



Stable isotope signatures of lotic invertebrates: Sources of variation, experimental design, and statistical interpretation

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Limnol. Oceanogr., 46(3), 2001, 723-730 | DOI: 10.4319/lo.2001.46.3.0723

ABSTRACT: In a subset of a stream food web, whole-body isotope values of $d^{13}C$ and $d^{15}N$ were measured for eight populations of lotic invertebrates. Observed isotopic differences among species corresponded broadly to their trophic status, as also revealed by gut content analysis, but with some exceptions. Species within a guild of grazer/scrapper mayflies differed significantly in $d^{13}C$; a predatory caddisfly (*Rhyacophila dorsalis*) and a collector/gatherer stonefly (*Leuctra inermis*) had statistically indistinguishable values of $d^{13}C$ and $d^{15}N$. The variation associated with the mean isotope value of each population was partitioned into the variation among individuals and the variation that arises from analysis by isotope ratio mass spectrometry. For some taxa, within-population variance was lower than or equal to the variance attributable to the measurement error of the mass spectrometer. The highest but conservative estimate of within-population variation was a mean coefficient of variation of 11% for $d^{15}N$ in a predator, *R. dorsalis*. The minimum detectable difference between two populations was negatively associated with the number of replicate samples and the number of individual animals combined in each replicate. The optimum number of replicate samples, therefore, varies depending on the hypotheses of interest.

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