Detection of complex sounds in quiet conditions by seals and sea lions

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Baseline hearing data, such as absolute detection thresholds and critical ratios, are often used to inform noise-exposure limits for marine mammals. However, these data are traditionally generated using pure-tone or narrow-band stimuli while natural sounds tend to have more complex structure. In particular, marine mammal vocalizations commonly exhibit varying degrees of frequency modulation, amplitude modulation and harmonic structure. Because of this, a basic understanding of how simple audiometric hearing data can be used to predict the detection of complex sounds is desirable. For this experiment, underwater absolute detection thresholds for complex stimuli were obtained for one harbor seal (*Phoca vitulina*) and one California sea lion (*Zalophus californianus*). In order to test the influence of various features of natural sounds on detection, stimuli were designed to isolate common characteristics of marine mammal vocalizations. Three types of stimuli were synthesized and tested: frequency modulated (FM) chirps, amplitude modulated (AM) pure tones, and broadband harmonic signals. Each type of signal was tested at several frequencies selected to span the functional range of hearing for these species. Comparisons were then made between detection thresholds obtained for these complex stimuli and pre-existing detection thresholds for narrow-band stimuli from the same animal subjects. Preliminary data from this ongoing project indicate that narrow-band thresholds are reliable predictors of detection thresholds for low to mid frequency AM and FM signals, but are not reliable for high-frequency FM signals.