2:00

4pABa4. Automatic type classification and speaker identification of african elephant (*Loxodonta africana*) vocalizations. Patrick J. Clemins and Michael T. Johnson (Elec. and Computer Eng. Dept., Marquette Univ., P.O. Box 1881, Milwaukee, WI 53201-1881, Patrick.Clemins@marquette.edu)

This paper presents a system for automatically classifying African elephant vocalizations based on systems used for human speech recognition and speaker identification. The experiments are performed on vocalizations collected from captive elephants in a naturalistic environment. Features used for classification include Mel-Frequency Cepstral Coefficients (MFCCs) and log energy which are the most common features used in human speech processing. Since African elephants use lower frequencies than humans in their vocalizations, the MFCCs are computed using a shifted Mel-Frequency filter bank to emphasize the infrasound range of the frequency spectrum. In addition to these features, the use of less traditional features such as those based on fundamental frequency and the phase of the frequency spectrum is also considered. A Hidden Markov Model with Gaussian mixture state probabilities is used to model each type of vocalization. Vocalizations are classified based on type, speaker and estrous cycle. Experiments on continuous call type recognition, which can classify multiple vocalizations in the same utterance, are also performed. The long-term goal of this research is to develop a universal analysis framework and robust feature set for animal vocalizations that can be applied to many species.

2:15

4pABa5. Sound localization of aerial broadband noise in pinnipeds. Marla M. Holt, Ronald J. Schusterman, David Kastak, and Brandon L. Southall (Long Marine Lab., Univ. of California, Santa Cruz, 100 Shaffer Rd., Santa Cruz, CA 95060)

Pinnipeds (seals, sea lions, and walruses) emit broadband calls on land as part of their communication system in order to coordinate their reproductive activities. How well do they localize these types of signals? In this study, the aerial sound localization acuities of a harbor seal (*Phoca vitulina*), a California sea lion (*Zalophus californianus*), and a northern elephant seal (*Mirounga angustirostris*) were measured in the horizontal plane with a broadband white noise stimulus. Testing was conducted in a hemi-anechoic chamber using a left/right forced choice procedure to measure the minimum audible angle (MAA) for each subject. MAAs were defined as half the angular separation of two sound sources relative to a subject's midline that corresponded to 75% correct discrimination. MAAs were 3.6, 4.2, and 4.7 deg for the harbor seal, California sea lion, and northern elephant seal, respectively. These results demonstrate that these pinniped species had sound localization abilities comparable to the domestic cat and rhesus macaques. The acuity differences between our subjects were small, were not predicted by head size, and therefore likely reflect the relatively acute abilities of other pinniped species to localize aerial broadband signals.

2:30

4pABa6. Evoked potential measurement of the masked hearing threshold of a Pacific white-sided dolphin (*Lagenorhynchus obliquidens*). Whitlow W. L. Au (Marine Mammal Res. Prog., Hawaii Inst. of Marine Biol., P.O. Box 1106, Kailua, HI 96734), Thomas Jeanette, A. Western (Western Illinois Univ./RIRUC, Moline, IL 61265), and Kenneth M. Rameriz (John G. Shedd Aquarium, Chicago, IL 60605)

The masked hearing threshold of a Pacific white-sided dolphin (*Lagenorhynchus obliquidens*) was determined by measuring the animal's auditory brainstem response (ABR). The dolphin was trained to wear surface-contact electrodes embedded in suction cups and to swim into a hoop centered at 1 m below the water surface facing a sound projector 5 m away. Broadband transient signals with center frequencies of 8, 16, 32, 64, 80, and 100 kHz were used as the stimuli. ABR signals were measured by digitizing the electrode signals in 32 point blocks at a sampling rate of 20 kHz. Five hundred blocks were averaged in order to obtain an ABR. The response latency for suprathreshold threshold signals was approximately 1.9 ms with the highest peak-to-peak ABR amplitude of approximately 2.8 uV occurring for a signal frequency of 64 kHz. The spectrum of the ABR signal was similar to that of Tursiops truncatus, with a major peak at 1120 Hz and a secondary peak at 664 Hz. Threshold was determined by progressively reducing the amplitude of the stimulus until an evoked potential could not be detected. The energy signal-to-noise ratio within an integration window at threshold varied between 1 and 8 dB.

THURSDAY AFTERNOON, 1 MAY 2003 ROOM 201, 3:00 TO 5:05 P.M.

Session 4pABb

Animal Bioacoustics: General Topics in Animal Bioacoustics

Elizabeth Brittan-Powell, Chair

Psychology Department, University of Maryland, Biology-Psychology Building, College Park, Maryland 20742

Chair's Introduction—3:00

Contributed Papers

3:05

4pABb1. Toward standardization of noise exposure in animal bioacoustics. Robert Burkard (Ctr. for Hearing & Deafness, Univ. at Buffalo, 215 Parker Hall, Buffalo, NY 14214)

In the United States, the American National Standards Institute (ANSI) Accredited Standards Committee on Bioacoustics S3 develops voluntary standards related to psychological and physiological acoustics, including areas such as general acoustics, vibration, and shock. Several years ago, an S3 working group (WG) was formed, WG90 Animal Bioacoustics, with the goal of developing guidelines and standards in the area of animal bioacoustics, including relevant terminology, procedures to quantify noise exposure, and the effects of noise exposure on animals. The scope of this working group involves both terrestrial and marine animals, and their environments. Although ANSI Standards are voluntary, the development of accepted sound measurement procedures is needed before any legislation can be implemented that is intended to protect these animals from sound exposures detrimental to their long-term survival. To date, no standards have emerged from the Animal Bioacoustics working group. The purpose of this presentation is to provide an overview of the ANSI stan-