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Proposal for a freshwater trophic magnification study based on a comprehensive literature evaluation

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The bioaccumulation potential is a critical property used for the risk assessment of chemicals and is usually expressed by parameters derived from laboratory or field experiments, in particular bioconcentration-, bioaccumulation- and biomagnification factors . A relatively new approach is the determination of so-called trophic magnification factors (TMF) which integrate enrichment processes in a food web. Reliable TMF can provide valuable information to answer different questions in regulatory and monitoring affairs. The TMF can be used in the evaluation of the biomagnification potential of chemicals under REACH. However, TMF may be also applied in the context of the Water Framework Directive to normalize chemical monitoring data of fish to a common trophic level as well as to derive environmental quality standards for the protection goal ‘secondary poisoning of predators’. To date, only a few detailed TMF studies have been performed and the investigated endpoints have shown considerable variation.

The aim of this study is to define a sound concept for TMF investigations to enhance both, the reproducibility and accuracy of TMF estimates to allow the regulatory usage of this endpoint. The developed concept focuses on freshwater habitats, covers different invertebrate and fish species and will be tested in a pilot field study. A water body will be selected under consideration of several aspects such as the chemical burden of the water body, the type of contamination source, and species diversity in the water body. Invertebrate and fish species will be collected in the water body during spring/summer 2018. The trophic levels of the species will be determined applying different methods such as comparison of stable isotope patterns in the collected species against a baseline organism (including stable isotope analysis of different amino acids.). Sample handling will follow the protocols applied by the German Environmental Specimen Bank (ESB) including cryo-milling, homogenization, sub-sampling, and long-term storage. During all processing steps samples will be kept constantly at a temperature < - 150°C. The sample material obtained will be analyzed to derive TMF estimates for different contaminants found in the selected water body. Different normalization-, benchmarking-, and statistical methods will be applied. The validated concept may provide the framework for a new TMF testing scheme integrated in the German Environmental Specimen Bank (ESB).