Session 3aABb

Animal Bioacoustics: Animal Hearing and Vocalization

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Contributed Papers

10:30

3aABb1. Aerial audiograms of Steller and California sea lions measured using auditory steady-state response methods. Jason Mulsow (U.S. Navy Marine Mammal Program, SSC Pacific, Code 71510, 53560 Hull St., San Diego, CA 92152, jmulsow@hotmail.com), Colleen Reichmuth (Univ. of California, Santa Cruz, Santa Cruz, CA 95060), Frances Gulland (The Marine Mammal Ctr., Sausalito, CA 94965), David A. S. Rosen (Univ. of British Columbia, Vancouver, BC V6T 1Z4, Canada), and James J. Finneran (U.S. Navy Marine Mammal Program, SSC Pacific, San Diego, CA 92152)

Detection of aerial vocal signals by conspecifics is important in the reproductive behavior of the otariid pinnipeds. However, aerial hearing sensitivity measurements have only been obtained for a few otariid individuals that were trained to participate in behavioral experiments. In order to expand upon this small data set, auditory steady-state response (ASSR) methods were used to examine the aerial hearing sensitivity of Steller and California sea lions. Although ASSR thresholds were elevated relative to behavioral thresholds reported for otariids, the ASSR audiograms of the majority of individuals were similar to each other and to behavioral audiograms in terms of relative sensitivity. A marked reduction in sensitivity with increasing frequency regularly occurred between 16 and 32 kHz, indicating a consistent high-frequency cutoff. The reliability of the ASSR audiograms for both species suggests that behavioral aerial audiograms that exist for a few Steller and California sea lion individuals can be appropriately extrapolated to larger populations. The similarity of the ASSR audiograms among the Steller and California sea lions supports the notion that the otariid pinnipeds form a functional hearing group, with similar aerial hearing in terms of sensitivity and frequency range of hearing. [Work supported by ONR and NOAA Ocean Acoustics Program.]

10:45

3aABb2. Marine mammal auditory evoked potential measurements using swept amplitude stimuli. James J. Finneran (US Navy Marine Mammal Program, SSC Pacific, 53560 Hull St., San Diego, CA 92152, james .finneran@navy.mil)

Auditory evoked potentials are routinely used to characterize hearing in marine mammals for whom behavioral testing is not practical. For frequency-specific audiometry, the most popular evoked potential method has been the measurement of the auditory steady state response (ASSR). These tests normally entail measuring the ASSR to a sequence of sinusoidally amplitude modulated tones so that the ASSR input-output function can be defined and the auditory threshold estimated. In this study, an alternative method was employed, where thresholds were estimated in response to a single amplitude modulated stimulus whose sound pressure level varied linearly with time. The tone sound pressure was therefore swept over a range of levels believed to bracket the threshold. The input-output function was obtained by analyzing the resulting grand average evoked potential using a short-time Fourier transform. The swept amplitude technique was performed with bottlenose dolphins and California sea lions, with the resulting thresholds similar to those obtained with constant amplitude tones. The tradeoffs between the swept amplitude technique and the traditional, constant amplitude approach will be discussed. [Work supported by ONR.]

11:00

3aABb3. Relative salience of acoustic features in zebra finch song. Beth A. Vernaleo, Robert J. Dooling (Dept. of Psych., Neurosci. and Cognit. Sci. Program, Univ. Maryland, College Park, MD 20740, bgoldman@umd.edu), and Marjorie R. Leek (Natl. Ctr. for Rehab. Aud. Res., Portland, VA and Medical Ctr., Portland, OR 97239)

Zebra finch song consists of complex acoustic elements repeated over several hundred milliseconds with extreme vocal-motor precision. Much less is known about how song is perceived though previous work has shown that zebra finches easily discriminate between normal and time-reversed versions of song syllables. Here, we used operant conditioning, psychophysical methods, and various synthetic song models to assess the bird's sensitivity to local versus global temporal changes in song and to determine which cues are most salient in these complex syllables. Birds could discriminate syllable reversals in songs made up of the song envelope filled with noise, suggesting that syllable envelope cues can provide the basis for discrimination. However, birds could also discriminate syllable reversals in songs made up entirely of Schroeder harmonic complexes, stimuli that provide only phase (reversals of fine structure) cues without syllable envelope cues. Birds performed better on longer syllables, suggesting a window of temporal integration for fine structure discrimination. In contrast, humans could perceive few of the syllable reversals within these song modifications. This fine-grained perception in birds suggests that the machinery used for song perception is as precise as the machinery used for song production. [Work supported by NIH.]

11:15

3aABb4. Distance perception by non-territorial zebra finches (Taeniopygia guttata) and budgerigars (Melopsittacus undulatus). Kelly E. Radziwon and Micheal L. Dent (Dept. of Psych., Univ. of Buffalo, SUNY, 206 Park Hall, NY 14260, radziwon@buffalo.edu)

Birds use long-range acoustic signals to defend territories, attract mates, and locate conspecifics. However, long-range acoustic signals progressively degrade during their transmission from the signaler to the receiver. This degradation makes perceiving these signals more difficult, but receivers can use such information to estimate the signaler's distance. The perception of auditory distance cues (overall amplitude, frequency-dependent attenuation, and reverberation) has typically been studied in the field with territorial birds. The present study examined auditory distance perception in a non-territorial songbird, the zebra finch, and in a non-songbird, the budgerigar in a controlled laboratory setting. Three zebra finches and three budgerigars were trained to identify 1-m (undegraded) and 75-m (degraded) recordings of three budgerigar contact calls, one male zebra finch song, and one female zebra finch call. Test stimuli were then introduced on 20% of the total number of trials. These stimuli were created manually by manipulating the naturally recorded 1-m calls. By editing these calls, we could manipulate each distance cue separately to determine which cue was the most salient for the birds. Our results suggest that amplitude was the most important cue for these birds, similar to humans and other animals.