

Improving the method and regulatory framework for predicting metal bioavailability and toxicity in Australia and New Zealand

Accurate methods for measuring and predicting metal toxicity in water sources are key to setting more accurate and protective environmental guidelines, and must avoid both under-protection (which leads to pollution) and overprotection (which can result in unnecessary costs and burdens for industry).

No single value for a metal protects aquatic biota across different water sources, since metal toxicity is dependent on its bioavailability, which in turn is dependent on the chemical make-up of a particular water source.

Currently, the Australian and New Zealand water quality guidelines for most metals account only for the hardness of water, but bioavailability is also influenced by other parameters such as pH, alkalinity and dissolved organic carbon (DOC). With funding from the International Zinc Association (IZA), and in collaboration with numerous partners, La Trobe researchers Jenny Stauber (formerly CSIRO), Gwil Price (PhD student) and Aleicia Holland have developed new bioavailability-based models to more appropriately predict toxicity of zinc and form the basis of updated guideline values and regulatory frameworks in Australian and New Zealand Waters.

In April 2023 in Sydney, 30 invited scientists, regulators and state/federal government representatives participated in a workshop where the new models were presented and the best method for implementation was discussed. This led to a follow-up project in 2024 in collaboration with WCA, the National Institute of Water and Atmospheric Research (NIWA) and WQAdvice, funded by The Metals Environmental Research Associations (MERA), to develop a tiered implementation framework, tool and training material to develop and implement guidelines for zinc, copper and nickel.

In August 2025 at the SETAC/ACTRA conference (Society of Environmental Toxicology and Chemistry / The Australasian College of Toxicology and Risk Assessment), the research team presented the updated framework for bioavailability-based guideline values for zinc, copper and nickel, demonstrated the online metals bioavailability tool, and showed how the tool supports environmental assessment and management in Australia and New Zealand.

The principles, guidelines, and tools are also applicable to the broader Southeast Asia and Melanesia (SEAM) region.