5:00

1pAB16. Detection of complex sounds in quiet and masked conditions by a California sea lion (*Zalophus californianus*) and a harbor seal (*Phoca vitulina*). Kane A. Cunningham (Ocean Sci., Univ. of California at Santa Cruz, 100 Shaffer Rd., Santa Cruz, CA 95060, kacunningham413@yahoo.com), Brandon Southall (Southall Environ. Assoc., Aptos, CA), and Colleen Reichmuth (Inst. of Marine Sci., Long Marine Lab., Univ. of California at Santa Cruz, Santa Cruz, CA)

Standard audiometric data, such as absolute detection thresholds and critical ratios, are often used to inform noise-exposure limits for marine mammals. However, these data are traditionally generated using simple stimuli, such as pure-tones and flat-spectrum noise, while natural sounds tend to have more complex structure. In this experiment, detection thresholds for complex stimuli were obtained in (a) quiet and (b) masked conditions for one California sea lion and one harbor seal. For part (a), three stimuli types were synthesized, each isolating a common feature of marine mammal vocalizations: amplitude modulation (AM), frequency modulation (FM), and harmonic structure. Detection thresholds in quiet conditions were then obtained for these stimuli at frequencies spanning the functional hearing range. For part (b), the same complex signals were combined with flat-spectrum noise or shipping noise. To test how well standard hearing data predict detection of complex sounds, the results of parts (a) and (b) were compared to *a priori* predictions based on previously obtained audiogram and critical ratio data. Preliminary results indicate that absolute detection thresholds for AM and FM stimuli are reliably predicted by audiogram data, but that thresholds for harmonic stimuli are lower than predicted, in some cases by more than 10 dB.

MONDAY AFTERNOON, 2 DECEMBER 2013 PLAZA A, 1:30 P.M. TO 5:00 P.M.

Session 1pAO

Acoustical Oceanography: Contributed Papers in Acoustical Oceanography (Poster Session)

Timothy K. Stanton, Chair
Woods Hole Oceanogr. Inst., M.S. #11, Woods Hole, MA 02543-1053

Contributed Papers

1pAO1. Observations of region-specific fish behavior using long- and short-range broadband (1.5—6 + kHz) active acoustic systems. Timothy K. Stanton (Dept. Appl. Ocean Phys. and Eng., Woods Hole Oceanogr. Inst., M.S. #11, Woods Hole, MA 02543, tstanton@whoi.edu), J. Michael Jech (Northeast Fisheries Sci. Ctr., NOAA, Woods Hole, MA), Roger C. Gauss (Acoust. Div., Code 7164, Naval Res. Lab., Washington, DC), Benjamin A. Jones (Oceanogr. Dept., Naval Postgrad. School, Monterey, CA), Cynthia J. Sellers (Dept. Appl. Ocean Phys. and Eng., Woods Hole Oceanogr. Inst., Woods Hole, MA), and Joseph M. Fialkowski (Acoust. Div., Code 7164, Naval Res. Lab., Washington, DC)

Two broadband active acoustic systems, in concert with traditional narrowband systems and nets, were used to study distributions of fish in three regions within the Gulf of Maine. The long-range multi-beam broadband system detected fish out to 15 km range and the downward-looking short-range broadband system detected fish throughout the water column close behind the ship. The multi-year (2007–2011) study revealed distinct spatial patterns of fish and corresponding echo statistics in each region—diffusely distributed, sparsely distributed compact patches, and long (continuous) shoals. The broadband capabilities of the sonar systems (each spanning 1.5—6 + kHz) uniquely allow observations of resonance phenomena of the local swimbladder-bearing fish. The observed resonances were consistent with the fish species, sizes, and depths that were concurrently sampled in each area from a second research vessel. Spectral peak analysis also interestingly revealed the presence of distinct modes, which may be useful indicators of mixed-species and/or mixed-sized (e.g., juvenile and adult) assemblages of fish. [Work supported by Office of Naval Research.]

1pAO2. The history detectives: Establishing the parameters of the 1960 Perth-Bermuda antipodal acoustic propagation experiment. Brian D. Dushaw (Appl. Phys. Lab., Univ. of Washington, 1013 N.E. 40th St., Seattle, WA 98105-6698, dushaw@apl.washington.edu)

In 1960 three 300-lb explosive shots were detonated off Perth, Australia at 3 am, 22 March (local) by HMAS Diamantina to determine if those sound signals could propagate the antipodal distance to the Bermuda SOFAR station. These data offer a rare measure of the ocean temperature a half century ago, averaged across large stretches of the Southern, South Atlantic, and North Atlantic Oceans. The accuracy of these data are determined by the accuracy of the essential parameters of the experiment, e.g., the time and position of the shots. The narrative of HMAS Diamantina the night of 21 March 1960 was reconstructed from the ship's log, the captain's Report of Monthly Proceedings, and other information. The experiment was conducted with care to obtain a precise measurement, subject to the resources available to the ship at the time. The largest uncertainty is in the position of the shots, determined by triangulation from shore landmarks in the evening, celestial navigation at dawn, and dead reckoning in between. In addition, the depth was measured at the time of the shots. The 1960 position was measured to an equivalent travel-time accuracy of about 3 s, biased toward closing the range to Bermuda.

1pAO3. Fluctuations of the sound field in the presence of internal Kelvin waves in a stratified lake. Boris Katsnelson (Marine Geosci., Univ. of Haifa, 1, Universitetskaya sq, Voronezh 394006, Russian Federation, katz@phys.vsu.ru), Andrey Lunkov (Wave Res. Ctr., General Phys. Inst., Moscow, Russian Federation), and Ilia Ostrovsky (Kinneret Limnological Lab., Oceanogr. Limnological Res., Haifa, Israel)

In stratified lakes internal waves has great ecological significance since they affect mixing, resuspension, material transport, chemical regime and ecosystem productivity. Reconstruction of spatio-temporal heterogeneity of the basin scale internal waves and their accurate parameterization are important tasks. The effect of internal Kelvin waves (IKWs) on spatiotemporal variability of the mid-frequency (1 kHz) sound field in a deep lake using geoacoustic modeling is studied. It is demonstrated that IKWs cause significant fluctuations of the sound field, such as horizontal shift of interference structure. This shift can be easily measured in situ and used for practical reconstruction of IKW parameters. Overall, it is suggested implementing the low-cost geoacoustic methodology for accurate parameterization of the basin scale internal waves and studying their dynamics.