frequencies above 1 kHz and responses to playbacks depended on call directivity patterns. Males moved farther away from the playback source when it simulated a caller oriented toward them compared to when playbacks simulated a caller oriented away from them. These results suggest that threat call directionality provides meaningful information about the auditory scene and spatial orientation of male elephant seals in reproductive competition.

Contributed Papers

9:45

3aABa6. Source characteristics of the underwater knocking displays of a male Pacific walrus (*Odobenus rosmarus divergens*). William R. Hughes (Dept. of Ecology and Evolutionary Biology, Univ. of California, Santa Cruz, CA 95064), Colleen Reichmuth (Univ. of California, Santa Cruz, CA 95060), Jason L. Mulsow (U.S. Navy Marine Mammal Program, SSC Pacific, San Diego, CA 92152), and Ole Næsbye Larsen (Univ. of Southern Denmark, Odense DK-5230, Denmark)

Walruses breed in winter at high latitudes in conditions that make close-range observations difficult. Males are known to produce complex underwater songs that can extend over multiple days and propagate over several kilometers. These acoustic displays are comprised of highly rhythmic sharp "knocks" punctuated by occasional metallic "bells." The source characteristics of the knocking sounds that were regularly emitted by a male walrus raised in captivity were examined. Knocks were produced as single 20 ms pulses, or as doublets and triplets, and were typically repeated at rates of 0.8/s to 1.2/s. These were loud sounds with greater bandwidth than previously reported: mean source levels were 186 dB pk-pk *re* 1 μPa at 1 m (range 161–196) with maximum frequency >24 kHz. Production of each knock was associated with visible impulsive movement of the forehead. During rut, this walrus had difficulty inhibiting sound production and would often continue to emit knocks in air during haul-out and even while eating, suggesting an endogenous component to this behavior. A strong correlation between his seasonal testosterone levels and the persistence of knocking displays was confirmed. Captive research provides unique access to acoustic and reproductive behavior that is presently impossible to study in wild walruses.

10:00

3aABa7. Automatic localization of individual Hawaiian minke whales from boing vocalizations. Stephen W. Martin (Biosciences Div., SPAWAR Systems Ctr. Pacific, 53366 Front St., San Diego, CA 92152, steve.w.martin@navy.mil), Tom Norris (Bio-Waves Inc., 517 Cornish Dr., Encinitas, CA 92024), Eva-Marie Nosal (Univ. of Hawaii, 2540 Dole St., Honolulu, HI 96822), David K. Mellinger (Oregon St. Univ., 2030 SE Marine Sci. Dr., Newport, OR 97330), Ronald P. Morrissey, and Susan Jarvis (Naval Undersea Warfare Ctr., Bldg. 1351, Newport, RI 02841)

A method is described to automatically localize Hawaiian minke whales from their boing vocalizations. Recorded passive acoustic data from 15 deep water seafloor mounted hydrophones at the Pacific Missile Range Facility is utilized. A critical step is the automatic association of the same vocalization as received by the widely spaced hydrophones. The peak frequency of the vocalization in the detection bandwidth is shown to aid in the association process. Temporal integration of standard time difference of arrival localizations reduces erroneous automatic localizations, which occur for a variety of reasons. A case study of a 2009 minke visual sighting by a field team, which was facilitated by radioing near real-time location information from shore is described. The peak frequency feature (PFF) has unexpectedly been observed to be very stable for what is believed to be the sighted individual over a 6 hour time period ($n = 57$, $\overline{PF}=1384.0$Hz, $\sigma = 1.78$ Hz). When the minke ceased vocalizing at 13:44 HST, no vocalizations at this frequency were again observed until 18:30 HST. This suggests a possible acoustic feature unique to individual animals with potential anatomical relationship with the sound production mechanism.

WEDNESDAY MORNING, 25 MAY 2011 ISSAQUAH, 10:30 TO 11:45 A.M.

Session 3aABb

Animal Bioacoustics: General Topics in Bat Acoustics

James A. Simmons, Chair
Brown Univ., Neuroscience Dept., Providence, RI 02912

Contributed Papers

10:30

3aABb1. Echolocation of fluttering insects by using the frequency modulated sound. Ikuo Matsuo (Dept. of Information Sci., Tohoku Gakuin Univ., 2-1-1 Tenjinzawa, Sendai 981-3193, Japan, matsuo@cs.tohoku-gakuin.ac.jp) and Takuma Takanashi (Forestry and Forest Products Res. Inst., Tsukuba 305-8687, Japan)

Using the echolocation, bats can capture insects in real 3-D space. The echoes from the insect were changed with the wing beats and its orientation. In the case of emitting the constant-frequency (CF) sound, the wing beats could be estimated from the amplitude modulation and frequency modulation (FM) dependent on the Doppler-shift. In this study, the echoes were measured from several kinds of insects when both the CF and FM sounds were intermittently emitted from the ultrasonic loudspeaker. At the same time, the movements of the wing were measured by the high speed camera. The impulse responses and time-frequency pattern were computed by using the cross-correlation function and the convolution of the chirplet filters, respectively. It was examined that these patterns were related to its orientation and the wing beats, that is, the change of wing positions along the time axis. [Work supported by the Research and Development Program for New Bio-industry Initiatives.]

10:45

3aABb2. Developmental change in ultrasonic echolocation sounds of Japanese echolocating bats, *Pipistrellus abramus*. Shizuko Hiryu and Hiroshi Riquimaroux (Faculty of Life and Medical Sci., Doshisha Univ., 1-3 Miyakotani Tatara, Kyotanabe 610-0321, Japan)

The development of vocalization during the first post-natal month in *Pipistrellus abramus* was studied. Vocalizations were recorded from each pup (five pups from two mothers; captive-born and captive-raised in a laboratory) everyday when isolated from its mother. The sounds produced by pups on the day of birth were categorized into a long isolation call and seemingly an echolocation precursor call (EP call). The terminal frequencies of the fundamental (TF) was 19.3 ± 1.9 kHz ($n = 98$), indicating that TF ranges of the second harmonic produced by newborn bats almost corre-