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Assessing the Impact of Persistent and Emerging Contaminants on Aquatic Organisms

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The aquatic environment is often the ultimate recipient of increasing amount and range of contaminants, in all probable combinations. This presents a major challenge to protect the quality and sustainability of natural resources. The continued developments of integrated and multidisciplinary approaches incorporating analytical, biological (including 'omics'), statistical and computational technologies are realising the importance of natural organisms, which could serve as sentinel or surrogate to correlate human and ecosystem health in order to improve environmental risk assessment (ERA). In this context, we have attempted to develop and validate a range of sub-lethal biological or biomarkers responses in ecologically important species such as bivalve mollusks. The broader aims have been to determine the relative sensitivity of the biomarkers and the species following exposure to a range of well known (e.g. metals, PAHs) and emerging contaminants (e.g. engineered nanoparticles or ENPs) in combinations with other pollutants (e.g. PAHs). Linking 'toxicokinetics' with 'toxicodynamics' processes and using appropriate analytical, statistical and computational modelling tools, our studies compliment the observed biological responses with bioavailability and tissue-specific body burden of the contaminants. The synthesized information from our studies offer information pertaining to potential detrimental impact of contaminants on the health of the organisms. The adopted approach could be translated in other organisms and environmental conditions for the protection of human and ecosystem health. We however need to evaluate inherent limitations and challenges of various available tools, while aiming to readily integrate them into regulatory frameworks.