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Comparison of echolocation clicks produced by four killer whale communities in the northeastern Pacific Ocean

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Visually validated towed hydrophone array recordings made in the presence of four killer whale communities (northern and southern residents, offshores, and west coast transients) were collected during the Pacific Orca Distribution Surveys (PODS) conducted by the Northwest Fisheries Science Center in the winters of 2006-2009, 2012, 2013, and 2015. Killer whale communities are known to exhibit differences in their prey preferences, genetic structure, and acoustic call repertoire, but little is known about differences in echolocation clicks. Over 20,000 echolocation clicks were measured from 49 independent killer whale acoustic encounters that were recorded during these cruises to compare signal parameters between communities. Echolocation click parameters were measured automatically using tools available in PAMGuard software. Results of pairwise comparisons indicated that duration, center frequency, peak frequency, sweep rate, number of zero crossings, and inter-click interval were significantly different (Kolmogorov-Smirnov test, $p < 0.05$) between the four communities. The differences in click characteristics of these communities may be due to differences in prey preferences, environment, anatomy, or other unknown factors. For example, offshore and resident killer whale communities consume different species of fish, with offshore killer whales favoring longer-lived fish species (rockfish, shark, tuna) and residents having a clear preference for salmonids. Alternatively, transients primarily consume marine mammals. These communities also have different habitat preferences, with offshores exhibiting a mainly offshore distribution while both residents and transients inhabit mainly near shore coastal waters. The results of this work will contribute to current understanding of killer whale bioacoustics and ecology and will be critical for developing automated acoustic classifiers that use information from clicks.

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