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Higher trophic level affects nutrient, silicon, metal(loid), and radionuclide mobilization from freshwater sediments

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Organic sediments in aquatic ecosystems are well known sinks for nutrients, silicon, and metal(loid)s. Organic matter-decomposing organisms like invertebrate shredders, grazers, bioturbators, and filter feeder are key-species for the carbon and energy turnover within the decomposer community. We could show that invertebrate shredders and grazer affect element fixation or remobilization by changing binding properties of organic sediments and the attached biofilm. Bioturbators affect element fixation or remobilization by changing redox conditions within the uppermost sediment layer. Last but not least filter feeders, like the zebra mussel Dreissena polymorpha, an invasive organism in North American and European freshwater ecosystems significantly contributed to element mobilization of silicon, iron, phosphorus, arsenic, and copper and to immobilization of uranium ($p<0.001$), probably driven by redox conditions, microbial activity within the gut system, or active control of element homeostasis. Except of the filter feeder D. polymorpha, the invertebrates are able to minimize the accumulation of non-nutrient elements due to specific strategies, which is an important strategy for species living in systems tending to element accumulation. However, D. polymorpha revealed a significant uptake and accumulation of arsenic, copper, iron, and especially uranium both into the soft body tissues and the seashell. This accumulation by D. polymorpha is in line with previous observations of metal(loid) accumulation from biomonitoring studies. In summary, higher trophic level strongly contributes to element fixation or remobilization in aquatic systems.