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Per- and polyfluoroalkyl compound bioaccumulation, trophic transfer, and impacts on organic matter decomposition in a stream ecosystem impacted by a food processing facility

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Process wastewaters from food, beverage, and feedstock facilities, although regulated, are an under-investigated environmental contaminant source. In a 2018 national (USA) reconnaissance of food process wastewaters, cumulative per- and polyfluoroalkyl substances (PFAS) concentrations were found up to 185,000 ng L^{-1}, including concentrations of 6:2 fluorotelomer sulfonic acid (6:2 FTS) as high as 143,000 ng L^{-1} (6:2 fluorotelomer sulfonic acid, 6:2 FTS) at a seed oil processing facility. In 2022, we investigated bioaccumulation and transfer of PFAS sourced from this food processing facility into the aquatic and riparian food webs. Source wastewater and surface water, sediment, fish, benthic invertebrates, algae, adult aquatic insects, and riparian spiders (tetragnathid) were collected upstream and downstream of the wastewater discharge point. In addition, pre-weighed maple (*Acer saccharum*) leaf litter packs were deployed at the upstream and downstream locations to investigate the potential influence of PFAS on organic matter processing. PFAS concentrations downstream were higher (mean $\sum_{40}$PFAS 3,678 ng L^{-1} [+ s.e. 486]) than upstream and reflected inputs from the wastewater and dominated by precursor 6:2 FTS and its degradation products. All fish collected had at least one PFAS compound detected; however, elevated concentrations of 6:2 FTS were observed in most fish downstream of the facility outfall compared to those collected upstream, with the black stripe top minnow (*Fundulus notatus*) bioaccumulating the highest concentration of 6:2 FTS. Within the aquatic food web, perfluorooctanesulfonate (PFOS) was the most biomagnified and 6:2 FTS was the most biodiluted. Conversely, transfer of PFAS to riparian spiders via aquatic insect prey resulted in highly biomagnified 6:2 FTS and biodiluted PFOS. Reduced decomposition and microbial respiration rates were observed in leaf litter packs deployed downstream of the facility's outfall compared to those upstream, suggesting a potential deleterious impact on organic matter processing and carbon cycling from PFAS contamination. Our results suggest the strong PFAS gradient associated with this food processing facility effluent discharge resulted in aquatic and terrestrial contamination and altered ecosystem function and highlight the importance of ecological endpoints in risk assessment of PFAS.