

1       The Southern Resident killer whale (SRKW) is an endangered population of whales  
2       found in the northeast Pacific. They have a vocal dialect unique from other killer  
3       whales, having a repertoire of distinct stereotyped calls. A framework for distinguish-  
4       ing SRKW call types using the frequency traces of the amplitude ridges from their  
5       spectrograms (termed frequency ridges) is proposed. The first step is the extraction  
6       of these frequency ridges of SRKW calls using an Sequential Monte Carlo (SMC) ap-  
7       proach. Next, these frequency ridges are converted into functional data using B-spline  
8       functions. They are analysed with a functional principal component (FPC) analysis  
9       to characterise the intrinsic variability of frequency ridges within a call type. The  
10      FPCs are able to capture the general patterns in the frequency ridges of the different  
11      SRKW call types. The FPCs are also used as the basis for call classification. This  
12      framework proves to be successful for classification with some call types correctly  
13      classified almost 80% of the time, while other calls are less well discriminated. On  
14      balance, this approach showed reasonable performance given the small sample size  
15      available, and provides a useful contribution towards the development of a universal  
16      tool for call classification.

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