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Analysis of Trophic Transfer, Bioaccumulation, and Microbiome Alterations of Chinese Mystery Snails Exposed to Arsenic

In the Puget Sound region, some lowland lake ecosystems have been contaminated with metals from the former ASARCO copper smelter located in Ruston, WA. Arsenic, a toxic metalloid, is one of the contaminants found in our local lakes. Chinese Mystery Snails (CMS) are a ubiquitous freshwater snail species that feed on periphyton, an environmental compartment found to hyperaccumulate arsenic (Hull et al., 2023). This feeding could be a key entry point of arsenic into freshwater food chains. Our research has utilized CMS to test the hypothesis that trophic transfer of arsenic occurs through consuming periphyton and their gut microbiome is altered as a result. To test this, our lab conducted a feeding-based arsenic exposure with lab acclimated reference lake CMS. These CMS were either fed algae wafers (control) or periphyton obtained from a high arsenic concentration lake. Trophic transfer of arsenic was not observed in this preliminary food-based arsenic exposure. This led us to hypothesize that waterborne arsenic exposure is an important route for bioaccumulation in CMS, with arsenic concentration correlating to gut microbiome changes. To test this, we conducted a comparative waterborne experiment, exposing CMS to arsenic concentrations of 0, 20ppb and 200ppb. At the end of the exposure, 16S amplicon sequencing was performed on CMS gut contents to assess how the varying arsenic concentrations affect microbiome composition. Whole-body arsenic quantification was conducted using ICP-MS to determine the degree of arsenic bioaccumulation that occurs at different exposure concentrations.