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SOURCE-FILTER THEORY APPROACH FOR REVEALING BIOLOGICALLY MEANINGFUL INFORMATION IN CONTACT CALLS OF BANDED PENGUINS (*SPHENISCUS* spp.)

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Contact calls have evolved as social signals to maintain group cohesion in stable animal groups. Contact calls can also advertise on the identity of the sender, which is of particular importance in fission-fusion societies. Moreover, there is growing evidence that these vocalisations are species-specific and might inform on the sex of the emitter. Penguin vocalisations have been studied extensively over the past decades, but limited research effort has been directed toward vocal communication in banded penguins (*Spheniscus* spp.). This genus comprises four known extant species that inhabit temperate and equatorial areas of the Southern Hemisphere. We aimed to determine whether contact calls of banded penguins have the potential to discriminate between different individuals, sexes, and species. We recorded vocalisations from two *ex-situ* colonies of African penguins (*Spheniscus demersus*; Zoom Torino) and Magellanic penguins (*Spheniscus magellanicus*; Acquario di Genova) between 2012 and 2015. We measured temporal (e.g. duration), source-related (fundamental frequency), and filter-related (formants) acoustic features of each call. The acoustic parameters were used to carry out a series of stepwise, cross-validated permuted discriminant function analyses. Our results showed that contact calls could be classified according to the emitter, in a manner proved to be far greater than that attributable to chance. We also showed that species discrimination by calls is possible, despite the limited genetic distance between the African and the Magellanic penguins. However, we did not find sex-related vocal distinctiveness in contact calls of any of the two species. Overall, we demonstrated that penguin vocalisations could be studied by considering independent contributions from three different parts of the respiratory apparatus, namely lungs (temporal patterns), vocal source (determining the fundamental frequency) and vocal tract (responsible for formant peaks). These results provide evidence that the source-filter theory can be used to study vocal communication in nesting penguins.