

Automatic Detection and Characterization of Mid-Frequency Active Sonar and Its Impact on Marine Mammal Vocalizations

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Mid-Frequency Active (MFA) sonar includes a variety of constant-frequency and frequency-modulated signal types, ranging between 1 kHz and 10 kHz. Studies have shown correlations between MFA sonar and marine mammal strandings, behavioral reactions, and potential temporary threshold shifts. Presently, there are no standardized methods available for detection and quantification of sonar signals, or assessment of their impacts on marine mammal acoustic behavior. ‘SonarFinder’ is a semi-automated Matlab-based program we have developed to fill that need. SonarFinder is intended for use on large acoustic datasets such as those collected from autonomous recorders and other passive acoustic systems. It can batch process all wav-format files in a folder unsupervised, and save results to multiple spreadsheets. SonarFinder uses a 3-step testing scheme to separate true sonar from noise and transients. Step 1 uses an amplitude threshold, step 2 an ‘amplitude integrated over time’ threshold, and step 3 the power spectral density of a predefined band. Only detections which pass all three steps are logged as sonar. Measurements in the frequency and time domains are used to characterize and classify sonar pings. Output from the detector can be automatically compared to a user-supplied list of marine mammal detections. A dose response parameter and the probabilities of animal vocalizations occurring in the presence and absence of sonar are calculated based on this comparison to allow assessment of the relationship between sonar presence and marine mammal acoustic behavior. We tested SonarFinder using several autonomous recorder datasets. Precision and recall for these tests ranged from .56 to .71 and .33 to .89, respectively. Based on these results, SonarFinder is a valuable tool for quantifying the presence of sonar with respect to marine mammal vocalizations. The output of SonarFinder will allow a deeper understanding of how marine mammals may be responding to this anthropogenic sound.



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