Limited effects of nutrient enrichment on bacterial carbon sources in intertidal sediments

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Eutrophication affects the composition of organic matter in coastal sediments. Evaluating the sources of autochthonous and allochthonous organic matter decomposed by sediment bacteria and how these vary across seasons and with nutrient loading can provide insight to carbon cycling and fate in coastal habitats. To test the effects of nutrient availability and seasonality on bacterial assimilation of carbon from autochthonous and allochthonous sources, we conducted stable isotope probing experiments with sediment cores from two salt marsh tidal creeks that are part of a long-term nutrient enrichment experiment within the Plum Island Ecosystem-Long Term Ecological Research site (MA, USA). One creek is fertilized while the second creek has low, ambient nutrient concentrations. Seasonally (spring – fall), ^{13}C-labeled sodium bicarbonate was added to the water column overlying experimental cores and traced into benthic microalgae and bacteria over 48 hours using compound specific isotope analysis of phospholipid fatty acids. During the summer only, ^{13}C-enriched *Spartina alterniflora* detritus was added to a parallel set of sediment cores and the ^{13}C label was traced into microbial phospholipids over one week. In these experiments, microalgae and *S. alterniflora* represented autochthonous and allochthonous organic matter substrates to bacteria, respectively.

In the ^{13}C-sodium bicarbonate experiments, the label was incorporated into algal and bacterial lipids within 4h. The rate and extent of label uptake into algal lipids were greatest in spring and lowest in fall but did not vary with nutrient fertilization. In contrast, the efficiency of ^{13}C transfer from algae to bacteria was higher in the summer and fall and in sediments from the low nutrient creek. In the ^{13}C-*S. alterniflora* experiment, the label was assimilated by bacteria within 8 h and the extent of incorporation increased throughout the experiment but was not affected by nutrient fertilization. Overall, our results indicate that carbon exchange between benthic algae and bacteria varied seasonally but was independent of nitrogen fertilization and that bacteria depend on carbon from autochthonous and allochthonous sources.