

Mercury burden of German freshwater fish depending on age, size and trophic level

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With EU-Directive 2013/39/EU under the Water Framework Directive (WFD) new chemicals were categorized as priority substances (PS) and environmental quality standards (EQSs) for these have been introduced. As a new approach, for several PS including mercury (Hg) EQSs have to be monitored in fish. This project was initiated to develop an optimal fish monitoring strategy in this context. Important questions to be answered are for example: Which fish species can be used? Which age is appropriate? Which tissue should be chosen? Which trophic level should be sampled? Here the effect of these factors on fish Hg levels is reported.

First, an appropriate sampling campaign was designed which covers several freshwater sites. It is intended to sample at each site three of the fish species recommended in the German guidance document on biota monitoring: bream, chub, perch and roach. Up to now fish were caught at sampling sites in the rivers Weser, Havel and Elbe. The target is to obtain twenty fish per species from two different age classes allowing multiple comparisons. Fish were dissected into fillets and carcasses which were processed separately. Biometric data (e.g. size, weight, sex) were documented. Age was determined by examination of scales and exact trophic position by ¹⁵N/¹³C stable isotope measurements. Total mercury (Hg) concentrations were determined for both individual fish fillets and carcasses as well as for age-grouped pools of both (data for Elbe fish under progress). From fillet and carcass data original whole body Hg concentrations were calculated.

The EQS for Hg in fish is 20 µg/kg wet weight and aims at protecting top predators from secondary poisoning. Thus, it seems most appropriate to compare whole fish Hg levels to this EQS. Only four bream and two roach individuals from river Havel complied with the EQS. Across all species and both sampling sites already analyzed, highest Hg concentrations were found in chub from river Weser with a maximum of 92 µg/kg Hg. Overall, for all species higher Hg mean values were observed for the Weser compared to the Havel fish. The data also allow deriving a factor between whole body and fillet Hg levels for each species. Hg concentrations in fillet were generally higher than those in whole fish (factors 1.2–1.6).

On the basis of the individual fish data weakly significant correlations ($p < 0.05$) were detected for most species and sampling sites between length, age and weight and whole body Hg concentrations. No significant correlations were found for chub from river Weser for Hg and age, perch from river Weser for Hg and length and perch from river Havel for Hg and age.

The statistical analysis will be extended with data regarding trophic positions obtained by stable isotope ratios. Furthermore, pool samples will be analyzed for organic WFD priority substances HCB, HBCDD, PBDE, PFOS, dioxins and PCB allowing further evaluations.

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