acoustic communication, from the simple examples from mothers and calves, to more complex evidence that some males preferentially approached playbacks of calls from specific females. Future research investigating the complexity of baleen whale sound use will include studies of individual recognition and the localization and spatial memory abilities of these whales. New technological developments are making it possible to answer these more complex questions and will reveal more details of how baleen whales to use sound to survive.

1:45

4pAO3. Sound production and detection by pinnipeds. Brandon L. Southall (NOAA Ocean Acoust. Program, NMFS Office of Sci. and Technol., 1315 East-West Hwy., Silver Spring, MD 20910), David Kastak, Colleen Reichmuth Kastak, Steven J. Insley, Marla M. Holt, Jason Mulsow, and Ronald J. Schusterman (Univ. of California, Santa Cruz CA 95060)

Pinnipeds (seals, sea lions, and walruses) emit and receive sounds both in air and water. Their amphibious natural history has resulted in a number of fascinating sensory capabilities, including but not limited to hearing, but has apparently precluded the evolution of sophisticated biosonar systems. Pinnipeds produce vocalizations in a variety of social contexts, notably reproduction and aggression. Attraction calls in many species serve to retain or re-establish contact between females and offspring and to draw the attention of potential mates. Repulsion vocalizations warn adversaries and can advertise strength and intent. Cognitive processes, including conditioned learning, are an essential foundation of the sophisticated acoustic communication systems of pinnipeds. Recent advances in understanding these systems and passive listening in the context of predator and prey detection and spatial orientation will be discussed.

2:05

4pAO4. Imaging acoustic centers of the dolphin brain with positron emission tomography. Sam Ridgway, Dorian Houser, Don Carder (SPAWAR Systems Ctr. San Diego, Div. D235, 53560 Hull St., San Diego, CA 92152-5001), and Carl Hoh (Univ. of California, San Diego, CA 92093)

In human subjects, positron emission tomography (PET) has been used in diagnosis of disease, in studies of complex cognitive tasks, and in localizing areas of sensory activation, motor movement, and attention. Now, brain physiology of bottlenose dolphins, *Tursiops truncatus*, has been studied with PET. The dolphin brain is in the human size range but is more highly convoluted. The known acoustic centers of the dolphin brain are greatly enlarged compared with human brains. However, dolphins have a multi-tiered cortex with an extensive extra lobe, the paralimbic lobe, which does not occur in mammals or other animals outside the Order Cetacea. Because of its inaccessible location, there are no functional studies of the paralimbic cortex. PET offers an opportunity to study activity in this unique part of the dolphin brain during various stimulus conditions that may help to reveal functional aspects of the paralimbic cortex. For experimental scans, the dolphin was exposed to acoustic stimuli (tones or pulses) to reveal areas of relative brain metabolism after 18-F-FDG administration. These scans have revealed interesting features of the living dolphin brain including the paralimbic lobe as well as known acoustic areas in the cortex, midbrain, and acoustic nuclei.

Contributed Papers

2:25

4pAO5. Dolphin pods of the Southern California Offshore Range: Localization and behavior. Katherine H. Kim, Paul Hursky, Michael B. Porter (Heat, Light, and Sound Research, Inc., 12730 High Bluff Dr., Ste. 130, San Diego, CA 92130, katherine.kim@hlsresearch.com), John A. Hildebrand, E. Elizabeth Henderson, and Sean M. Wiggins (Scripps Inst. of Oceanogr., UCSD, La Jolla, CA 92093-0205)

The Southern California Offshore Range, a U.S. Navy training area located near San Clemente Island, is rich in odontocete activity. Pods of dolphins, numbering as many as several hundred individuals, regularly transited the area and frequently vocalized during the 2004 SCORE 23F experiment. Such acoustic data were collected on a high-frequency, four-element, horizontal line array as well as on a high-frequency, single-element buoy. The copious dolphin vocalizations were then processed using automated whistle and click detection techniques and various localization methods which utilized time-of-arrival differences, frequency-domain beamforming, and multipath arrival structure. Combining the acoustic tracking results with concurrent visual observations provides a unique look at large numbers of free-ranging dolphins at and below the sea surface and suggests certain group behavioral patterns.

2:40

4pAO6. Depth/range localization of diving sperm whales using passive acoustics on a single hydrophone disregarding seafloor reflections. Christophe Laplanche, Olivier Adam, Maciej Lopatka, and Jean-François Motsch (Université Paris 12, 61 av. du Gal de Gaulle, 94000 Créteil, France)

Depth and range of sound sources can be estimated using a single hydrophone. Such a passive acoustic technique requires the detection of direct path transmitted, sea surface, and seafloor reflected source signals, so as to measure their time of arrival differences (TOADs). Sperm whales almost continuously emit powerful, directional echolocation sounds (usual clicks) when diving. Sperm whales often dive in deep water, and click seafloor reflections are usually well detected only at the beginning of the dive. Surface echoes may be detected during the entire dive. If the measurement of the surface reflection TOAD of a single click is not enough for estimating the depth/range of the sperm whale at the time when this click was emitted, the joint consideration of delays emitted during the whole dive may provide this estimation. Such delays are indeed the measurements of a single phenomenon: the underwater movements of a single-clicking sperm whale. One can merge such data using a Bayesian technique, as well as use prior information (e.g., range when fluking-up). Such