

Decreasing Aqueous Mercury Concentrations to Meet the Water Quality Criterion in Fish: Examining the Water-Fish Relationship in Two Point-Source Contaminated Streams

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DOE/Office of Environmental Management/Groundwater and Soil Remediation Program

Objective

- Examine the relationship between aqueous mercury concentrations and bioaccumulation in fish using monitoring data in 2 contaminated streams on the Oak Ridge Reservation

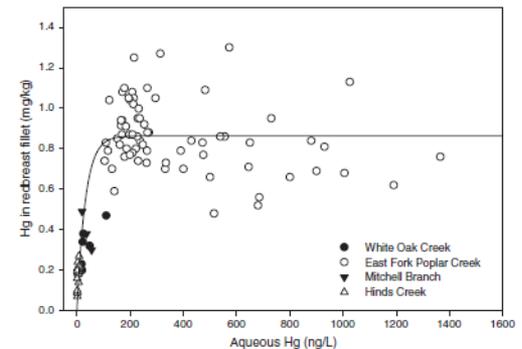
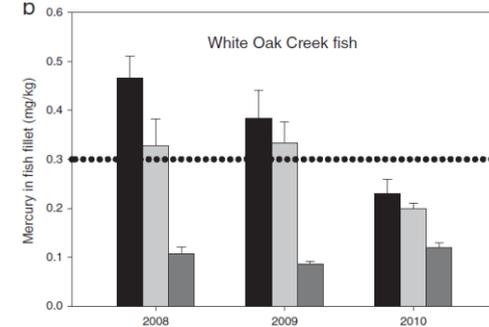
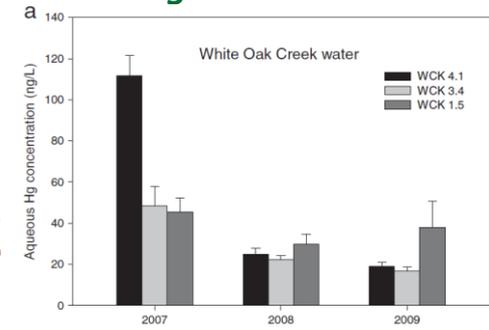


New Findings

- Recent remediation actions in White Oak Creek that decreased aqueous mercury concentrations to ~20 ng/L succeeded in reducing fish tissue concentrations below the U.S. EPA's guideline for mercury (0.3 mg/kg in fish fillet)
- The relationship between mercury in water and mercury in fish across the Oak Ridge Reservation is non-linear and suggests a threshold aqueous concentration above which fish tissue concentrations will not respond to remedial actions

Significance

- Aqueous total mercury concentrations as remediation targets may not be appropriate
- Need to better understand the relationship between aqueous total mercury and methylmercury concentrations in stream systems



Mathews, TJ, G Southworth, MJ Peterson, WK Roy, RH Ketelle, C Valentine, and S Gregory, 2013. "Decreasing Aqueous Mercury Concentrations to Meet the Water Quality Criterion in Fish: Examining the Water-Fish Relationship in Two Point-Source Contaminated Streams" *Science of the Total Environment*, vol. 443, pp.836-848

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East Fork Poplar Creek (EF) and White Oak Creek (WC) are two mercury-contaminated streams located on the United States (U.S.) Department of Energy Oak Ridge Reservation in East Tennessee. East Fork Poplar Creek is the larger and more contaminated of the two, with average aqueous mercury (Hg) concentrations exceeding those in reference streams by several hundred-fold. Remedial actions over the past 20 years have decreased aqueous Hg concentrations in EF by 85% (from >1600 ng/L to ~400 ng/L). Fish fillet concentrations, however, have not responded to this decrease in aqueous Hg and remain above the U.S. Environmental Protection Agency National Recommended Water Quality Criteria (NRWQC) of 0.3 mg/kg. The lack of correlation between aqueous and fish tissue Hg concentrations in this creek has led to questions regarding the usefulness of target aqueous Hg concentrations and strategies for future remediation efforts. White Oak Creek has a similar contamination history but aqueous Hg concentrations in WC are an order of magnitude lower than in EF. Despite the lower aqueous Hg concentrations (~100 ng/L), fish fillet concentrations in WC have also been above the NRWQC, making the aqueous Hg remediation goal of 200 ng/L in EF seem unlikely to result in an effective decrease in fillet Hg concentrations. Recent monitoring efforts in WC, however, suggest an aqueous total Hg threshold above which Hg bioaccumulation in fish may not respond. This new information could be useful in guiding remedial actions in EF and in other point-source contaminated streams.

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