

## A TRAIT-BASED FRAMEWORK TO IDENTIFY MARINE INVERTEBRATES VULNERABLE TO UNDERWATER NOISE

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Anthropogenic underwater noise is an emerging pollutant with growing concern for marine life. The North Sea is one of the busiest shipping areas in the world, a significant expansion of offshore wind farms is foreseen, and numerous recreational boats operate in coastal, shallow, sensitive areas with high biodiversity. To achieve Good Environmental Status, regional threshold values need to be specified, including noise levels compromising the fitness and survival of animals. Defining indicator species across different animal taxa is therefore crucial for the assessment of noise impacts. Hitherto, invertebrates have largely been overlooked, despite their abundance and great importance to ecosystem structure and function.

As part of the Interreg North Sea project DEMASK\*, a trait-based scoring system was developed for marine invertebrates as a framework for assessing their relative vulnerability to underwater noise and for selecting indicator species. The scoring system defines several vulnerability factors related to hearing ability, sound production and reported impacts of impulsive and continuous anthropogenic noise, and highlights species of particular concern and ecological and commercial importance. Further, a set of basic life-history traits related to productivity and mobility was scored to assess general susceptibility of a species to environmental stressors. Altogether 20 invertebrate species from the North Sea region were identified to provide data available for the assessment. Based on an extensive literature review and expert consultation, each species was assigned a score from low to high for each vulnerability factor, combined with a data quality score estimating the reliability of the information used for vulnerability scoring.

The scoring system identified the European lobster, Norway lobster, blue mussel, great scallop, and common cuttlefish as species with a good evidence base of vulnerability to underwater noise. They scored high for all assessment categories: noise vulnerability, data quality and general susceptibility. Even if data availability is currently poor, we suggest including the copepod *Acartia tonsa* to cover the group of planktonic invertebrates. The selection is based on current knowledge. New indicator species are likely to be identified as more knowledge becomes available. Nonetheless, including invertebrates in impact assessments will be a great step forward to achieve a more comprehensive and ecosystem-based risk assessment of underwater noise. Through habitat suitability maps of the selected indicator species, overlaid with noise level maps from different policy scenarios, the effects of underwater noise can be mitigated employing effective management strategies.

\* Interreg North Sea project DEMASK: <https://www.interregnorthsea.eu/demask>