New spectral analysis algorithm helps identify dialects between whale groups

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Photo: Fred Benko - National Oceanic and Atmospheric Administration (NOAA) Central Library. Credit: Wikimedia Commons

A team of researchers from Norway and Germany has come up with a computer algorithm that analyses sound recordings that quantify how various noises change over time, allowing for studying the sounds whales make in a new way. In their paper published in the journal *Physical Review E*, the team describes the ideas they used to create the algorithm and how well it worked as the team analyzed recordings of pilot whales off the coast of Norway.

As the researchers note, current research regarding whale communications typically centers around attempting to isolate the sounds individual whales make, which hopefully can lead to a better understanding of the whistles, calls, buzzes and clicks that are emitted.

But they note, such an approach tends to lead researchers to search for noises that seem meaningful to the human ear. In this new effort, the team looked to use a computer to analyze whale communications to overcome such a bias. They developed an algorithm they call a bag-of-calls—it is based on a statistical approach that quantifies how multiple sounds from a single group change over a period of time. This allows for capturing a form of group-speak, which the researchers say, allows for noting the particular dialect of a pod, rather than for individual members of any given pod. They liken the approach to recognizing the differences in human accents, such as British, versus American—both are the same language, they just sound different when someone is speaking. In running their algorithm on test recordings, they noted that the differences between sounds in one group of whales were significantly different from those in another group, which they noted, allowed for distinguishing between them.

To test their algorithm, the researchers recorded the calls of six different pods of long-finned pilot whales analyzed each with their algorithm and then compared the results of each against the others. Doing so, the team reports, allowed for recognizing dialects between pods—thus, moving forward, a team of researchers could drop a microphone in the ocean and be able to identify which pod is making the sounds that are being picked up, using only the algorithm running on a computer.

More information: Heike Vester et al. Quantifying group specificity of animal vocalizations without specific sender information, *Physical Review E* (2016). DOI: 10.1103/PhysRevE.93.022138

Abstract
Recordings of animal vocalization can lack information about sender and context. This is often the case in studies on marine mammals or in the increasing number of automated bioacoustics monitorings. Here, we develop a framework to estimate group specificity without specific

sender information. We introduce and apply a bag-of-calls-and-coefficients approach (BOCCA) to study ensembles of cepstral coefficients calculated from vocalization signals recorded from a given animal group. Comparing distributions of such ensembles of coefficients by computing relative entropies reveals group specific differences. Applying the BOCCA to ensembles of calls recorded from group of long-finned pilot whales in northern Norway, we find that differences of vocalizations within social groups of pilot whales (Globicephala melas) are significantly lower than intergroup differences.