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The fate of bacterial carbon in an intertidal sediment: Modeling an in situ isotope tracer experiment

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ABSTRACT: We report the results of an integrated modeling and in situ isotope tracer experiment study examining the fate of bacterial carbon in an intertidal sediment. ^{13}C-glucose was injected into the upper 10 cm of an intertidal sediment, which successfully tagged the bacterial community as evidenced by ^{13}C enrichment of bacterial specific polar-lipid-derived fatty acids. Over a period of 4.5 months, ^{13}C enrichment was monitored in sediment organic carbon, bacteria, meiobenthos, macrobenthos, and dissolved inorganic carbon. A mechanistic model accurately simulated label transfer among the biotic and abiotic compartments and was used to derive bacterial production and the loss processes grazing, mortality, respiration, and exchange. Bacterial production averaged 67 mmol C m^{-2} d^{-1}, of which 8% was lost from the sediment by exchange processes, 3% was grazed by meiobenthos and 24% by macrobenthos. The primary fate of bacterial production was mortality (65%) and the released bacterial carbon was recycled back to dissolved organic carbon, resulting in recycling of carbon within the dissolved organic carbon-bacteria loop. Bacterial respiration was the main loss process from this loop. Although a significant fraction of bacterial carbon production was grazed, our results show that bacterial carbon is primarily a sink of organic carbon in the food web of intertidal sediments.

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