

Killer whales living with bottlenose dolphins demonstrate cross-species vocal learning

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Study killer whale F13. Credit: SeaWorld

From barks to gobbles, the sounds that most animals use to communicate are innate, not learned. However, a few species, including humans, can imitate new sounds and use them in appropriate social contexts. This ability, known as vocal learning, is one of the underpinnings of language.

Vocal learning has also been observed in bats, some birds, and cetaceans, a group that includes whales and dolphins. But while avian researchers have characterized [vocal learning](#) in songbirds down to specific neural pathways, studying the trait in large marine animals has presented more of a challenge.

Now, University of San Diego graduate student Whitney Musser and Hubbs-SeaWorld Research Institute senior research scientist Dr. Ann Bowles have found that [killer whales](#) (*Orcinus orca*) can engage in cross-species vocal learning: when socialized with [bottlenose dolphins](#), they shifted the types of sounds they made to more closely match their social partners. The results, published in the *Journal of the Acoustical Society of America*, suggest that vocal imitation may facilitate social interactions in cetaceans.

Killer whales have complex vocal repertoires made up of clicks, whistles and pulsed calls—repeated brief bursts of sound punctuated with silence. The acoustic features of these vocalizations, such as their duration, pitch and pulse pattern, vary across social groups. Whales that are closely related or live together produce similar pulsed calls that carry vocal characteristics distinct to the group, known as a dialect.

"There's been an idea for a long time that killer whales learn their dialect, but it isn't enough to say they all have different dialects so therefore they learn. There needs to be some experimental proof so you can say how well they learn and what context promotes learning," said Bowles.

Testing vocal learning ability in social mammals usually requires observing the animal in a novel social situation, one that might stimulate them to communicate in new ways. Bottlenose dolphins provide a useful comparison species in this respect: they make generally similar sounds but produce them in different proportions, relying more on clicks and

whistles than the pulsed calls that dominate killer whale communication.

"We had a perfect opportunity because historically, some killer whales have been held with bottlenose dolphins," said Bowles. By comparing old recordings of vocalization patterns from the cross-socialized subjects with recordings of killer whales and bottlenose dolphins housed in same-species groups, Bowles and her team were able to evaluate the degree to which killer whales learned vocalization patterns from their cross-species social partners.

All three killer whales that had been housed with dolphins for several years shifted the proportions of different call types in their repertoire to more closely match the distribution found in dolphins—they produced more clicks and whistles and fewer pulsed calls. The researchers also found evidence that killer whales can learn completely new sounds: one killer whale that was living with dolphins at the time of the experiment learned to produce a chirp sequence that human caretakers had taught to her dolphin pool-mates before she was introduced to them.

Vocal learning skills alone don't necessarily mean that killer whales have language in the same way that humans do. However, they do indicate a high level of neural plasticity, the ability to change circuits in the brain to incorporate new information. "Killer whales seem to be really motivated to match the features of their [social partners](#)," said Bowles, though the adaptive significance of the behavior is not yet known.

There are immediate reasons to study the vocal patterns of cetaceans: these marine mammals are threatened by human activities through competition for fishery resources, entanglement in fishing gear, collisions with vessels, exposure to pollutants and oil spills and, ultimately, shrinking habitats due to anthropogenic climate change. If their social bonds are closely linked to their vocalizations, killer whales' ability to survive amidst shifting territories and social groups may be tied

to their ability to adapt their communication strategies.

"It's important to understand how they acquire [their vocalization patterns], and lifelong, to what degree they can change it, because there are a number of different [cetacean] populations on the decline right now," said Bowles. "And where killer whales go, we can expect other small whale species to go—it's a broader question."

More information: "Differences in acoustic features of vocalizations produced by killer whales cross-socialized with bottlenose dolphins," Whitney B. Musser, Ann E. Bowles, Dawn M. Grebner, and Jessica L. Crance. *Journal of the Acoustical Society of America*. October 7, 2014. DOI: [10.1121/1.4893906](https://doi.org/10.1121/1.4893906)

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