

Title: The Hydro-bio-geochemistry of the Columbia River - Tributary Confluences

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Project Abstract:

River-tributary confluences, where diverse organic matter (OM) sources mix, are considered aquatic critical zones of biogeochemical cycling. The sources of OM to the Columbia River watershed are diverse, including dry land used for agricultural activity upstream from the McNary Dam and the Gifford Pinchot National Forest along the western reaches of the Cascades. Here we evaluate dissolved OM (DOM) composition and bioavailability in the mainstem of the Columbia River and four of its tributaries (Snake, Yakima, Walla Walla, and Wind rivers) in August 2018 and April 2019, respectively. We quantified concentrations of total dissolved organic carbon (DOC), total dissolved nitrogen (TDN), chromophoric dissolved organic matter (CDOM), dissolved lignin, dissolved hydrolysable amino acids, and examined the overall DOM molecular composition via Fourier-transform ion cyclotron resonance mass spectrometry (FT-ICR MS). DOC, TDN, and dissolved lignin concentrations were higher at most sampling locations in April when discharge was greater. Spatial and temporal variability in DOM composition was evident when examining the high-resolution mass spectrometry data along with the biomarker data via principal component analysis (PCA). For example, the Walla Walla River was relatively enriched in protein-like DOM in August but was enriched in dissolved lignin and phytochemical/oxyaromatic compounds in April. To assess bioavailability, field replicates and mixtures representing river-tributary confluences were incubated in the dark for 15 days. Total DOC significantly decreased only in a mixture representing the confluence of the Columbia and Walla Walla rivers sampled in August 2018. This was accompanied by a general decrease in dissolved lignin, but the decrease was not statistically significant. As mentioned above, the Walla Walla tributary was relatively enriched in protein-like DOM in August 2018. Therefore, it is possible this labile material primed the more stable Columbia River DOM. However, based on the insignificant decrease in dissolved lignin coupled with no significant changes in the compound class distribution measured via FT-ICR MS, the microbial community in the Walla Walla-Columbia mixture appeared to be indiscriminate of the molecular structure of the DOM.