providing damping. Intense AC stimulation likely stimulates the human saccule. A proprietary stapedial saccular strut is described that serves as a surgically implanted coupling device for humans, allowing more efficient use of AC saccular hearing in clinical deafness. The human saccular resonance is about 350 Hz, which should allow for sufficient speech coding for intelligibility assuming connectivity to the auditory neuraxis. BC stimulation through audible ultrasound also likely activates the saccule in individuals with profound deafness. A stand-alone stapedio-saccular strut or one used in combination with an ultrasonic hearing aid offers the potential of communication through saccular hearing.

12:05–12:35
Panel Discussion

FRIDAY MORNING, 9 JUNE 2006 ROOM 550AB, 8:00 TO 10:00 A.M.

Session 5aABb

Animal Bioacoustics: Classification and Parameter Estimation

John R. Buck, Chair
Univ. of Massachusetts, Dartmouth, SMAST, 706 S. Rodney French Blvd., New Bedford, MA 02744-1211

Contributed Papers

8:00

5aABb1. Online acoustic parameter extraction and annotation for a marine sound collection. Shelagh A. Smith and Jack W. Bradbury (Macaulay Library, Cornell Lab of Ornithology, Ithaca, NY 14850)

After 3 years of archival and with the collaboration of more than 20 researchers and institutions, the online marine sound collection at the Macaulay Library, Cornell Lab of Ornithology, is now in a proof of concept phase. This presentation introduces the new annotation and acoustic parameter extraction and retrieval tools. It is further explained how these tools are used for fine-grain searches and recovery of specific sounds within long recordings while online. Also included is a description of the online open access model and delivery mechanism. [Work supported by ONR and NSDL.]

8:15

5aABb2. Dynamic time warping for automatic classification of killer whale vocalizations. Judith C. Brown (Phys. Dept., Wellesley College, Wellesley, MA 02481 and Media Lab., MIT, Cambridge, MA 02139) and Patrick J. O. Miller (Univ. of St. Andrews, St. Andrews, Fife KY16 9QQ UK)

A large number of sounds from the captive killer whale population at Marineland of Antibes, France have been classified perceptually into call types. [A. Hodgins-Davis, thesis, Wellesley College (2004)]. The repetition rate of the pulsed component of five or more examples of each call type was calculated to give a set of melodic contours. These were compared pairwise using dynamic time warping to give a dissimilarity or distance matrix. The distances were then transformed into a component space using multidimensional scaling, and the resulting points clustered with a k-means algorithm. In grouping 57 sounds into 9 call types, there was a single discrepancy between the perceptual and automated methods. Preliminary measurements on a second set of 74 sounds from northern resident killer whales have been made. Both the high-frequency and low-frequency contours have been measured and classified perceptually into 7 groups. Errors for the automatic classification of this group are over 10%. [Sound recording supported by grants from WHOI's Ocean Life Institute and the Royal Society to Patrick J. O. Miller.]

8:30

5aABb3. Probability distributions for locations of calling animals, receivers, sound speeds, winds, and data from travel time differences. John Spiesberger (Dept. of Earth and Environ. Sci., Univ. of Pennsylvania, 240 S. 33rd St., Philadelphia, PA 19104-6316, johnsr@sas.upenn.edu)

A new, nonlinear sequential Monte Carlo technique is used to estimate *posterior* probability distributions for the location of a calling animal, the locations of acoustic receivers, sound speeds, winds, and the differences in sonic travel time between pairs of receivers from measurements of those differences, while adopting realistic *prior* distributions of the variables. Other algorithms in the literature appear to be too inefficient to yield distributions for this large number of variables (up to 41) without recourse to a linear approximation. The new technique overcomes the computational inefficiency of other algorithms because it does not sequentially propagate the joint probability distribution of the variables between adjacent data. Instead, the lower and upper bounds of the distributions are propagated. The technique is applied to commonly encountered problems that were previously intractable, such as estimating how accurately sound speed and poorly known initial locations of receivers can be estimated from the differences in sonic travel time from calling animals, while explicitly modeling distributions of *all* the variables in the problem. In both cases, the new technique yields one or two orders of magnitude improvement compared with initial uncertainties. The technique is suitable for accurately estimating receiver locations from animal calls.

8:45

5aABb4. Automatic call recognition of cricket songs using image processing. T. Scott Brandes (Tropical Ecology Assessment and Monitoring (TEAM) Initiative, Conservation Intl., 1919 M St., NW, Washington, DC 20036), Piotr Naskrecki (Harvard Univ., Cambridge, MA 02138), and Harold K. Figueroa (Cornell Lab. of Ornithology, Ithaca, NY 14850)

An automatic call recognition (ACR) process is described that uses image processing techniques on spectrogram images to detect constant-frequency cricket calls recorded amidst a background of evening sounds found in a lowland Costa Rican rainforest. This process involves using image blur filters along with binary filters to isolate calling events. The binary filters are used to isolate potential calls from background noise, and the blur filters are used to unite discrete call fragments as a single continuous call. Features of these events, notably the events central frequency, duration, and bandwidth, along with the type of blur filter applied, are used with a Bayesian classifier to make identifications of the different calls. Of the 22 distinct sonotypes (calls presumed to be species specific)