

Support of benthic invertebrates by detrital resources and current autochthonous primary production: results from a whole-lake ^{13}C addition

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SUMMARY

1. Secondary production of benthic invertebrates in lakes is supported by current autochthonous primary production, and by detritus derived from a combination of terrestrial inputs and old autochthonous production from prior seasons. We quantified the importance of these two resources for the dominant benthic insects in Crampton Lake, a 26 ha, clear-water system.
2. Daily additions of $\text{NaH}^{13}\text{CO}_3$ to the lake caused an increase in the stable carbon isotope ratios ($\delta^{13}\text{C}$) of the current primary production of phytoplankton and periphyton. We measured the response of four insect groups (taxon-depth combinations) to this manipulation, quantifying their current autochthony (% reliance on current autochthonous primary production) by fitting dynamic mixing models to time series of insect $\delta^{13}\text{C}$.
3. The $\delta^{13}\text{C}$ of all four groups increased in response to the manipulation, although the magnitude of response differed by taxon and by depth, indicating differences in current autochthony. Odonate larvae (Libellulidae and Corduliidae) collected at 1.5 m depth derived 75% of their C from current autochthonous primary production. Chironomid larvae collected at 1.5, 3.5 and 10 m depths derived, respectively, 43%, 39% and 17% of their C from current autochthonous primary production.
4. Both taxon-specific diet preferences and depth-specific differences in resource availability may contribute to differences in current autochthony. Our results demonstrate significant but incomplete support of insect production by current autochthony, and indicate that allochthonous inputs and old autochthonous detritus support a substantial fraction (25–83%) of insect production.

Keywords: allochthonous, aquatic insect, food web, lake, subsidy