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Intra-specific variability in delphinid whistle structure: Implications for acoustic species identification

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Passive acoustic methods are commonly used to study and monitor marine mammals. Identifying sounds recorded from marine mammals to species can be challenging and often necessitates using statistically based classification analysis. Training and testing classifiers requires visually validated, single-species recordings and large amounts of data, which can be difficult to obtain. Combining data recorded from different locations to train classifiers would allow for larger sample sizes, however, due to geographic variation in signal structure, it has been suggested that classifiers should be trained using recordings made in the locations where they will be used. To examine the effect of geographic variation on classifier performance, whistles were measured from three delphinid species that occur in both the eastern tropical Pacific (ETP) and northwest Atlantic (NWAt) oceans: striped dolphins (*Stenella coeruleoalba*), bottlenose dolphins (*Tursiops truncatus*), and short-finned pilot whales (*Globicephala macrorhynchus*). Twenty-eight variables characterizing the frequency, slope and duration of whistles were statistically compared between study areas for each species (n=1,077, students t-test, α=0.05). Striped dolphin whistles exhibited the greatest geographic variation, with significant differences in both frequency and slope variables. For bottlenose dolphins and pilot whales, most of the significant differences were observed in slope variables. To examine the effects of geographic variation on classifier performance, a classifier trained using ETP whistles was used to classify NWAt whistles, and vice versa. Correct classification scores were significantly (Fisher's exact test) lower for both ETP and NWAt bottlenose dolphins ($p<0.0001$), for NWAt pilot whales ($p=0.0003$), and for ETP striped dolphins ($p<0.0001$) when compared to the correct classification results for classifiers trained and tested using data from the same location. These results suggest that geographic variation does have an effect on classifier performance and therefore we recommend that classifiers should be trained using data recorded in the locations where they will be used.