

Dolphins use extra energy to communicate in noisy waters

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Scientists trained dolphins to whistle at different sound levels under a transparent hood that measures oxygen consumption as an indicator of their metabolic rate. The dolphins are part of Dr. Terrie Williams' Mammalian Physiology lab at the University of California Santa Cruz. All procedures were approved by the UC Santa Cruz Institutional Animal Care and Use Committee and conducted under US National Marine Fisheries Service permit No.13602. Credit: Dawn

Dolphins that raise their voices to be heard in noisy environments expend extra energy in doing so, according to new research that for the first time measures the biological costs to marine mammals of trying to communicate over the sounds of ship traffic or other sources.

While [dolphins](#) expend only slightly more energy on louder whistles or other vocalizations, the metabolic cost may add up over time when the animals must compensate for chronic [background noise](#), according to the research by scientists at NOAA Fisheries' Northwest Fisheries Science Center and the University of California Santa Cruz.

"If they're repeatedly exposed to a lot of noise, the repeated effort to call louder or longer or more often—that's where the impacts could become more significant," said Marla Holt, a research biologist at the Northwest Fisheries Science Center in Seattle and lead author of the paper published this week in the *Journal of Experimental Biology*.

The impacts could be pronounced for young, growing animals or nursing females already struggling to eat enough to maintain their energy balance, the researchers concluded. Some animals also react to nearby vessels and associated noise by slapping their tails on the water or breaching - jumping clear out of the water. That could add to the extra effort required by louder calls to further drain their energy.

"You have to try to piece all these energetic costs together to analyze the increased metabolic expense that they incur when they're around different sources of disturbance," said Dawn Noren, a NWFSC research biologist who specializes in physiology of marine mammals and coauthor of the research.

The study funded by the Office of Naval Research also supports NOAA Fisheries' program to examine threats to Southern Resident Killer Whales that frequent Puget Sound. A [10-year-report](#) on the [killer whales](#) last year identified vessel traffic and noise as one of three major risks to the whales and noted that the [whales increase the volume of their calls](#) in noisy surroundings.

The report also noted that ship noise can interfere with the echolocation the whales use to locate and hunt for food. The new findings suggest that consistently noisy surroundings could take a toll on marine mammals that rely on calls for basic life functions such as communication and foraging.

"If they are going to have to compensate for long periods, day after day, then that cumulative impact could be a concern," Noren said. "How much more fish will they need to eat to compensate for that? That is a concern for these whales because we know their food sources may be limited."

The research examined the energy expenditures of trained captive dolphins at UC Santa Cruz as stand-ins for killer whales, since the species produce sound in similar ways. The dolphins were trained to whistle softly as they might in quiet conditions and more loudly as they would in situations with greater background noise. Plastic hoods over the dolphins measured their oxygen consumption as a gauge of how much energy they expended in producing the whistles of different volumes.

The study found that the dolphins consumed about 80 percent more oxygen when whistling at the highest vocal energy levels than they did at rest. Dolphins have been found to whistle at higher repetition rates when boats are approaching, a behavior that is predicted to expended more energy based on the study's results. The results are consistent with other similar studies on birds and humans that also found similar increases in

oxygen consumption associated with longer, more frequent and louder calls.

"These data would have been impossible to collect from wild animals, so without these trained dolphins we could not have conducted this study," Noren said.

More information: *Journal of Experimental Biology*,
[jeb.biologists.org/content/ear ... /jeb.122424.abstract](http://jeb.biologists.org/content/ear.../jeb.122424.abstract)

Provided by NOAA Headquarters

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