Thanks to humans, Salish Sea waters are too noisy for resident orcas to hunt successfully

September 10 2024, by James Urton

A northern resident orca initiates a dive while wearing a Dtag temporarily stuck to its back by neoprene suction cups. The waterproof tag contains two underwater microphones, pressure and temperature sensors, triaxial accelerometers and magnetometers to help researchers understand how orcas move through the water and interact with their environment. Image taken under NOAA permit. Credit: Brianna Wright/Fisheries and Oceans Canada

The Salish Sea—the inland coastal waters of Washington and British Columbia—is home to two unique populations of fish-eating orcas, the northern resident and the southern resident orcas. Human activity over much of the 20th century, including reducing salmon runs and capturing orcas for entertainment purposes, decimated their numbers. This century, the northern resident population has steadily grown to more than 300 individuals, but the southern resident population has plateaued at around 75. They remain critically endangered.

New research led by the University of Washington and the National Oceanic and Atmospheric Administration has revealed how underwater noise produced by humans may help explain the southern residents' plight. In a paper published Sept. 10 in *Global Change Biology*, the team reports that underwater noise pollution—from both large and small vessels—forces northern and southern resident orcas to expend more time and energy hunting for fish.

The din also lowers the overall success of their hunting efforts. Noise from ships likely has an outsized impact on southern resident orca pods, which spend more time in parts of the Salish Sea with high ship traffic.

"Vessel noise negatively impacts every step in the hunting behavior of northern and southern resident orcas: from searching, to pursuing and finally capturing prey," said lead author Jennifer Tennessen, a senior research scientist at the UW's Center for Ecosystem Sentinels, who began this study as a postdoctoral researcher with NOAA's Northwest Fisheries Science Center.

"It shines a light on why southern residents in particular have not recovered. One factor hindering their recovery is availability and accessibility of their preferred prey: salmon. When you introduce noise, it makes it even harder to find and catch prey that is already hard to find."

Northern and southern resident orcas search for food via echolocation. Individuals transmit short clicks through the water column that bounce off other objects. Those signals return to orcas as echoes that encode information about the type of prey, its size and location. If the orcas detect salmon, they can initiate a complex pursuit and capture process, which includes intensified echolocation and deep dives to try to trap and capture fish.

The team—which also includes scientists at Fisheries and Oceans Canada, Wild Orca, the Cascadia Research Collective and the University of Cumbria in the U.K.—analyzed data from northern and southern resident orcas, whose movements were tracked using digital tags, or "Dtags." The cellphone-sized Dtags, which attach noninvasively just below an orca's dorsal fin via suction cups, collect data on three-dimensional body movements, position, depth and other environmental data including—critically—the sound levels at the whales' locations.

"Dtags are a critical innovation for us to understand firsthand the environmental conditions that resident orcas experience," said Tennessen. "They open a window into what orcas are hearing, their echolocation behavior and the very specific movements they initiate when they hunt for prey."

The researchers analyzed data from 25 Dtags placed on northern and southern resident orcas for several hours on specific days from 2009 to 2014. The team's deep dive into Dtag data showed that vessel noise, particularly from boat propellers, raised the level of ambient noise in the water. The increased noise interfered with the orcas' ability to hear and interpret information about prey conveyed via echolocation. For every additional decibel increase in maximum noise levels around orcas, the researchers observed:

- An increased chance of male and female orcas searching for prey

- A lower chance of females pursuing prey
- A lower chance that both males and females would actually capture prey

Dtags also recorded "deep dive" hunting attempts by orcas. Out of 95 such attempts, most occurred in low or moderate noise. But six deep-hunting dives occurred in particularly loud settings, only one of which was successful.

The team found that noise had a disproportionately negative impact on females, who were less likely to pursue prey that had been detected during noisy conditions. Dtag data did not indicate the reason, though potential explanations include a reluctance to leave vulnerable calves at the surface while engaging prey in long chases that may not be fruitful, and the pressure for lactating females to conserve energy.

Though southern resident orcas often share captured prey with one another, the impact of noise may contribute to nutritional stress among females, which previous research has linked to high rates of pregnancy failure among southern residents.

Reducing vessel speeds leads to quieter waters for the orcas. Both sides of the U.S.-Canada border include voluntary speed-reduction programs for vessels: the Echo Program, initiated in 2014 by the Vancouver Fraser Port Authority, and Quiet Sound, launched in 2021 for Washington state waters. But reducing noise is only one factor in saving southern resident orcas and helping northern residents continue to recover.

"When you factor in the complicated legacy we've created for the resident orcas—habitat destruction for salmon, water pollution, the risk of vessel collisions—adding in noise pollution just compounds a situation that is already dire," said Tennessen. "The situation could be turned around, but only with great effort and coordination on our part."

More information: Jennifer B. Tennessen et al, Males miss and females forgo: Auditory masking from vessel noise impairs foraging efficiency and success in killer whales, *Global Change Biology* (2024). DOI: 10.1111/gcb.17490

Provided by University of Washington