



## **Masking in Marine Mammals: A Review**

**Christine Erbe**

Centre for Marine Science and Technology, Curtin University, [c.erbe@curtin.edu.au](mailto:c.erbe@curtin.edu.au)

**Colleen Reichmuth**

University of California, Santa Cruz

**Kane Cunningham**

University of California, Santa Cruz

**Klaus Lucke**

Centre for Marine Science and Technology, Curtin University

**Robert Dooling**

University of Maryland

Underwater noise, whether of natural or anthropogenic origin, may interfere with the abilities of marine mammals to receive and process relevant sounds and could potentially impact individual fitness. Of all the ways in which noise can affect the lives of marine mammals, auditory masking is perhaps the most pervasive. Masking occurs when the ability to detect or recognize a sound of interest is degraded by the presence of another sound (the masker). Quantitatively, masking refers to the amount in decibels by which an auditory detection threshold is raised in the presence of a masker. Although masking is a common, if not universal, feature of natural communication systems, masking levels are difficult to predict for any particular combination of sender, environment, and receiver characteristics. At present, there is no species for which a complete masking model exists; however, certain models have proven to be effective for some species in many listening situations. Here, we present our understanding of masking in marine mammals, review the parameters that affect hearing in noise (audiograms, critical ratios, critical bands, auditory integration times), explain the power spectrum model of masking, and discuss the masking release processes of receivers (including comodulation masking release and spatial release from masking) and the antimasking strategies of signalers (e.g., Lombard effect). Considering the available information, we highlight information gaps and suggest a research strategy to address these gaps. Our review indicates that more research is needed to understand the process of masking, the risk of masking by various anthropogenic activities, and the biological significance of masking and antimasking strategies before masking can be incorporated into regulation strategies or approaches for mitigation for marine mammals.