# "Potential Effects of Noise on Marine Mammals"
# A DOSITS webinar
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**I. Biological importance of sound in the lives of marine mammals**

- Any discussion of potential impacts of human noise in the marine environment on marine mammals should begin with an appreciation of the fundamental importance of sound in their lives and natural history. All species make and receive sound in the most critical life functions, including reproduction, foraging, predator avoidance, and basic orientation in a dark and vast three-dimensional realm where the efficacy of other senses is reduced.

**II. Differential hearing capabilities in marine mammals**

- Dr. Darlene Ketten's excellent preceding DOSITS webinar reviewed the fascinating essential and in some cases specialized mechanisms of how marine mammals hear. We will briefly consider differences among marine mammal "hearing groups" based largely on differential sensitivity to sounds of different frequencies. Amphibious hearing in the pinnipeds and other amphibious marine carnivores will also be discussed. Finally, the development of hearing "weighting functions" to account for these frequency-specific differences for different hearing groups in order to evaluate the effects of noise on hearing, and recent progress in improving weighting functions, will be considered

**III. Range of potential effects of noise on marine mammals**

***A. Physiological effects***. A brief discussion of non-auditory physiological effects of noise on marine mammals will consider phenomena including stress hormone responses.

***B. Auditory effects***. While whole species groups (*e.g.*, baleen whales) remain untested, considerable research has been done and is ongoing to measure and understand how noise exposure can temporarily or permanently change (reduce) the hearing abilities of different species. These studies have generally indicated that most marine mammal species tested (primarily dolphins and pinnipeds) are actually quite resilient to loud noise exposures, require relatively intense exposures within frequencies at which their hearing is more sensitive to experience temporary or permanent residual effects on hearing. However, some species groups (*e.g.*, porpoises) appear relatively more sensitive to such effects. Simultaneous interfering effects of noise on hearing (auditory masking) will also be discussed, as well as the relative implications of masking on communication systems and capabilities.

***C. Behavioral effects***. Extensive research has also been conducted to quantify how noise disturbance may influence marine mammal behavior. This has included both anecdotal observations from monitoring of acoustic or other behaviors and increasingly controlled experimental methods. Both methods will be discussed, with an emphasis on the later. Fine-scale resolution on behavior using movement and acoustic tags has particularly enabled detailed evaluations of behavior before and during known noise exposure events. These studies are increasingly revealing the complexities of behavior and behavioral response to noise of different types and amplitudes, as well as the considerable context-dependency of response given factors such as proximity, animal behavioral state, novelty, and the distribution of prey resources. How such variables interact with exposure variables such as received noise level will be discussed. Finally, recent and ongoing efforts to assess and model the biological significance and population consequences of behavioral disturbance will be considered.

**Additional information on the DOSITS website:**

Science of Sound > What are common underwater sounds?
https://dosits.org/science/sounds-in-the-sea/what-are-common-underwater-sounds/

Science of Sound > How is hearing measured?
https://dosits.org/science/measurement/how-is-hearing-measured/

Science of Sound > What sounds can animals hear?
https://dosits.org/science/measurement/what-sounds-can-animals-hear/

Science of Sound > Why do sounds have different properties?
https://dosits.org/science/sounds-in-the-sea/why-do-sounds-have-certain-properties/

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 Sound Exposure Levels
https://dosits.org/science/advanced-topics/sound-pressure-levels-and-sound-exposure-levels/

Science of Sound > Introduction to Signal Levels
https://dosits.org/science/advanced-topics/introduction-to-signal-levels/

Science of Sound > Frequency Weighting of Signal Levels
https://dosits.org/science/advanced-topics/frequency-weighting-of-signal-levels/

Animals and Sound > How do marine mammals hear?
https://dosits.org/animals/sound-reception/marine-mammals-hear/

Hearing in Land Mammals
https://dosits.org/animals/sound-reception/marine-mammals-hear/land-mammals/
Hearing in Pinnipeds, the Amphibious Ear
https://dosits.org/animals/sound-reception/marine-mammals-hear/hearing-pinnipeds/
Hearing in Cetaceans and Sirenians, the Fully Aquatic Ear
https://dosits.org/animals/sound-reception/marine-mammals-hear/hearing-in-cetaceans/

Animals and Sound > How do marine animals use sound?
https://dosits.org/animals/use-of-sound/how-do-marine-animals-use-sound/

Animals and Sound > Marine Mammal Communication
Individual-specific vocalizations
https://dosits.org/animals/use-of-sound/marine-mammal-communication/individual-specific-vocalizations/
Group-specific vocalizations
https://dosits.org/animals/use-of-sound/marine-mammal-communication/group-specific-vocalizations/
Vocalizations associated with reproduction
https://dosits.org/animals/use-of-sound/marine-mammal-communication/vocalizations-associated-with-reproduction/
Sounds associated with aggression
https://dosits.org/animals/use-of-sound/marine-mammal-communication/sounds-associated-with-aggression/

Animals and Sound > How do marine mammals use or make sound when feeding?
https://dosits.org/animals/use-of-sound/marine-mammals-feeding/

Animals and Sound > How do marine mammals use sound to navigate?
https://dosits.org/animals/use-of-sound/marine-mammal-navigation/

Animals and Sound > Potential Effects (Marine Mammals) > 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 > Potential Effects > Behavioral Changes
https://dosits.org/animals/effects-of-sound/potential-effects-of-sound-on-marine-mammals/behavioral-changes-in-mammals/

Animals and Sound > Potential Effects> How do you measure a marine mammal's reaction to sound?
https://dosits.org/animals/effects-of-sound/measure-marine-mammals-reaction-to-sound/

Animals and Sound > Potential Effects > Masking
https://dosits.org/animals/effects-of-sound/potential-effects-of-sound-on-marine-mammals/masking-in-mammals/

Animals and Sound > Potential Effects> Strandings
https://dosits.org/animals/effects-of-sound/potential-effects-of-sound-on-marine-mammals/strandings/