of best hearing sensitivity. Future studies can potentially examine the relevance of frequency composition and other vocalization parameters using psychophysical methods that include complex acoustic stimuli and an analysis of subject response latencies. Such methods have proven useful for studying the manner in which birds perceptually categorize vocalizations [Dooling *et al.*, J. Comp. Psychol. **101**, 367–381 (1987)] and they may provide novel tools for investigating the link between vocalization structure and auditory perception in otariids. [Work supported by ONR.]

8:25

3aABa2. Why do Weddell seals shout? Jack Terhune (Dept. of Biology, Univ. of New Brunswick, 100 Tucker Park Rd., Saint John, NB, E2L 4L5, Canada, terhune@unb.ca)

Source levels (SLs) of Weddell seal (*Leptonychotes weddellii*) underwater calls near Mawson, Antarctica, were determined using a two hydrophone array. SLs were 161 ± 10 dB *re* 1 μPa m (range 135–179, $n = 280$). SLs from 0.1–6 kHz varied little with frequency ($r^2 = 0.02$, $t = -2.46$, $P = 0.01$, $n = 251$). One-sixth octave ambient noise levels (ANLs) from 0.1–6 kHz were measured on low ($n = 1$), medium ($n = 7$), and high ($n = 7$) noise level days. The ANLs were flat (0.1–6 kHz) and the mean 1/6 octave ANLs were 77 ± 2.8, 96 ± 6.5, and 110 ± 6.1 dB *re* 1 μPa. SLs were randomly paired against ANLs in a Monte Carlo ($n = 100\,000$) model to calculate the seal communication ranges (*m*), assuming spherical spreading and received levels 20 dB above threshold. The mean communication ranges for low, medium, and high ANLs were 2806 ± 2718, 428 ± 662, and 83 ± 124 m, respectively (median distances were 2006, 205, and 43*m*). The distributions were highly skewed toward the shorter distances. The high amplitude calls of Weddell seals may have evolved to facilitate local communication under noisy conditions rather than for very long range purposes.

8:45

3aABa3. Vocalization source levels of adult male northern elephant seals (Mirounga angustirostris). Brandon L. Southall (SEA, Inc., 9099 Soquel Dr., Ste. 8, Aptos, CA 95003), Stephen Insley (Univ. of California, Santa Cruz, OCA.), Marla Holt (Northwest Fisheries Sci. Ctr.), and Colleen Reichmuth (Univ. of California, Santa Cruz, CA)

Aerial vocalization source levels were obtained for adult male northern elephant seals from 1999–2010. Vocalizations from known individuals (marked within years) were selected from three breeding seasons (1999–2000, 2004–2005, and 2009–2010) evenly spaced during this interval so that it is unlikely animals were resampled across seasons. Sound pressure levels of calls were measured on-axis (0-deg orientation) at 1-m range using Brel and KJær 2203 and 2250 precision sound level meters. Calls almost always occurred in series, as previously described; the maximum received level for any pulse in each series is used as the source level. Source levels are reported for individuals with at least four complete bouts. All sex/age classes were measured; the adult male data will be discussed and compared with other mammals in terms of rms levels (two temporal weighting functions) and peak sound pressure levels. Results indicate that calls almost always exceed 100 dB rms (re: 20 μPa) with peak levels regularly exceeding 120 dB. These loud sounds might suggest long-range communication, but considering hearing data Ron Schusterman and Dave Kastak first collected on this species and environmental noise levels in their rookeries, intense signals are likely required even for the small ranges over which they apparently function. [Funding provided by ONR.]

9:05

3aABa4. Vocal recognition of individuals versus relative dominance rank among breeding male northern elephant seals (*Mirounga angustirostris*). Stephen J. Insley (Dept. of Biology, Univ. of Victoria, P.O. Box 3020, Station CSC, Victoria, BC V8W 3N5, Canada, sinsley@uvic.ca), Marla M. Holt (Northwest Fisheries Sci. Ctr., Seattle, WA 98112), and Brandon L. Southall (Southall Environ. Assoc., Santa Cruz, CA 95060)

Whether an animal truly recognizes an individual or a simple rule-based category (e.g., neighbor or offspring) has important behavioral and evolutionary implications such as the accuracy of social reciprocity. Many tests of individual recognition have focused on neighboring territorial males ("dear enemy" or "neighbor-stranger" recognition). Unfortunately the static territorial context of these tests, mostly with male songbirds, opens them to the criticism of being merely associative habituation. More dynamic mating assemblages, such as leks where vocally advertising animals encounter numerous others, are a potentially rich and largely untested alternative. The female defense polygyny practiced by male northern elephant seals during terrestrial breeding is such a dynamic system. To examine whether elephant seals were recognizing individuals or dominance categories we conducted a total of 53 playback experiments to 18 males at Año Nuevo State Reserve. Each playback was a series of threat calls assigned to four dominance conditions relative to the subject. Dominance was based on the outcomes of interactions among contesting male dyads. Responses were measured using three assays *in situ* and from video records of each experiment. Results thus far are consistent with the males not recognizing individuals but instead recognizing and responding appropriately to relative rank.

9:25

3aABa5. Directionality of male northern elephant seal (*Mirounga angustirostris*) threat calls and how it influences receiver behavior. Marla M. Holt (Marine Mammal Ecology Team, NOAA Fisheries Northwest Fisheries Sci. Ctr., 2725 Montlake Blvd. East, Seattle, WA 98112, marla.holt@noaa.gov), Brandon L. Southall (Southall Environ. Assoc. Inc., Santa Cruz, CA 95060), Stephen J. Insley, and Ronald J. Schusterman (Univ. of California, Santa Cruz, CA 95064)

Many animal sounds are directional in which the sound energy is focused in a direction that depends on the signaler's orientation. In the 1970s, Ron Schusterman quantitatively showed this in barking California sea lions and dogs. Several investigators have suggested ways that such features might be particularly useful among individuals in acoustic communication networks. However, only a few have tested such hypotheses experimentally and even fewer have investigated how directional signals affect receiver behavior. In this study, we measured directivity patterns of male northern elephant seal threat calls and used an acoustic playback approach to determine how call directionality influenced the responses of male seals in reproductive competition. We collected data on adult and older subadult seals on a breeding rookery (Ano Nuevo State Park) over three field seasons. Threat calls had substantial directionality, particularly at