Invited Paper

9:20

4aUW4. Temporary threshold shift in pinnipeds induced by octave-band noise in water. David Kastak, Brandon L. Southall, Ronald J. Schusterman, and Colleen J. Reichmuth (Long Marine Lab., Univ. of Calif., 100 Shaffer Rd., Santa Cruz, CA 95060)

Low-frequency noise from manmade sources represents an increasing portion of the total noise in the ocean. Such noise may adversely impact diving pinnipeds, which hear relatively well at low frequencies. The effects of octave bands of moderately intense noise (under 4 kHz, 60–76 dB SL, 20–22 min duration) were examined in three species of pinniped, the California sea lion (*Zalophus californianus*), harbor seal (*Phoca vitulina*), and northern elephant seal (*Mirounga angustirostris*). Auditory sensitivity data were obtained behaviorally, using a go/no-go psychophysical procedure. Thresholds were determined before noise exposure, immediately after noise exposure, and again after 24 h. Mean threshold shifts ranged from 2.9–4.9 dB at the center frequency of the noise band. Recovery was complete after 24 h. These results show that noise levels as low as 60 dB SL can induce TTS. However, between 60 and 76 dB SL, there was no relationship between noise level and degree of TTS. Additionally, maximum hearing loss occurred at center frequency rather than one-half octave above the center frequency. Further testing at longer exposure durations and higher noise levels is needed to more completely assess the degree to which pinniped underwater hearing is affected by continuous noise exposure.

9:50–10:05 Break

Contributed Paper

10:05

4aUW5. A software package calculating zones of impact on marine mammals around industrial noise sources. Christine Erbe and David M. Farmer (IOS-Ocean Acoust., 9860 W. Saanich Rd., Sidney, BC V8L 4B2, Canada, erbec@dfo-mpo.gc.ca)

A software package is presented which estimates zones of interference around underwater noise sources affecting marine mammals. An ocean sound propagation model based on ray theory computes the spreading of complex underwater sound such as broadband animal vocalizations and manmade noise. On a grid of receiver locations (representing the affected marine mammal), the received signal and noise sound spectra are compared. Given a species-specific audiogram, the software package plots zones of audibility around the noise source. Given species-specific vocalizations, zones of masking are plotted based on results obtained during an earlier study which measured masked hearing thresholds of a beluga whale. Tools developed during this study (such as an artificial neural network model to predict the amount of masking) can be linked to the software package. Zones of behavioral disturbance are plotted based on received sound levels reported in the literature. Zones of discomfort, injury, and hearing loss could be plotted if thresholds were known or using current estimates. The software package is applicable to a variety of ocean environments requiring location-specific oceanographic input data. The case of icebreakers affecting beluga whales in the Beaufort Sea is demonstrated.

Invited Paper

10:20

4aUW6. Temporary threshold shift in hearing induced by an octave band of continuous noise in the bottlenose dolphin. Whitlow W. L. Au, Paul E. Nachtigall, and Jeffery L. Pawloski (Hawaii Inst. of Marine Biol., P.O. Box 1106, Kailua, HI 96734)

Temporary threshold shift in hearing at 7.5 kHz was studied with an Atlantic bottlenose dolphin. Immediately following a threshold measurement, the animal was required to station in a hoop and be exposed to an octave band of continuous noise from 5 to 10 kHz. Noise exposure sessions lasted about 50 min, with the requirement that the animal spend a total of 30 min in the hoop. The dolphin also had two preferred locations both about a meter to the side of the hoop, one at the surface, and the other at the hoop depth. The noise levels at the hoop and to the side were about the same but with different spectra. The noise at the surface was about 3-dB lower. After exposure to the fatiguing stimulus, the animal's hearing sensitivity was immediately measured. The animal's hearing was not affected when the noise was 171 dB at 1 μPa with a total energy flux density of 205 dB at 1 μPa^2 s. Temporary threshold shifts of 12–18 dB were obtained when the noise increased to 179 dB with an energy flux density of 213 dB or 1330 J/m^2. The fatiguing stimulus was about 96 dB above the animal's pure tone threshold of 84 dB. [Work supported by ONR.]