Field-based species sensitivity distribution and community sensitivity distribution as alternative ways for field validation of the PNECs derived from laboratory based approaches

Kenneth Mei Yee Leung
The Swire Institute of Marine Science and School of Biological Sciences, The University of Hong Kong, Hong Kong, China

The determination of predicted no-effect concentrations (PNECs) and sediment quality guidelines (SQGs) of toxic chemicals in marine sediment is very crucial in ecological risk assessment, sediment quality management (e.g. mud disposal in the sea) and environmental remediation (e.g. dredging of contaminated mud). However, current methods of deriving sediment PNECs are primarily based on toxicity data generated from laboratory ecotoxicity bioassays that are often lack of ecological realism. To tackle this issue, we have developed two novel alternative approaches to scientifically derive site-specific SQGs by utilizing field data of benthic biodiversity and contaminant concentration which are concurrently measured in sediment samples collected from the area of concern. In this talk, I will first describe the principle of these field-based approaches. Secondly, I will introduce the field-based species sensitivity distributions (f-SSDs) approach, which is based on the relationship between species abundance and contaminant level [Environmental Science & Technology 39:5148-5156; Environmental Toxicology & Chemistry 27:226-234]. Since its establishment, f-SSDs have been utilised in different parts of the world such as Europe, Hong Kong, New Zealand and the United States. Norwegian continental shelf and the marine environment of Hong Kong will be taken as examples to illustrate the methodology. Thirdly, I will present the community sensitivity distributions (CSDs) approach which is founded on the relationship between species density and contaminant level, and makes use of Empirical Bayes methods [Environmental Science & Pollution Research 21: 177-192]. Overall, the field-data-derived SQGs appear to be more environmentally relevant and ecologically realistic. The f-SSD and CSD can be directly adopted as 'effect distributions' for probabilistic risk assessment. The field-data-derived SQGs can be employed as site-specific guidelines, and used to validate the current PNECs or SQGs derived from laboratory ecotoxicity data. Finally, the limitation of these field-based approaches will be discussed, while their recent development and application in different countries will be highlighted.