Beluga whales are highly social and vocal marine mammals. They use

acoustics to navigate, find prey, avoid predators and maintain group cohesion. For Alaska's critically endangered Cook Inlet beluga population, these crucial communications may compete with a cacophony of noise from human activities.

New research from the University of Washington, the National Oceanic and Atmospheric Administration's Alaska Fisheries Science Center, and the Alaska Department of Fish and Game is the first to document the complex vocal repertoire of the Cook Inlet [beluga](#) whale population. It is also the first to quantify how ship noise may be masking specific beluga calls in this region.

The [study](#), published in the *Journal of the Acoustical Society of America*, finds 41 distinct types of calls, of which 18 are unique to this population. It also finds that commercial ship noise completely masks these whales' most commonly used calls.

"The core critical habitat for these whales is a very noisy area. Commercial shipping, an international airport, military operations and gas and oil exploration are all concentrated there," said lead author Ariel Brewer, a doctoral student in the School of Aquatic and Fishery Sciences at the UW who did the work in collaboration with NOAA Fisheries' Alaska Fisheries Science Center.

"A fundamental knowledge gap for the Cook Inlet beluga population is how they communicate important information. The first step is to describe their vocal repertoire," she added. "With that information, we can begin to understand if their communication is impacted by human-caused noise."

Twenty-one populations of belugas are recognized worldwide, including five distinct populations in Alaska. The geographically and genetically isolated Cook Inlet beluga population is the smallest, recently estimated

at just 331 individuals. Cook Inlet [beluga whales](#) live exclusively in their namesake waters alongside Anchorage, the state's largest city and busiest port.

The Cook Inlet beluga whale population was listed as endangered under the Endangered Species Act in 2008. A 2016 recovery plan ranked three threats as the highest level of concern, one being human-caused noise. Commercial shipping is the most prominent noise source within Cook Inlet, particularly in the upper inlet, where most of the federally designated critical habitat is located.

"All of that human-caused noise means the belugas may not hear critical communications from each other, such as predator alarm calls or a mother calling to her calf," Brewer said.

While all whales are affected by noise, Cook Inlet belugas may be particularly vulnerable to noise as a stressor.

"Cook Inlet is extremely turbid year-round from glacial runoff. It looks like chocolate milk," Brewer said. "Acoustic communication is extremely important for this population since visibility is so poor. And, unlike other, higher-Arctic beluga populations, this population is non-migratory, so they are exposed to this noise year-round."

Cook Inlet's extreme turbidity, dramatic tides, rapid currents, and seasonal ice cover make it an extremely challenging place to study belugas. One way scientists can monitor these highly vocal whales is through sound.

The Cook Inlet Beluga Acoustics Program has been deploying bottom-mounted passive acoustic recorders to monitor belugas and human-caused noise since 2008. The study focused on recordings of beluga whale calls from 2018 to 2019.





Cook Inlet beluga mother and calf in turbid, or cloudy, waters. Credit: Paul Wade/NOAA Fisheries

"Until now, we did not have a quantified measure of masking by ship noise on Cook Inlet beluga communication. We knew this was a potential disturbance mechanism to focus our research efforts, but we were lacking a good understanding of what vocalizations are most important for beluga," said co-author Manuel Castellote, a research scientist at the UW-based Cooperative Institute for Climate, Ocean, and Ecosystem Studies who manages the acoustics program.

"This study provides the first two steps in this direction: We now have a solid understanding of key vocalizations for this population and how

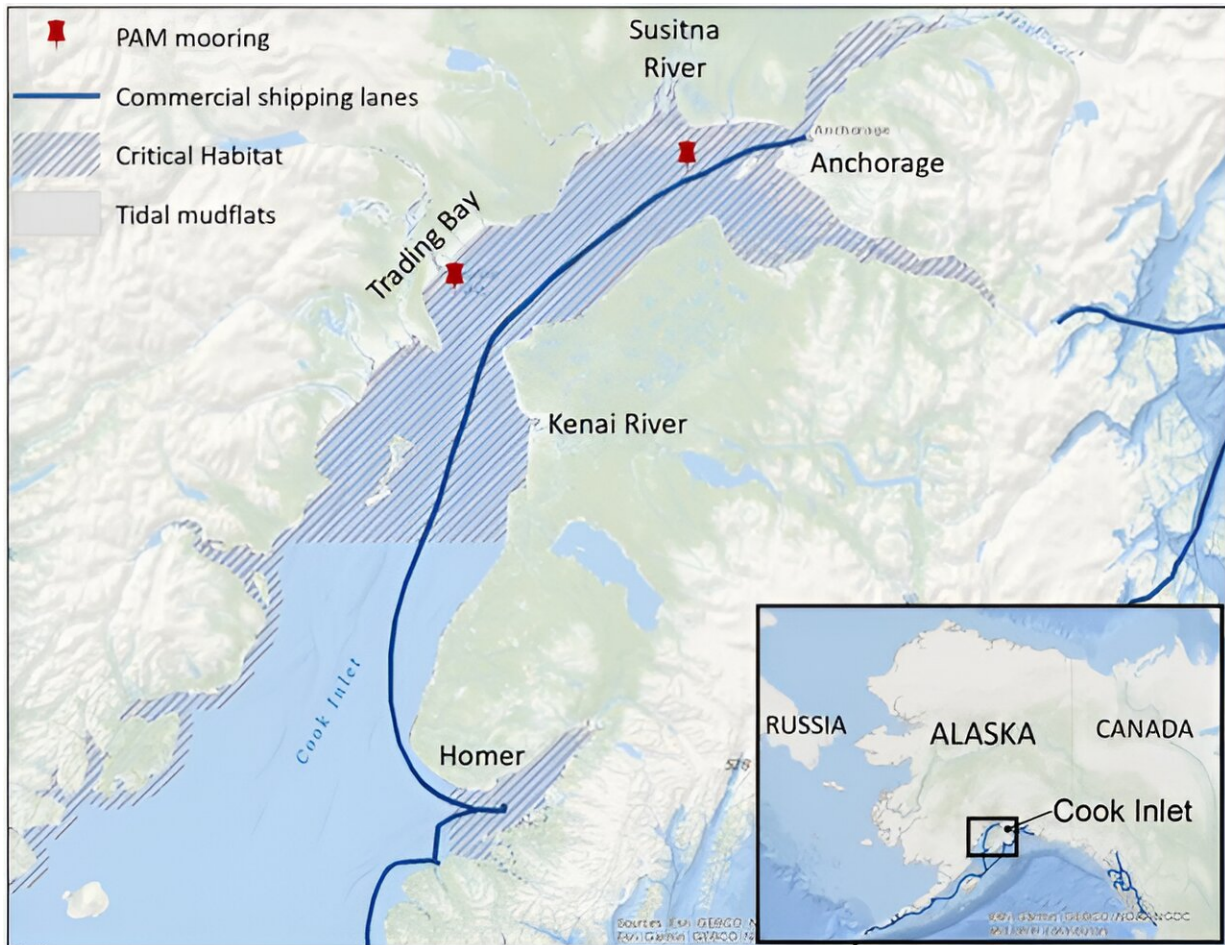
each ship transit is affecting beluga vocal exchange in the core area of their critical habitat."

For the new study, scientists analyzed recordings at two [critical habitat](#) locations: Susitna River, just outside of Anchorage, and Trading Bay, farther out in the inlet.

They classified beluga vocalizations into three broad categories—whistles, pulsed calls and combined calls—and then further into 41 unique call types.

"I've spent thousands of hours listening to this population. Anytime I find a new call type, it's really exciting," Brewer said, "Eavesdropping on their world is really fascinating."

The study found that the Cook Inlet beluga population, like other beluga populations, has a rich and complex repertoire. Vocal repertoire has been documented for eight of the 21 populations of belugas worldwide. Results from this study support the hypothesis that some call types are shared across populations while others are unique.



Map of Cook Inlet, Alaska, with red pins where underwater recordings used for this study. Stripes show Cook Inlet beluga whale critical habitat, and the blue line shows designated Port of Alaska commercial shipping lanes. Credit: Kim Shelden/NOAA Fisheries

Of the 41 types of calls the authors documented in the Cook Inlet population, 18 were not documented in any other population; 16 were documented in some but not all of the previously studied populations, and seven were common to all populations studied so far.

"Differences in vocal repertoire among different beluga populations may



be driven by unique evolutionary, environmental or cultural influences," Brewer said. "The divergence of the Cook Inlet vocal repertoire may be in part due to the [population](#)'s long-term geographic and genetic isolation."

The researchers next looked at how the most commonly-used call types may be masked by human-caused noise. They focused on commercial ship noise, which is the most prominent noise type in Cook Inlet.

The analysis found that all seven of the most commonly used call types in the Cook Inlet beluga vocal repertoire were partially masked by the time a commercial ship was within about 10 miles (17 kilometers) of the study site. Calls were completely masked when the vessel was closest to the site during the transit through the designated shipping lanes.

Roughly 486 commercial ships use the Port of Alaska annually, with an average of 8-10 ships coming and going per week. It is estimated that each ship passage will mask beluga communication at the study site for 1 hour and 50 minutes on average.

"Our results suggest that every time a commercial vessel transits through the Port of Alaska shipping lanes, Cook Inlet beluga communication could be heavily impacted within their core habitat," Brewer said.

"Humans are such a visual species. It's hard for us to comprehend how noisy it is under the surface of the ocean and how much [noise](#) impacts marine mammals such as belugas. We hope our findings will lead to further studies to better inform management about these types of human-caused impacts."

**More information:** Ariel M. Brewer et al, Communication in Cook Inlet beluga whales: Describing the vocal repertoire and masking of calls by commercial ship noise, *The Journal of the Acoustical Society of*

*America* (2023). [DOI: 10.1121/10.0022516](https://doi.org/10.1121/10.0022516)

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