Relative independence of organic carbon transport and processing in a large temperate river: The Hudson River as both pipe and reactor

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ABSTRACT: Bacterial respiration (BR) of organic matter is an important flux in the carbon budgets of large rivers, yet the regulation of BR and the relationship of this respiration to various organic matter sources is poorly understood. Using detailed spatial transects, we evaluated transport and consumption of dissolved organic matter in the Hudson River estuary, and compared both with BR. Dissolved organic carbon (DOC) concentration, long-term DOC lability, and in situ BR were measured at 24 stations on each of five transects. DOC lability, measured in long-term bioassays, averaged 15 μg L^{-1} d^{-1} and was similar to the average net rate of decline of DOC from the upper to lower estuary. BR averaged 156 μg L^{-1} d^{-1} C, far exceeding the net downriver DOC decline and measured DOC lability. BR was well predicted by a model that included seston, chlorophyll, and DOC consumption. Rate coefficients derived from this model indicate that BR is primarily supported by carbon derived from seston and chlorophyll. Changes in DOC concentration along the Hudson flow path were well predicted from a combination of freshwater input, DOC concentration in the headwaters, and long-term DOC lability. Although most of the total respiration is due to free-living bacteria and thus mediated by DOC, <20% of this respiration is actually supported by DOC loaded in the headwaters, and transported downstream. The Hudson River, therefore, acts as a pipe transporting dissolved terrestrial organic matter seaward while also functioning as a reactor where intense bacterial activity degrades organic matter associated primarily with particles or generated locally.

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