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The inclusion of cumulative sound exposure in assessment of noise impact on marine mammals

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ABSTRACT

The interest in the effects of acoustic noise for both airborne and underwater species has grown significantly in recent years. Many species are protected from either harm or disturbance by international legislation and/or are of commercial interest. The impact assessment methodologies used to assess these effects often follow those used in airborne acoustics with humans. These include determination of peak pressures (maximum excursion zero-peak positive or negative levels) leading to physiological damage such as temporary / permanent threshold shifts (TTS/PTS) to behavioral response effects such as habitat exclusion, masking effects such as prey / predator avoidance and co-species communication. Other potential effects considered included both direct and indirect non hearing related effects leading to injury and even death such as stranding and induced decompression sickness. In almost all cases very little data exists for very few species.

More recently in the case of marine mammals the inclusion of cumulative sound exposure metrics has begun to emerge (Southall et al. 2007). Data suggests analogies with cumulative sound exposure similar to that seen in humans in air. As a result, assessment of the effects of both temporal and spatial cumulative exposures for many offshore operations are now becoming required. This trend has potentially significant implications to development of offshore industries, such as shipping, petroleum, offshore renewables, etc. Example data is presented of models used to estimate both instantaneous and cumulative SEL levels for an example marine piling sequence in relation to a marine mammal. These models require knowledge of source properties, complex propagation conditions and assumptions about the animal's physiology and its behavioral response. Capabilities and limits of these models are discussed and future needs highlighted in context of future cumulative sound exposure estimate and effects of noise on the marine environment.