11:15

3aAB11. Simulating neural responses to biosonar signals. David C. Mountain (Boston Univ. Hearing Res. Ctr., 44 Cummington St., Boston, MA 02215)

The mammalian auditory system is a highly evolved acoustic signal-processing system that performs well even in highly reverberant and cluttered acoustic environments. In echolocating species, the auditory system is even more highly evolved and is generally more important than vision for navigation and foraging. Since invasive physiological experiments using echolocating species is challenging at best and is illegal for protected species, other methods must be sought if we are to understand how biosonar systems function. Biophysically based computer models provide a method by which we can extrapolate from physiological experiments performed on species that can be used for invasive experiments to those species that cannot be used. Results will be presented for simulations of physiological responses in the auditory nerve and brainstem to biosonar signals for several species. The simulations were done using the EARLAB (http://earlab.bu.edu) desktop simulation environment. Model parameters for species of interest were estimated from behavioral audiograms and from other available data. The models can be used to predict how different types of biosonar signals are represented in neural firing patterns and how the neural representation degrades in the presence of anthropogenic noise. [Work supported by ONR and NSF through the NOPP program.]

Contributed Papers

11:30

3aAB12. Bat sonar and the role of frequency diversity. Kenneth G. Foote (Woods Hole Oceanogr. Inst., 98 Water St., Woods Hole, MA 02543) and James A. Simmons (Brown Univ., Providence, RI 02912)

Species of echolocating bats that forage in foliage, in the presence of clutter with attendant multiple, often overlapping echoes, use 3–5 simultaneous harmonic sweeps to cover a broad bandwidth, whereas species of bats that hunt only in the open use a single sweep to cover the same broad bandwidth. It is hypothesized that the frequency diversity evident in the presence of several harmonically related frequencies is vital to success in clutter. It is additionally hypothesized that the bat processes harmonic FM echoes in a manner tantamount to split-beam processing. Simultaneous determination of phase at several related frequencies enables the bat to distinguish between single and multiple targets, as in the theory of coincidence echoes [K. G. Foote, J. Acoust. Soc. Am. **99**, 266–271 (1996)]. The plausibility of the second hypothesis is gauged by computations based on empirical knowledge of the signal parameters and timing acuity of the big brown bat (*Eptesicus fuscus*).

11:45

3aAB13. Echolocating big brown bats shorten interpulse intervals when flying in high-clutter environments. Anthony E. Petrites (Ecology & Evolutionary Biol., Brown Univ., 80 Waterman St., Box G-W, Providence, RI, 02912), Donald S. Mowlds, Oliver S. Eng, James A. Simmons, and Caroline M. DeLong (Brown Univ., Providence, RI, 02912)

Insectivorous big brown bats (*Eptesicus fuscus*) use frequency-modulated ultrasonic echolocation calls to locate and capture prey, often while navigating through highly cluttered areas of vegetation. To test how their calls change while flying through different clutter densities, a matrix of vertically hanging chain links was constructed in a 4.5-m-wide, 10.5-m-long, and 2.6-m-high flight room. Three different clutter densities (low, medium, and high) were created by varying the number of chains in the matrix (9, 114, and 150, respectively). Four wild-born bats were trained to fly through curved gaps in the chain network. These flights were recorded in the dark with a stereoscopic pair of thermal imaging cameras and a heterodyne bat detector. The bats were flown first through the high-, then the low-, and finally the medium-density configuration over a period of 40 days. Preliminary analysis of the pulse intervals of the bats sounds during flight reveals that the interpulse intervals shorten considerably under high-clutter conditions as compared to medium or low clutter. The data suggest that bats flying through high clutter become limited to shorter interpulse intervals in order to ensonify their immediate environment at the expense of larger-scale navigation. [Work supported by NIH.]

WEDNESDAY MORNING, 7 JUNE 2006 BALLROOM D, 8:45 TO 10:00 A.M.

Session 3aAO

Acoustical Oceanography: Acoustical Oceanography Prize Lecture

James F. Lynch, Chair
Woods Hole Oceanographic Inst., Woods Hole, MA 02543

Chair's Introduction—8:45

Invited Paper

9:00

3aAO1. Acoustic species identification: When biology collides with physics. John K. Horne (UW School of Aquatic and Fishery Sci., P.O. Box 355020, Seattle, WA 98195)

Acoustic species identification remains a long-term goal of fishers, researchers, and resource managers that use sound to locate, map, and count aquatic organisms. Interpreting acoustic data from aquatic organisms requires an understanding of how pressure waves interact with biological targets to produce single or multiple echoes. Intensity and variability of backscattered energy is influenced by physical factors associated with energy propagation through a dense medium, and biological factors including the morphology,