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Phonemic segment characterization of Norwegian killer whale call types

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An important issue in animal vocal communication concerns the fundamental unit used to build signals into a repertoire and the syntactic rules associated with that assembly. Killer whale vocal production has traditionally been categorized by human observers into a set of discrete call types. These call types often contain internal spectral shifts, silent gaps and synchronously produced low and high frequency components. Such features motivated the analysis here which tested whether call types could be represented by a set of flexibly arranged and smaller phonemic segments. We evaluated whether segmented characterizations of stereotyped Norwegian killer whale calls yielded automated classification results of contour traces that paralleled a classification scheme using whole call type designations. Representations of calls in their entirety or as sets of either distinct or shared syllables did achieve similar performance. Calls composed of shared segments may provide a more parsimonious approach to parsing the vocal stream since there were fewer segments than call types, nearly 75% of all call types contained at least one shared syllable, and some syntactic patterns were evident. Such a system could flexibly generate new call types and contain the killer whale vocal repertoire within a subset of the possible combinations of segments.