Ship noise extends to frequencies used by endangered killer whales

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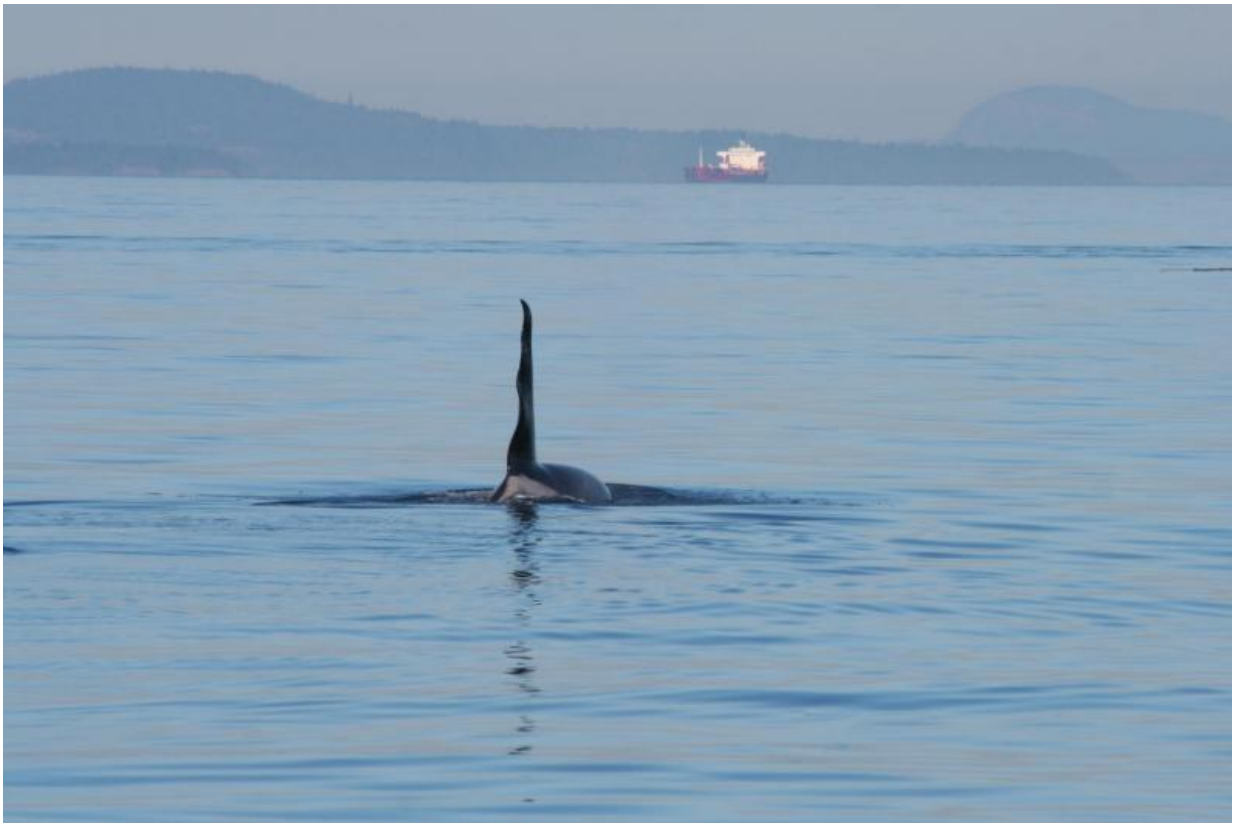

The male orca "Ruffles" uses echolocation to find his favorite food -- Chinook salmon -- as a tanker approaches him in Haro Strait, WA, USA. Credit: beamreach.org

When an endangered *orca* is in hot pursuit of an endangered salmon,

sending out clicks and listening for their echoes in the murky ocean near Seattle, does the noise from the nearby shipping lane interfere with them catching dinner? To find out scientists measured underwater noise as ships passed their study site 3,000 times. This unprecedented characterization of ship noise will aid in the understanding of the potential effects on marine life, and help with possible mitigation strategies.

One of the threats faced by today's oceans is underwater noise pollution from ships. Amazingly, the growth in commercial shipping has raised the intensity of low-frequency noise almost 10-fold since the 1960s. Because this noise occurs at the low frequencies used by baleen whales there is growing evidence it may impact their ability to communicate, and therefore their survival. But could ship noise extend to the higher frequencies used by toothed whales and therefore pose similar threats to them?

To answer this question and understand the nature of ship noise, particularly in coastal areas where ships access ports, scientists measured approximately 1,600 unique ships as they passed through Haro Strait, in Washington State. This area is the core critical habitat for the endangered Southern Resident killer whales—salmon-eating *orcas* which are iconic in the Pacific Northwest and which support a multi-million dollar ecotourism industry in the U.S. and Canada.

Because these *orcas*, like other toothed whales, use mid-and high-frequencies to communicate and find their prey, the study measured a wide range of frequencies (10 Hz to 40,000 Hz). The results show that ships are responsible for elevated background noise levels not only at low frequencies as expected, but also at medium and higher frequencies (including at 20,000 Hz where killer whales hear best). This means that in coastal environments where marine mammals live within a few kilometers of shipping lanes, ship noise has the potential to interfere

with both communication and echolocation.

Two endangered Southern Resident killer whales rise in unison from the Salish Sea as a tanker passes through their critical habitat along the Canada-US border. Credit: beamreach.org

The study is unique because it estimates the source levels of larger populations and more classes of ships than in previous studies. Overall, container ships exhibited the highest median source levels (at all frequencies below 20,000 Hz). Military vessels had some of the lowest levels, suggesting that transfer of quieting technology to the commercial sector could be a successful noise mitigation strategy.

The study shows that another potential way to reduce noise pollution is to simply slow down. The data suggest that, on average, each reduction in a ship's speed by 1 knot could reduce broadband noise levels by 1 dB.

More information: Veirs et al. (2016), Ship noise extends to frequencies used for echolocation by endangered killer whales. *PeerJ* 4:e1657; DOI: 10.7717/peerj.1657

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