Marine invertebrates have noisy human neighbors

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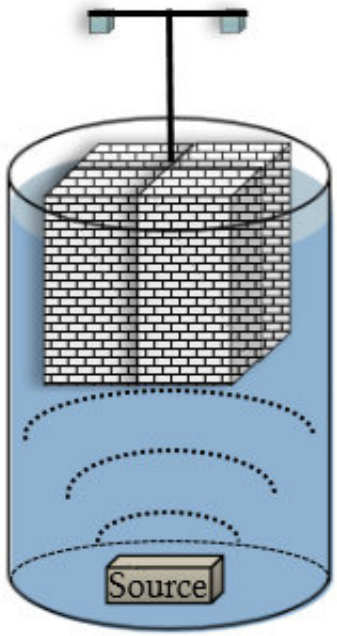

Standing wave tube design. Credit: J.S. Krumholtz, D.M. Hudson, D.L. Pochtar, N.C. Dickenson, G.A. Dossot, E.B. Baker, T.E. Moll

Just like humans, marine life experiences constant stress. They face threats of competition, the fear of predation and a growing list of anthropogenically induced stressors. Humans have contributed to rising ocean temperatures, increases in pollution, ocean acidification and growing pressures from the seafood industry. Similar to the way humans experience elevated levels of stress when exposed to loud or impulsive

noise, marine invertebrates are impacted by the rising levels of underwater noise produced by their intrusive human neighbors.

According to a recent United Nations study, approximately 40% of the global population lives within 100 km of the coastline. As human life continues to expand and develop along the ocean waters, ecological conservation and environmental protection become mere afterthoughts. The production of underwater noise is not only difficult to control, but the direct effect on marine invertebrates can be challenging to observe or measure.

Researchers Georges Dossot, Jason Krumholtz, David Hudson and Darby Pochtar, working in collaboration with the Naval Undersea Warfare Center, will present results from a Navy-funded study on the use of a standing wave tube to simulate and measure the effects of anthropogenic noise on marine invertebrates at the 174th Meeting of the Acoustical Society of America, being held Dec. 4-8, 2017, in New Orleans, Louisiana.

The team focused their efforts on crustaceans, an important invertebrate for commercial fishing, to determine how these marine creatures could be impacted by naval Ships. "All testing and training conducted by the Navy undergoes rigorous environmental review assessing the potential for negative impact on biota from things such as vessel noise and SONAR use, but the impact of these activities on invertebrates is not well studied," said Krumholtz.

To assess the impacts of anthropogenic noise the researchers used a standing wave tube approach. The tube creates a uniform sound field, while mimicking the natural environment of invertebrate and also allowing for simultaneous experimentation with multiple invertebrates per trial. Blue crabs and American lobsters were exposed to low-frequency boat noise and mid-frequency sonar, and their behavior was

studied for a period of seven days. Behavioral and physiological responses were assessed, along with measurements of acoustic pressures and particle motion.

"The experimental setup turned out to be a unique compromise between acoustic factors and biologic factors," said Dossot. The noise exposure remained strictly acoustic, avoiding vibrations, by hanging an enclosure over the sound source. A normal marine environment was maintained inside the enclosure to ensure that invertebrates demonstrated typical behaviors. Measurements of acoustic particle acceleration fields were done using prototype vector-sensors to detect pressures and particle motion.

The simulated sonar exposure was found to physiologically impact both the blue crabs and the lobsters. "What this means is that even though they can't 'hear' this mid-frequency sonar signal, it may be having impacts on them through their general physiological stress response," said Hudson. There were also observed behavioral impacts on both species: "Exposed animals exhibited increased aggressive behaviors, and reduced feeding relative to controls."

This research can help inform effective environmental permitting for naval activities in coastal areas. Additionally, "although not the primary target of the study, the results are also pertinent to the maritime shipping and commercial fishing industries, and may be of interest in considering impacts of coastal developments such as pile driving, bottom surveys, or wind farms," said Dossot.

More information: Abstract: 3aAB6: "Simulated anthropogenic noise exposure to marine invertebrates using a standing wave tube," by Georges Dossot, Jason Krumhotz, David Hudson and Darby Pochtar, Wednesday, Dec. 6, 2017, in Salon F/G/H in the New Orleans Marriott. asa2017fall.abstractcentral.com/s/u/nbhlwlaJ9Ns