

Effects of Small Impoundments on Leaf Litter Decomposition and Methane Derived Carbon in the Benthic Foodweb in Streams

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Abstract : Leaf litter decomposition is an important process providing energy to biotic communities. Additionally, methane gas (CH₄) has been identified as an important alternative source of carbon and energy in some freshwater food webs. Flow regulation and dams can strongly alter freshwater ecosystems, but little is known about the effect of small impoundments on leaf litter decomposition and methane derived carbon in streams. In this study, we tested the effect of small water storage impoundments on leaf litter decomposition rates and methane derived carbon. Leaf litter decomposition rates were assessed by comparing treatment sites located close to nine impoundments (Rheinland Pfalz state, Germany) and reference sites located far away from the impoundments. CH₄ concentrations were measured in eleven impoundments and correlated with the $\delta^{13}\text{C}$ values of two subfamilies of chironomid larvae (i.e. Chironomini and Tanypodinae). Leaf litter break down rates were significantly lower in study sites located immediately above the impoundments, especially associated with a reduction in the abundance of shredders. Chironomini larvae had the lower mean $\delta^{13}\text{C}$ values (−29.2 to −25.5 ‰), than Tanypodinae larvae (−26.9 to −25.3 ‰). No significant relationships were established between CH₄ concentrations and $\delta^{13}\text{C}$ values of chironomids ($p > 0.05$). Mean $\delta^{13}\text{C}$ values of chironomid larvae (mean: −26.8‰, range: −29.2‰ to −25.3‰) were similar to those of sedimentary organic matter (SOM) (mean: −28.4‰, range: −29.3‰ to −27.1‰) and tree leaf litter (mean: −29.8 ‰, range: −30.5‰ to −29.1‰). In conclusion, this study demonstrates that small impoundments may have a negative effect on leaf litter decomposition in forest streams and that CH₄ has limited influence on the benthic food web in stream impoundments.

Keywords : river functioning, chironomids, Alder tree, stable isotopes, methane oxidation, shredder

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