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I'll be dammed: Beaver ponds as sites for net loss of methylmercury along stream networks on the peatland-rich Taiga Plains, western Canada

Jessica Lagroix¹, David Olefeldt¹, and Glynnis A. Hood²

¹University of Alberta, Renewable Resources, Edmonton, Canada

²University of Alberta, Augustana Campus, Camrose, Canada

North American beavers commonly build dams and create ponds, which alter both the stream hydrology and biogeochemistry. Beaver ponds are common in headwaters of boreal and arctic watersheds of Canada, and while they cover only a small portion of watershed area, their position and biogeochemical influence may allow them to have a large impact on the downstream delivery of solutes and their dominant forms. Previous studies have suggested that boreal beaver ponds commonly act as methylmercury (MeHg) sources to downstream ecosystems, but this has not been studied in the wetland-rich areas of the Taiga Plains, western Canada. Since wetlands are also known as key watershed locations of MeHg production, our objective was to determine whether beaver ponds receiving water from wetland-rich areas still act as net sources of MeHg. We sampled water chemistry at the inflow and outflow of 20 beaver ponds over two years to evaluate Hg and MeHg changes. We determined that there was a net loss of MeHg in the beaver ponds (-34.4% on average), particularly during conditions when water residence time was long. This effect was greatly reduced in wet conditions when water was passing through the ponds more quickly. Net MeHg losses were greater when water entering the pond was already high in MeHg, whereas ponds receiving low MeHg concentrations were neutral or even acted as small sources. These decreases were also correlated with higher dissolved oxygen concentration and isotopic changes in surface water which suggests that aerobic microbial demethylation and photodemethylation may be contributing to net MeHg loss. Understanding the conditions that drive solute delivery from these ponds will allow local land managers to determine appropriate courses of action for beaver management and support well-informed water quality risk assessments.