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# Bacterial Growth on Allochthonous Carbon in Humic and Nutrient-enriched Lakes: Results from Whole-Lake $^{13}C$ Addition Experiments

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## Abstract

Organic carbon (C) in lakes originates from two distinct sources—primary production from within the lake itself (autochthonous supply) and importation of organic matter from the terrestrial watershed (allochthonous supply). By manipulating the $^{13}C$ of dissolved inorganic C, thereby labeling within-lake primary production, we examined the relative importance of autochthonous and allochthonous C in supporting bacterial production. For 35 days, $NaH^{13}CO_3$ was added daily to two small, forested lakes. One of the lakes (Peter) was fertilized so that primary production exceeded total respiration in the epilimnion. The other lake (Tuesday), in contrast, was low in productivity and had high levels of colored dissolved organic C (DOC). To obtain bacterial C isotopes, bacteria were regrown in situ in particle-free lake water in dialysis tubes. The contribution of allochthonous C to bacterial biomass was calculated by applying a two-member mixing model. In the absence of a direct measurement, the isotopic signature of the autochthonous end-member was estimated indirectly by three different approaches. Although there was excess primary production in Peter Lake, bacterial biomass consisted of 43–46% allochthonous C. In Tuesday Lake more than 75% of bacterial growth was supported by allochthonous C. Although bacteria used autochthonous C preferentially over allochthonous C, DOC from the watershed contributed significantly to bacterial production. In combination with results from similar experiments in different lakes, our findings suggest that the contribution of allochthonous C to bacterial production can be predicted from ratios of chromophoric dissolved organic matter (a surrogate for allochthonous supply) and chlorophyll *a* (a surrogate for autochthonous supply).

**Key words:** lakes; bacteria; dissolved organic carbon; allochthonous carbon; autochthonous carbon; stable isotope.