

2021 DOSITS Underwater Acoustics Webinar Series
October 5, 2021
Causes of Marine Mammal Hearing Loss, Dr. Darlene Ketten

Key presentation points:

1. SIGNIFICANCE OF HEARING
 - a. Detecting some component of environmental sound is critical to the survival of most animals.
2. WHAT IS A HAIR CELL?
 - a. Sound detections are based primarily on hair cells that can generate neural signals in response to hair cell motions caused by sound components.
3. MAMMALIAN EARS
 - a. As ears became more sophisticated, hair cells were coupled to specialized membranes in dedicated organ systems, like the inner ear. This provided the ability to respond differentially to variations in multiple sound components such as frequency (pitch), intensity (sound pressure level or loudness), and timing of signals.
4. EAR DIVISIONS
 - a. All mammalian ears have the same fundamental components: an outer ear (collects and channels sound), middle ear (amplifies some sound ranges), and inner ear (transduces incoming sounds into neural signals sent to the brain).
5. SPECIES VARIATIONS
 - a. Structural differences in these ear parts determine differences in normal hearing abilities in each species, including hearing range, sensitivity, directionality, and ability to detect signals in noise.
6. MULTIPLE CAUSES OF HEARING LOSS
 - a. Hearing can be affected by changes in ear components. These may be caused by trauma, disease, congenital defects, aging of ear components (presbycusis), and exposure to intense or continuous loud sounds (NIHL). Hearing losses may be temporary or permanent, partial or total, and may affect very narrow or very broad ranges of the animal's hearing. A loss in one part of the animal's hearing does not mean it is totally deaf nor that the rest of the hearing is necessarily impaired. Even permanent losses can vary from "mild" (10-15 dB difference from normal) to "profound" (greater than 90 dB compared to normal).
7. NOT ALL EARS HAVE THE SAME RESPONSES
 - a. Because species and individuals vary widely in their hearing abilities, not all sounds will affect all ears equally. A sound that one animal hears well may not be heard at all by another and therefore have potentially great impact on one and no impact on another. This is especially important in comparing potential impacts across species, between genders within a species, and across age groups. For that reason, estimating potential impacts should consider the composition of the at-risk populations with respect to signals in question.

DOSITS Links:

- Science of Sound > Characteristics of Sound > Frequency
<https://dosits.org/science/sound/characterize-sounds/intensity/>
- Science of Sound > Characteristics of Sound > Intensity
<https://dosits.org/science/sound/characterize-sounds/frequency/>
- Science of Sound > How does sound in air differ from sound in water?
<https://dosits.org/science/sounds-in-the-sea/how-does-sound-in-air-differ-from-sound-in-water/>
- Science of Sound > What sounds can people hear?
<https://dosits.org/science/measurement/what-sounds-can-we-hear/>
- Science of Sound > What sounds can animals hear?
<https://dosits.org/science/measurement/what-sounds-can-animals-hear/>
- Science of Sound > Advanced Topics > What is Intensity?
<https://dosits.org/science/advanced-topics/what-is-intensity/>
- Science of Sound > Advanced Topics > Sound Pressure Levels and Exposure Levels
<https://dosits.org/science/advanced-topics/sound-pressure-levels-and-sound-exposure-levels/>
- Animals and Sound > Why is sound important to marine animals?
<https://dosits.org/animals/importance-of-sound/why-is-sound-important/>
- Animals and Sound > How do mammals hear?
<https://dosits.org/animals/sound-reception/marine-mammals-hear/>
- Animals and Sound > Sound Reception > Hearing, Land Mammals
<https://dosits.org/animals/sound-reception/marine-mammals-hear/land-mammals/>
- Animals and Sound > Sound Reception > Hearing, Cetaceans and Sirenians
<https://dosits.org/animals/sound-reception/marine-mammals-hear/land-mammals/>
- Animals and Sound > Sound Reception > Hearing, Amphibious Marine Mammals
<https://dosits.org/animals/sound-reception/marine-mammals-hear/hearing-pinnipeds/>
- Animals and Sound > Potential Effects, MM > Hearing Loss
<https://dosits.org/animals/effects-of-sound/potential-effects-of-sound-on-marine-mammals/hearing-loss-in-mammals/>
- Animals and Sound > Advanced Topics > Hearing Loss
<https://dosits.org/animals/advanced-topics-animals/hearing-loss-advanced/>
- Animals and Sound > Advanced Topics > What components of sound are used for hearing?
<https://dosits.org/animals/advanced-topics-animals/components-of-sound/>

- Animals and Sound > Advanced Topics > Blast Injury, Barotrauma, and Acoustic Trauma
<https://dosits.org/animals/advanced-topics-animals/blast-injury/>
- Animals and Sound > Advanced Topics > How did odontocete hearing evolve?
<https://dosits.org/animals/advanced-topics-animals/how-did-odontocete-hearing-evolve/>