Session 4pABa

Animal Bioacoustics: Marine Mammal Acoustics II

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Contributed Papers

1:15

4pABa1. Great ears: Functional comparisons of land and marine leviathan ears. D. R. Ketten (Harvard Med. School, Boston, MA; Woods Hole Oceanograph. Inst., Woods Hole, MA), J. Arruda, S. Cramer, M. Yamato (Woods Hole Oceanograph. Inst., Woods Hole, MA), J. O'Malley (Massachusetts Eye and Ear Infirmary, Boston, MA), D. Manoussaki (Vanderbilt Univ., Nashville, TN), E. K. Dimitriadis (NIH/NIDCD, Bethesda, MD), J. Shoshani (Univ. of Asmara, Asmara, Eritrea), and J. Meng (American Museum of Natural History, New York, NY)

Elephants and baleen whales are massive creatures that respond to exceptionally low frequency signals. Although we have many elephant and whale vocalization recordings, little is known about their hearing. Playback experiments suggest hearing in both proboscideans and mysticetes is tuned similarly to low or even infrasonic signals. This raises several interesting issues. First, they emit and perceive signals in two media, air and water, with radically different physical acoustic properties: 4.5-fold differences in sound speed, three-fold magnitude difference in acoustic impedance, and, for common percepts, whales must accommodate 60-fold acoustic pressures. Also, a commonly held tenet is that upper hearing limit is inversely correlated with body mass, implying there should be virtually no whale-elephant hearing overlap given body mass differences. This study analyzed how inner ears in these groups are structured and specialized for low-frequency hearing. Computerized tomography and celloidin histology sections were analyzed in six baleen whale ($n=15$) and two elephant species ($n=7$). The data show mysticetes have a substantially greater hearing range than elephants but that coiling and apical cochlear structures are similar, suggesting common mechanical underpinnings for LF hearing, including cochlear radii consistent with the Whispering Gallery propagation effect. [Work supported by ONR, NIH, WHOI OLI, Seaver Foundation.]

1:30

4pABa2. Social context of the behavior and vocalizations of the gray whale *Eschrichtius robustus*. Sarah M. Rohrkasse (School for Field Studies, Ctr. for Coastal Studies, Apartado Postal 15, Puerto San Carlos, BCS, CP 23740 Mexico, sarro101@hotmail.com) and Margaret M. Meserve (Guilford College, Greensboro, NC 27410)

Sound production and surface behavior of the gray whale were investigated at Bahia Magdalena, Mexico to determine if vocalizations have behavioral correlations or are used in specific social contexts. Fifteen-minute sessions of behavioral observations and acoustic recordings of gray whales in various social contexts were collected from February to April 2006 ($n=30$). Analysis of sound production included proportional use of different call types and acoustic variables of each sound type. Preliminary acoustic analysis found no correlation with social contexts or behaviors, but proportional use of different vocalizations is similar to past studies in Baja [Dahlheim *et al*, *The Gray Whale*, pp. 511–541 (1984), F. J. Ollervides, dissertation, Texas A&M University (2001)]. Initial results indicate significant differences in frequencies of high surface behaviors ($p=0.0477$) of groups that include mother-calf pairs. As analysis continues, possible correlations between social context and use of sounds could allow for acoustics to be an indicator of group composition, seasonal movements, and social patterns and to help determine the functions of sounds. [Work supported by SFS and NFWF.]

1:45

4pABa3. Ambient noise and gray whale *Eschrichtius robustus* behavior. Francisco Ollervides, Kristin Kuester, Hannah Plekon, Sarah Rohrkasse (School for Field Studies—Ctr. for Coastal Studies, Apartado Postal 15, Puerto San Carlos, BCS, CP 23740 Mexico, follervides@hotmail.com),Kristin Kuester (Univ. of Wisconsin−Madison, Madison, WI 53706), HannahPlekon (Davidson College, Davidson, NC), andSarahRohrkasse (Texas A and M Univ., College Station, TX 77843)

Between 14 February and 13, April 2006, we conducted 31 recording sessions of ambient noise and behavioral sampling of gray whales within Magdalena Bay, Mexico. This breeding lagoon does not have the same Marine Protected Area status compared to the other breeding lagoons of San Ignacio and Guerrero Negro in the Mexican Pacific coast. Poorly monitored guidelines and increasing boat traffic from whale−watching tourism in this area have the potential to affect the surface behavior of these animals and increase average ambient noise levels. Relative ambient noise levelswererecordedandcomparedtoapreviousstudy[Ollervides,2001]todetermine similarities or differences in the 5−year interval between both data sets. Although results are not comparable in decibel levels, probably due to equipment calibration problems, there was a significant difference between the different regions of the bay Kruskal−Wallis ($p=0.0067$). Activity levels ranged from 0.005–0.196 behaviors/whale/minute. Ambient noise levels ranged from 35.70–64.32 dB Re: 1 Pa. No correlation was found between the ambient noise levels in the bay and the activity level of gray whales (correlation value=0.0126; log correlation value=0.172). Further acoustic processing is currently underway.

2:00

4pABa4. Look who's talking; social communication in migrating humpback whales. Rebecca A. Dunlop, Michael J. Noad (School of Veterinary Sci., Univ. of Queensland, St. Lucia, Qld 4072, Australia. r.dunlop@uq.edu.au), Douglas H. Cato (Defence Sci. and Tech Org., Pyrmont, NSW 2009, Australia), and Dale Stokes (Scripps Inst. of Oceanogr., La Jolla, CA 92037)

A neglected area of humpback acoustics concerns nonsong vocalizations and surface behaviors known collectively as social sounds. This study describes a portion of the nonsong vocal repertoire and explores the social relevance of individual sound types. A total of 622 different sounds were catalogued and measured from whales migrating along the east coast of Australia. Aural and spectral categorization found 35 different sound types, and discriminate functions supported 33 of these. Vocalizations were analyzed from 60 pods that were tracked visually from land and acoustically using a static hydrophone array. Nonsong vocalizations occurred in all pod compositions: lone whales, adult pairs, mother/calf pairs, mother/calf/escorts, and multiple-adult pods. Thwops and wops were likely to be sex-differentiated calls with wops from females and thwops from males. Sounds similar to song-units were almost all from joining pods and yaps were only heard in splitting pods. Other low-frequency calls (less than 60 Hz) were thought to be within-pod contact calls. Higher-frequency cries (fundamental 450–700 Hz) and other calls (above 700 Hz) and presumed underwater blows were heard more frequently in joining

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