3:45

1pAB11. Sparse representation classification of dolphin whistles using local binary patterns. Mahdi Esfahanian, Hanqi Zhuang, and Nurgun Erdol (Elec. Eng., Florida Atlantic Univ., 777 Glades Rd., EE-96 Bldg., Boca Raton, FL 33431, mesfahan@fau.edu)

A sparse representation classifier (SRC) has been adapted and applied to spectrograms to identify bottlenose dolphin whistles by their types. The classifier that relies on near completeness of the training features renders their choice no longer crucial as long as criteria are met to assure signal sparsity. Signal sparsity is ensured via the employment of a robust, effective, and computationally simple local binary patterns (LBP) operator that eliminates the need for costly denoising and contour tracking operations. The performance of the proposed method is compared to classifier-feature combinations of the K-nearest neighbor (KNN) and support vector machine (SVM) classifiers, and feature vectors of time-frequency contour parameters, Fourier descriptors, and raw data. The experimental results demonstrate superior accuracy and robustness of the proposed method to classify dolphin whistles into distinct call types. The method can be generalized to all narrowband signals with time varying spectra.

4:00

1pAB12. Discrimination of baleen whales frequency-modulated downsweep calls with overlapping frequencies. Hui Ou, Whitlow Au (Hawaii Inst. of Marine Biol., Univ. of Hawaii, Kaneohe, HI, wau@hawaii.edu), Sofie V. Parijs (Northeast Fisheries Sci. Ctr., National Marine Fisheries Sci., Woods Hole, MA), Erin M. Oleson (Pacific Fisheries Sci. Ctr., National Marine Fisheries Sci., Honolulu, HI), and Shannon Rankin (Southwest Fisheries Sci. Ctr., National Marine Fisheries Sci., La Jolla, CA)

Spectrograms generated with the pseudo Wigner-Ville distribution (PWVD) provide much higher simultaneous time-frequency (TF) resolution compared with the traditional method using the short time Fourier transform (STFT). The WV-type spectrogram allows bioacousticians to study the fine TF structures of the sound, such as the instantaneous frequency, instantaneous bandwidth, contour slope, etc. These features set the foundation of identifying sounds that are usually considered difficult to discriminate using the traditional method. However, the PWVD requires much higher computational effort than the STFT method. In this research, the advantage of the WV spectrogram analysis was demonstrated by a case study on frequency-modulated, downsweep sounds from fin whales, sei whales, and blue whales D-calls. These calls overlapped in frequency range and have similar time duration. Automatic detection of fin, sei or blue whales FM downsweeps using the traditional spectrogram methodology tend to be ineffective because of the large temporal ambiguities needed to achieve the necessary frequency resolution. However, their WV spectrograms showed distinguishable characteristics, for example, the TF contour of fin and sei whales exhibited concave and convex shapes respectively. A support vector machine (SVM) classifier was trained and tested based on the parameters extracted from the WV spectrograms.

4:15

1pAB13. Fin whales (*Balaenoptera physalus*) in British Columbia sing a consistent song. Barbara Koot (Dept. of Zoology, Univ. of Br. Columbia, Rm. 247, 2202 Main Mall, Vancouver, BC V6T 1Z4, Canada, b.koot@fisheries.ubc.ca), John K. Ford (Fisheries and Oceans Canada, Nanaimo, BC, Canada), David Hannay (JASCO Appl. Sci., Victoria, BC, Canada), and Andrew W. Trites (Dept. of Zoology, Univ. of Br. Columbia, Vancouver, BC, Canada)

Geographic differences in fin whale song that may be related to population structure have been documented in the Atlantic and Southern Oceans. However, information on the songs and population structure of fin whales in the North Pacific is limited. We analyzed fin whale songs recorded over 9 months by an Autonomous Underwater Recorder for Acoustic Listening device (AURAL, Multi-Electronique Inc.) deployed west of Vancouver Island, British Columbia (July 2010 to March 2011). Our analysis focused on internote intervals—the song characteristic that others have shown to display the most geographic variation. We found that beginning in mid-August and continuing to the end of our study, fin whales produced one stereotyped song consisting of alternating classic (C) and backbeat (B) notes. Internote interval evolved slightly over this time period, and small differences in interval length occurred among individual songs. However, all songs shared the same note arrangement (i.e., the interval between C and B notes was always 30% longer than the interval between B and C notes). All whales recorded in this study produced a similar song, suggesting that they may belong to the same acoustic population. Future studies will help to determine the spatio-temporal boundaries of this acoustic population.

4:30

1pAB14. Vocal repertoire of Southeast Alaskan humpback whales (*Megaptera novaeangliae*). Michelle Fournet (College of Earth Ocean and Atmospheric Sci., Oregon State Univ., 425 SE Bridgeway Ave., Corvallis, OR 97333, mbellalady@gmail.com) and Andy Szabo (Alaska Whale Foundation, Seattle, WA)

Humpback whales (*Megaptera novaeangliae*) are vocal baleen whales that exhibit complex social interactions across broad spatial and temporal scales. On low latitude breeding grounds, humpback whales produce complex and highly stereotyped "songs" as well as a range of "social sounds" associated with breeding behaviors. While on their Southeast Alaskan foraging grounds, humpback whales produce vocalizations during cooperative foraging events as well as a range of unclassified vocalizations for which the social context remains unknown. This study investigates the vocal repertoire of Southeast Alaskan humpback whales from a sample of 366 vocalizations collected over a three-month period on foraging grounds in Frederick Sound, Southeast Alaska. We used a two-part classification system, which included aural-spectrogram and statistical cluster analyses, to describe and classify vocalizations. Vocalizations were classified into 19 individual call types nested within four call classes. The vocal repertoire of Southeast Alaskan humpbacks shows moderate overlap with vocalizations recorded in Atlantic foraging grounds and along the Australian migratory corridor.

4:45

1pAB15. The acoustic signature of the male northern elephant seal: Individual variation supports recognition during competitive interactions. Caroline Casey (Ecology and Evolutionary Biol., Univ. of California Santa Cruz, 100 Shaffer Rd., Santa Cruz, CA 95060, cbcasey@ucsc.edu), Colleen Reichmuth (Inst. of Marine Sci., UC Santa Cruz, Santa Cruz, CA), Selene Fregosi (Cooperative Inst. for Marine Resources Studies, Oregon State Univ. and NOAA Pacific Marine Environ. Lab., Newport, OR), Isabelle Charrier (Equipe Communications Acoustique, Université Paris Sud, Orsay, France), and Nicolas Mathevon (Laboratoire de Biologie Animale, Université Jean Monnet, Saint-Etienne, France)

Northern elephant seals (*Mirounga angustirostris*) have a polygynous breeding system in which adult males establish dominance hierarchies that determine access to females. Acoustic signaling plays an important role in settling fights between males, as stereotyped displays elicit appropriate behavioral responses from individuals without contact during an energetically demanding breeding season. To determine whether reliable differences exist in the acoustic displays of individuals and whether these differences function to convey identity, we behaviorally and acoustically sampled male seals during the breeding season. Vocalizations were recorded during competitive interactions and analyzed for spectral, temporal, and amplitude characteristics. A cross-validated discriminant function analysis revealed small differences within—and significant differences between—the calls produced by 17 adult males of known dominance status. To determine whether acoustic displays serve as individual signatures that males learn to recognize during the breeding season, we conducted playback experiments to test if having prior experience with a particular caller would influence the approach or avoidance response of the listener. Our findings reveal that these unique acoustic signals serve as individual vocal signatures, and males likely remember the identity of their rivals based on call features that have been associated with the outcome of previous competitive interactions.