Low-Frequency Hearing and Masking in Seals

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The most pervasive auditory effect of aquatic noise is likely to be masking, in which an animal's ability to hear sounds of interest is reduced by the presence of overlapping noise in the environment. Masking is a concern for marine mammals due to their reliance on acoustic information for orientation, conspecific communication, foraging, and predator avoidance. To understand and predict masking from any noise source, data are needed to parameterize the auditory capabilities of potential listeners. However, there are few auditory data available at very low frequencies, which prohibits an accurate consideration of the effects of industrial and ship noise on hearing in marine mammals. In this study, behavioral methods were used to examine low-frequency hearing in two trained bearded seals (*Erignathus barbatus*). We evaluated hearing sensitivity in quiet conditions, hearing in the presence of background noise, and auditory filter characteristics between 63 and 400 Hz. The resulting auditory parameters provide the first comprehensive hearing measurements available for any pinniped below 100 Hz, and enable evaluation of low-frequency masking by complex and naturally occurring sounds in the marine environment. These measurements demonstrate expected patterns based on auditory thresholds and critical ratio measurements obtained at higher frequencies for bearded, spotted, harbor, and ringed seals, and indicate that seals likely use the auditory sense (rather than the vibrotactile sense) to perceive sound frequencies > 63 Hz. This study improves understanding of masking in seals—which have the best demonstrated low-frequency hearing abilities among marine mammals. It also provides insight into masking in other presumed low-frequency specialists, including many whales requiring high levels of protection due to their threatened or endangered conservation status. Ultimately, these data support quantitative considerations of masking caused by specific low-frequency noise sources in realistic environments. [Supported by OGP JIP on Sound and Marine Life].