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New Measurement Capabilities to Support the Health of Life Below Water

A European national laboratory cooperation developed underwater acoustic calibration standards for frequencies below 1 kHz to prevent disruption to marine life

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The Challenge

Underwater noise from human activities, such as shipping and construction work, can disrupt marine life. This prompted the EU, in 2008, to adopt the Marine Strategy Framework Directive (MSFD)¹ to maintain clean, healthy, productive, and resilient marine ecosystems while securing a more sustainable use of marine resources. It also included limits on underwater noise generated by human activity, which can have a profound effect on marine fauna.

Although EU directives were in place to address the issue, there were no reliable calibration and measurement services to support the enforcement of the directive. Sound energy with frequencies between 20 Hz and 1 kHz is of greatest concern to the environment. However, there was a lack of metrologically traceable measurement standards for accurately detecting underwater sound using hydrophones in this range.

The Solution

A research project funded within the European Metrology Program for Innovation and Research (EMPIR) developed novel calibration methods for hydrophones and autonomous noise recorders at low frequencies of most concern, as well as free-field calibration setups and procedures for autonomous recorders, which were validated through measurement comparisons between laboratories. In 2019, two of the project partners began offering new calibration services for hydrophones and noise recorders to cover the range 20 Hz to 315 Hz (extended to higher frequencies later), with a wide variety of customers since that date including academia, offshore industry and consultancies, and government regulators.

A Quantifiable Impact

Project outcomes were demonstrated in the construction of the “1915 Çanakkale Bridge” opened in 2022 in Türkiye, where accurate data obtained from autonomous recorders calibrated using newly developed methods enabled the construction company to minimize disruption to marine life. The improved reliability of underwater acoustic measurements

¹ Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive. <https://eur-lex.europa.eu/eli/dir/2008/56/oj/eng>

helped minimize disruption to marine species² during the construction of the bridge in Türkiye. A manufacturer of acoustic recorders adopted the project results to provide its customers with more accurate calibration values, thereby improving the accuracy and relevance of their data.

New services are now in place in Europe to demonstrate compliance with the EU directive to protect vulnerable marine species. In addition, the outcomes from this project have contributed directly to ocean noise monitoring projects such as OSPAR, JOMOPANS, and HELCOM.

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A complete list of participants is provided on the EMPIR Project 15RPT02 UNAC-LOW Page.³

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² Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive) (Text with EEA relevance). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32008L0056>

³ EMPIR Project 15RPT02 UNAC-LOW, "Underwater acoustic calibration standards for frequencies below 1 kHz" <https://www.euramet.org/research-innovation/search-research-projects/details/project/underwater-acoustic-calibration-standards-for-frequencies-below-1-khz>