Underwater Noise Pollution: An Interdisciplinary Call to Action

Mittwoch, 18. Juni 2025 15:06 (12 Minuten)

With underwater noise pollution increasing globally—and formally recognized under the EU Marine Strategy Framework Directive (MSFD, Descriptor 11)—significant knowledge gaps remain regarding its effects on marine life, especially invertebrates. Addressing this requires monitoring and predicting the key elements of underwater noise, acoustic pressure and particle motion, while accounting for how these interact with abiotic changes like climate warming and ocean acidification across space and time. Detailed physical characterization of acoustic environments is crucial to recreate ecologically meaningful conditions in laboratory and field experiments. Yet equally important is understanding how marine organisms perceive and respond to noise. This receiver perspective is essential for defining dose-response relationships. A promising framework for noise monitoring in development by MSFD Descriptor 11 Noise Working Groups is the Level of Onset for Biologically Adverse Effects (LOBE). Defining LOBE demands species-specific threshold data, yet synthesizing diverse datasets remains a challenge. Our group conducts repeated soundscape recordings in the Wadden Sea, where complex hydrodynamics complicate data analysis—highlighting the need for automated approaches. From multiple sampling stations, we aim to develop sound propagation models that capture current acoustic conditions and enable future projections under varying environmental parameters in the future (e.g., temperature, salinity, pH, sediment, AIS data = noise). To determine biologically relevant thresholds, interdisciplinary research is needed—from behavioral and reproductive studies to molecular and neurobiological assessments. We focus on noise impacts on invertebrates and invite discussions and collaboration across physics, informatics, and biology to build a comprehensive understanding of underwater acoustic impacts.

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