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Temperature response of litter decomposition in streams of eastern Canada depends on the thermal tolerance of a leaf-shredding insect

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Small, shaded streams depend on organic carbon, mostly fallen leaves, imported from the surrounding forest as their chief energy source. Leaf litter decomposition is a microbial process, and therefore the rate increases non-linearly with increasing water temperature. Litter-feeding invertebrates (shredders), however, accelerate decomposition by macerating litter, decreasing particle size, softening structural tissues and cropping fungal communities.

In a soft-water drainage system in Nova Scotia, Canada, summertime mass loss from *Alnus incana* (speckled alder) and *Acer rubrum* (red maple) leaves was consistently faster in a cold, headwater stream than in a warm, unshaded, downstream river, despite that the river runs about 10^{o}C warmer. This reversal is largely attributable to the leaf-shredding stonefly *Leuctra*, a cold stenotherm which is found only upstream in summer. Other shredders at both sites (Ephemeroptera: *Paraleptophlebia*, Trichoptera: *Lepidostoma*, Diptera: Chironomidae) are either smaller or much less numerous than *Leuctra*. Preventing shredder access to decomposing leaves sharply reduced decomposition rates upstream but not downstream, especially for the slower decomposing *Alnus incana* leaves. Without the influence of shredders, the unexpectedly more rapid decomposition in cold upstream water than in warm downstream water disappeared or was reversed. In autumn and winter, temperatures upstream and downstream were similarly low, and decomposition rates were uniformly slow. Hence, litter decomposition rates in this system are governed by temperature in autumn but by the distribution of *Leuctra* in warm seasons. Modifications to the temperature regime may have strong and unexpected effects on in-stream processes by eliminating stenothermal insects.